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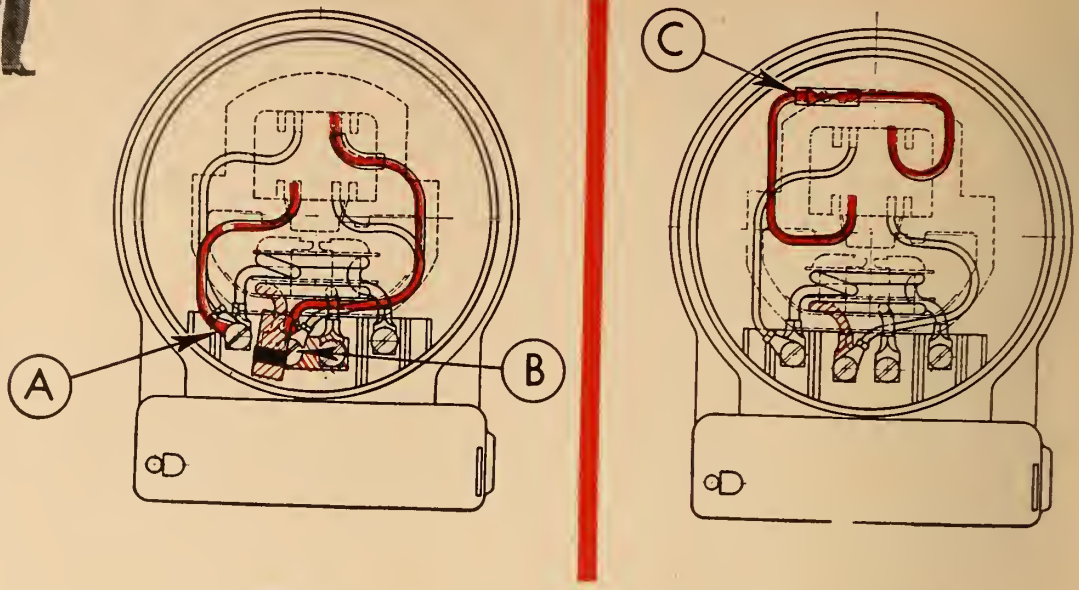

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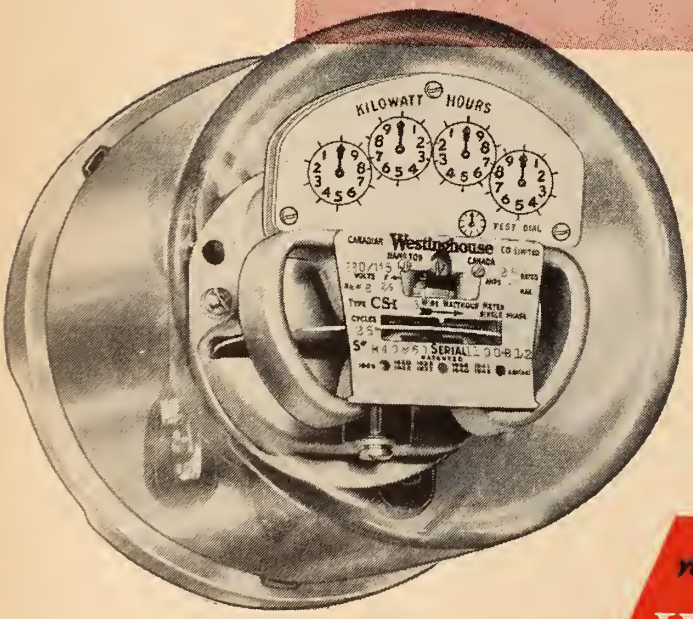

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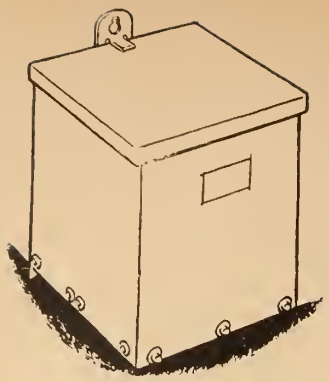

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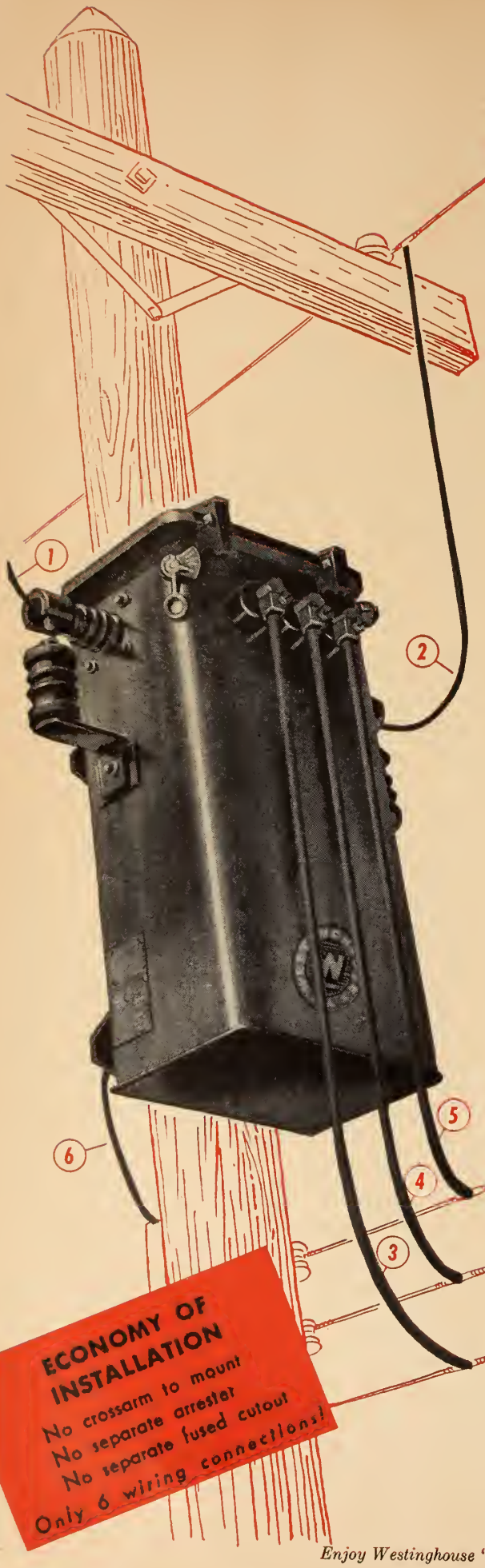

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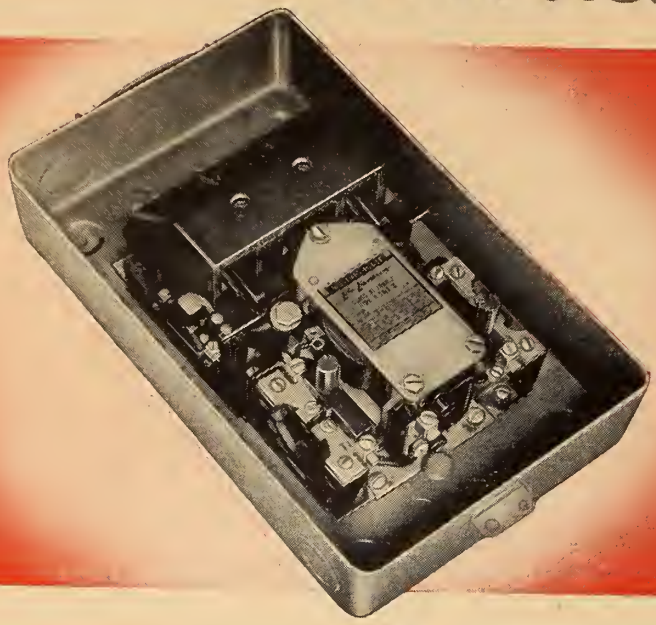

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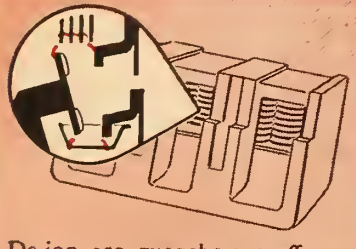

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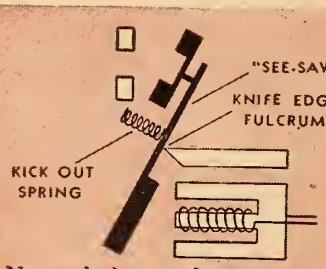

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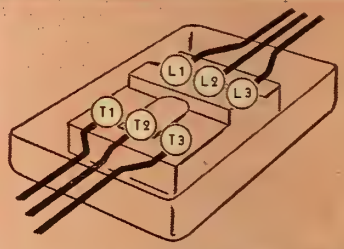

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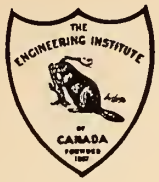

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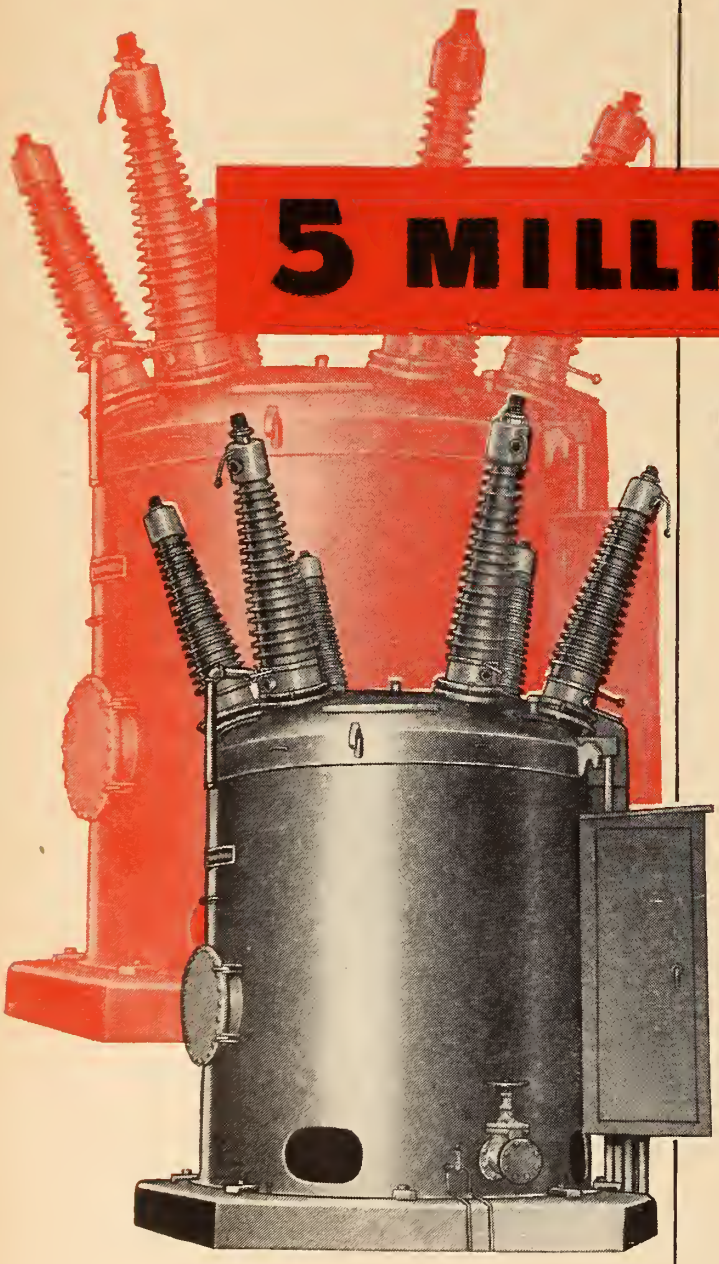

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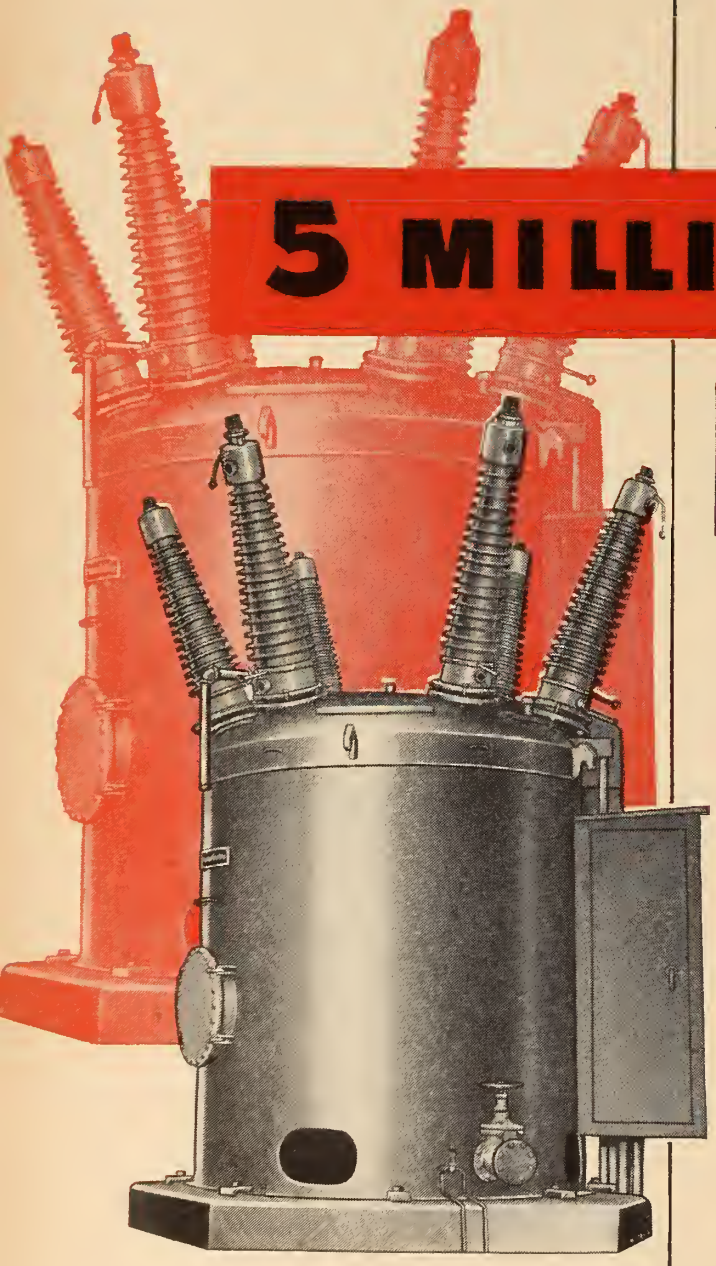

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5333-350

Determining Soil Moisture and Density by Nuclear Radiations

by

D. A. Lane, S.E.I.C.,
B. B. Torchinsky, M.E.I.C., and
J. W. T. Spinks

Departments of Chemistry and Civil Engineering, University of Saskatchewan, Saskatoon.

A paper presented at a meeting of Committee D-18 of the American Society of Testing Materials, in Cleveland, Ohio, on March 5, 1952.

Nuclear chemistry has made available a new set of tools to the research worker in soil mechanics. In the study of foundation movements, where moisture content, and especially variations of moisture content with time can so materially affect the properties of a soil, a method for detecting soil moisture without disturbing equilibrium conditions becomes all-important. In the construction of highways, airport runways and earth dams, a rapid, yet accurate method to determine soil moisture content and density is invaluable for field inspection and control.

The use of neutron activation of indium foil to measure soil moisture was recently reported by scientists working independently in the United States and in Canada (1,2). Further development work has led to an improved portable model of the original apparatus which has proved quite satisfactory in field experiments. The same basic equipment is also designed to determine soil density.

Neutron Moisture Meter

The underlying principle and general experimental arrangement of the moisture meter is shown in Figure 1 while mechanical details are given in Figure 2. The apparatus consists of a probe head (4) in Fig. 2, which is lowered into a 2-in. diameter vertical hole in the soil by means of an aluminum probe cylinder (1). A 50 mc. Ra/Be neutron source is then lowered into its seat using an electromagnet. A foil holder (3) containing indium foil, is lowered by means of a cord attached to the foil holder cap (2) into its seat, thus placing the indium foil around the neutron source. The fast neutrons emitted by the neutron source lose their energy by collision with the hydrogen atoms in the water molecules in the soil, and become slow neutrons which are absorbed by the stable Indium ^{115} causing it to change to Indium ^{116} which is radioactive. The slow neutrons are more readily absorbed by indium than the fast neutrons. The absorption cross section of the slow neutrons is 200 barns at 0.025 ev energy, as compared to 0.1 barn at 1 Mev energy for the fast neutrons, and thus the activity induced in the foil in a given time depends on the amount of moisture, or hydrogenous material, in the soil.

The growth of activity in the foil is given by an equation of the type:

$$\text{Activity} = K\,\sigma\left[1 - e^{\left(\frac{0.69t}{t_{1/2}}\right)}\right]$$

where K is a constant depending on the neutron flux, σ is the absorption cross section, t is the irradiation time, and $t_{1/2}$ is the half-life. From this equation it follows that, for a given isotope, 50 per cent of the saturation activity will be reached in one half-life, or nearly 90 per cent in three half-lives.

After exposing the foil for a definite time, measured by a stop watch, the foil in its holder is withdrawn and placed around the Geiger tube of a portable beta-gamma rate meter which is read at a definite time after removing the foil from the neighborhood of the source. After some experimentation, a ten-minute exposure, followed by a one-minute delay before measuring the activity, was chosen as standard procedure (see for example, Fig. 3).

The development of a meter which can be used to rapidly determine soil moisture and density, independent of soil type, is described. The moisture meter is based on fast neutron bombardment of the soil causing the reflection of slow neutrons which activate a detector foil. The activity of the detector foil after a given exposure time can be related to the water content of the soil. The density meter is based on the fact that the amount of gamma ray absorption of the soil is proportional to the density of the soil. Field and laboratory studies of the meter have shown it to have considerable promise, although further development work is necessary. A particular application of the meter is that it can be used to study soil moisture variations in the field over long periods without disturbing equilibrium conditions..

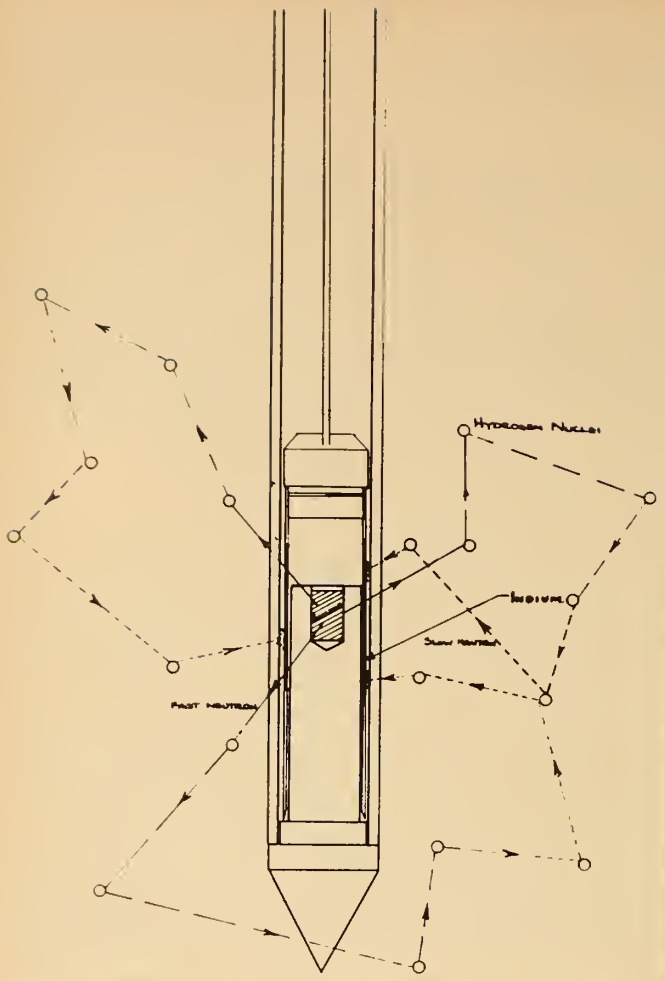
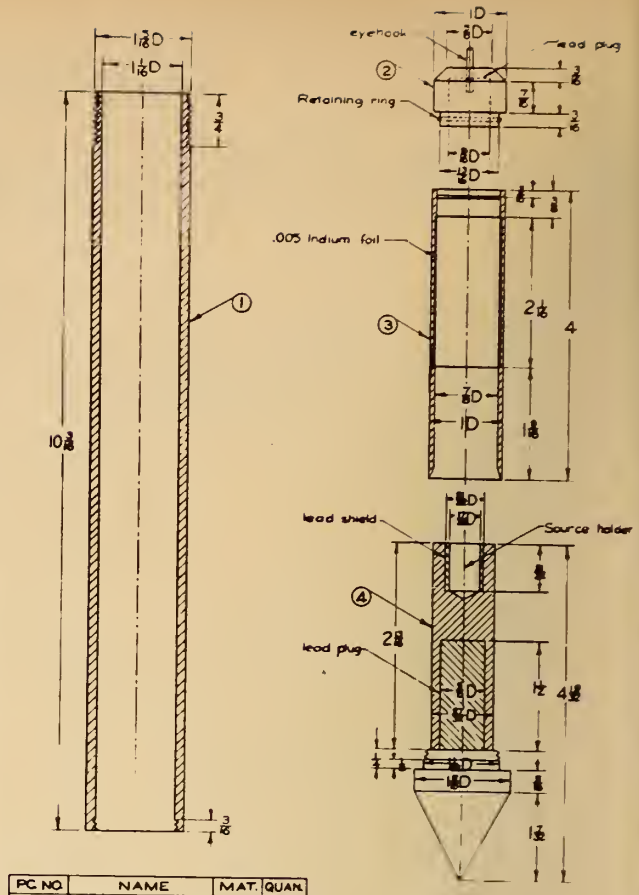


Fig. 1. Diagrammatic sketch illustrating principle of the neutron moisture meter.



PC NO.	NAME	MAT.	QUAN.
1	Probe cylinder	Al	1
2	Foil holder cap	Al	1
3	Foil holder	Al	6
4	Probe head	Al	1

June 29, 1951

Fig. 2. Moisture meter details.

The activity of the indium is actually due to two nuclides having half-lives of 13.8 sec. and 55 min. respectively. The natural background i.e., the residual count on the indium due to previous radiation, was allowed for by taking a reading on the foil before exposing it. It is desirable to have at least six identical foils for use so that an exposed foil can be left for its activity to decay before re-using. The activity induced for a given exposure time depends on the foil thickness and is also affected by the density of the surrounding soil. In making up a calibration curve, it is best to take this latter effect into account by plotting activity against pounds of water per cubic foot of soil. The wet density must then be determined before this water content can be expressed as a percentage of dry weight of soil.

Zone of Influence of Neutrons in Soil

The effect of varying the distance between the source and the foil for soils of two widely differing moisture contents is shown in Figure 4. The zone of influence is seen to extend from 8 to 10 in. from the source. However, as judged by the area under the curve, almost 90 per cent of the activity induced will be due to moisture in the soil within a distance of 6 in. from the source, the distance 6 to 10 inches contributing only about 10 per cent. Thus, for practical purposes, the zone of influence can be considered to be a sphere of about 6 in. radius.

Density Meter

The same 50 m.c. Ra/Be source used for moisture determinations was used as a gamma ray emitter for measuring soil densities. The principle on which this meter is based is that the number of gamma rays which are deflected is dependent on the unit mass of the material through which they radiate. The details of the density meter are shown in Figure 5. The Ra/Be source remains in the same holder as was used for the moisture determination. The density probe, which contains the Geiger tube of the portable beta-gamma rate meter is then lowered into position above the source. The tube is protected from receiving direct gamma radiations from the source by a lead shield placed between it and the source. Thus, the only rays which can strike it are those which have been scattered by the soil. The tube is connected to the portable ratemeter, which immediately indicates the average rate at which gamma rays strike the tube. This value can be calibrated against wet density. A typical calibration curve is shown in Figure 6. It is of the utmost importance in this test to keep the relative positions of source and Geiger tube absolutely constant in order to obtain reproducible results.

Health Precautions

The use of the neutron and density meter necessitates certain precautions to insure the health of the operator. Although these are not very elaborate nor expensive, nevertheless they are most import-

ant. An electromagnet mounted on a 3-ft. length of 5/16-in rod, projecting from an ordinary flashlight case facilitates the handling of the source. When not in use, the source is stored in a lead castle, weighing about 75 pounds. When it is in the ground, the operator should not stand directly over it. The operator wears a film monitor on his person whenever he works with the meter. This film gives an indication of the exposure to γ rays and should be checked every week. The amount of neutron radiation which the human body can safely tolerate has not yet been definitely established. However, keeping the allowable exposure down to one-third the tolerable amount for gamma radiation (100 milliroentgens per week), should be safe.

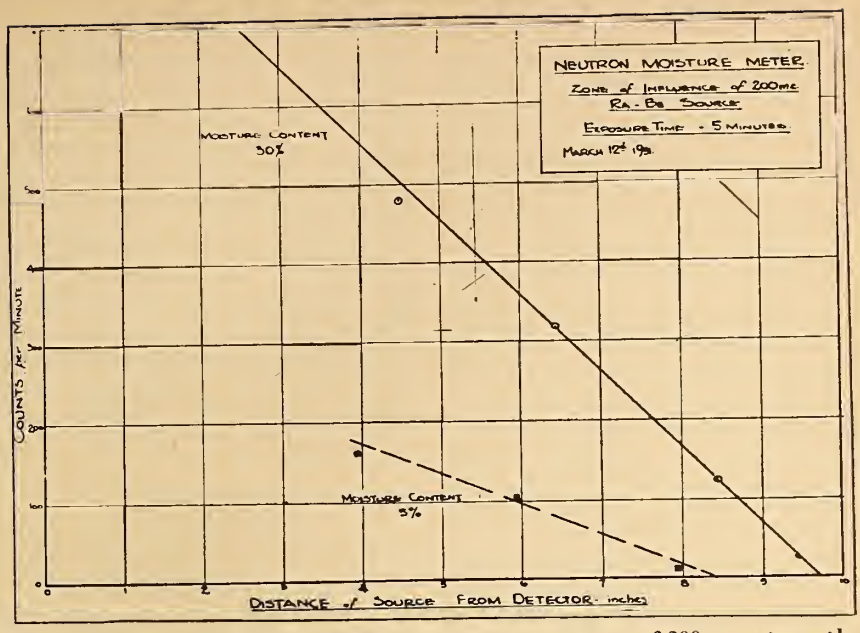


Fig. 4. Zone of influence for a Radium-Beryllium source of 200 mc. strength.

Field Experiments

(a) Calibration curves

In a typical field experiment, a series of holes, 6 ft. deep and 2 in. in diameter were drilled at various levels on the banks of the South Saskatchewan River to give a variety of soil types, densities and moisture contents. These were lined with aluminum pipe 0.050 inches

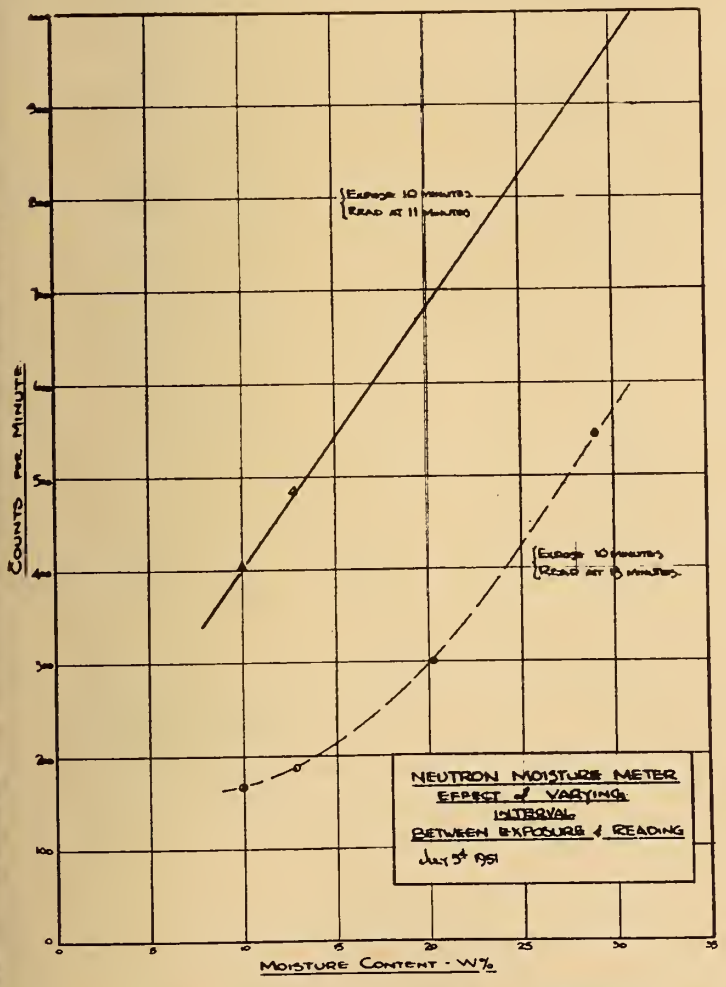


Fig. 3. Effect on calibration curve of varying interval between exposure time and reading activity.

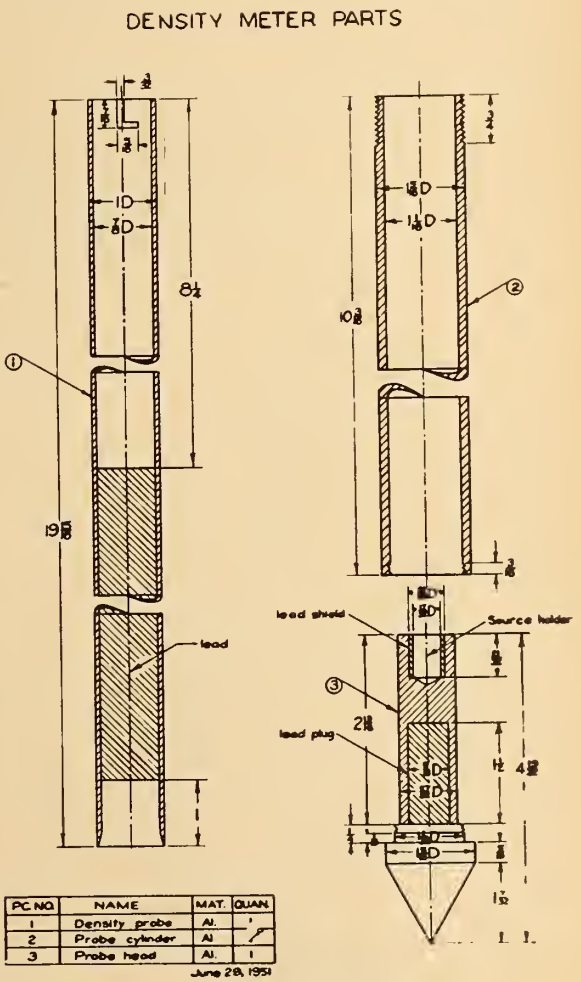


Fig. 5. Density meter details.

thick. The soil types encountered ranged from sandy silts to medium plastic alluvial clays. The depth of the source could be varied by adding lengths of aluminum tubing to the source holder and lowering it to the desired depth in the hole. A clamp on the tubing served to maintain the desired depth.

Samples of the soil were taken every 6 in. during excavation of the holes for determination of moisture content by the standard oven-drying method. Density variations at each hole site were determined from an auxiliary 4-in. hole about one foot away, using the standard oil displacement method of measuring volumes. Densities were determined for consecutive 6-in. layers.

Three readings for moisture content at each depth were averaged to give a mean value. This is plotted in Figure 7 against the average measured moisture content in the 6 in. above and below the source, since the zone of influence of the source is primarily a sphere of about 6 in. radius. The density used was the average density in the same 12-in. region. Figure 7 shows a reasonably linear relation between counts per minute and pounds of water per cubic foot. The equation for this line is $x = 0.02y - 2.5$, where x = pounds of water per cubic foot of soil and y = counts per minute. This curve was used as a standard calibration curve for future tests. Figure 8 shows a comparison of moisture content determinations in a vertical hole on the campus of the University of Saskatchewan. The neutron and gamma ray meter is compared with actual oven-drying methods. All determinations agree within 3 per cent moisture, and most are within 2 per cent moisture, or less.

(b) Effect of type of casing

In a second series of tests, holes were lined with standard, black steel pipe, having a wall thickness of 0.154 in. The results are plotted in Figure 9. Lower, but similar, activities to those using aluminum casing were obtained, indicating that steel casing can be used, if the proper calibration curves are available.

(c) Effects of flooding

A third field test consisted of drilling several 2-in. holes in a 12-ft. square area to a depth of 10 ft. Moisture content determinations were made by oven-drying soil samples taken during the drilling of the test holes, to serve as a check on neutron meter readings. The holes were lined with aluminum casing, which projected about 10 inches above the ground, and the area was dammed off so that it could be kept flooded with water.

Prior to flooding, a series of moisture content and density determinations were made, at 6-in. intervals of depth using the neutron meter and the previously obtained calibration curves. The area was then completely flooded and allowed to stand for 12 hours, after which moisture content determinations were again made with the neutron meter. This procedure was repeated three times. At the conclusion of flooding, further soil samples were obtained by drilling holes close to the original cased holes. Water content determinations were run on these in the conventional manner, and these were compared with the last set obtained with the neutron meter. The results of these two comparisons for one

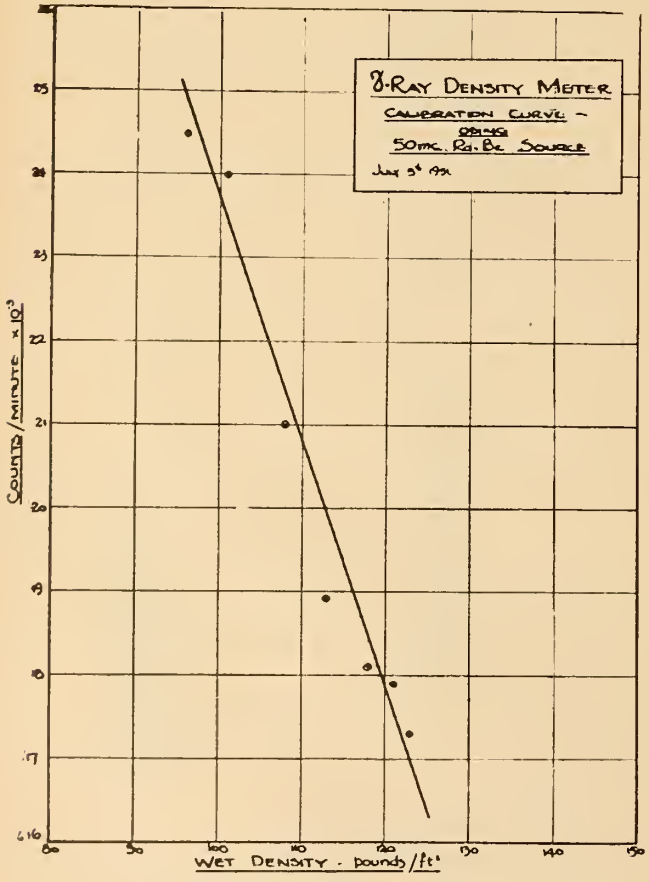


Fig. 6. Calibration curve for density meter using a 50-mc. Radium-Beryllium source.

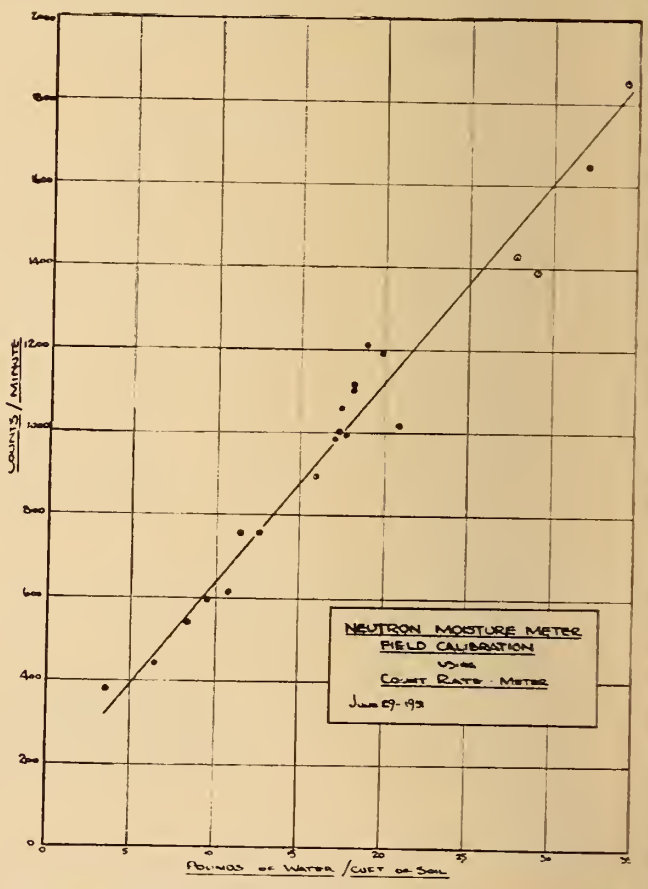


Fig. 7. Calibration curve for moisture meter using a 50 mc. Radium-Beryllium source (exposing 10 minutes and reading activity on 11th minute).

typical hole are shown in Figure 10. These indicate that the neutron meter can be used to detect moisture content variations in a mass of soil. This is one of the important uses of the meter, for in studying foundation movements of light buildings on highly plastic clays, a method of detecting moisture variations in the underlying clay, without disturbing the original equilibrium conditions is very important.

(d) Tests in Bearpaw Shale

A fourth field test was not as successful as the previous ones. This test was run at the site of the proposed South Saskatchewan damsite in central Saskatchewan, chosen because the bedrock in this area is Bearpaw shale, a highly compressed, highly plastic, very uniform clay. Convenient test pits through the overburden were available, which made it easy to get at the shale, and a considerable amount of information was available as to its water content, classification, etc., from the Prairie Farm Rehabilitation Administration.

The results obtained in this test were not as good as those previously obtained. One hundred and eight moisture content determinations were made using the neutron meter and the calibration curves which had been established from holes drilled on the campus of the University of Saskatchewan. These were compared with values of water content obtained by the standard oven-drying method. Of these, 65 were within 2 per cent, 26 others were within 4 per cent and 17 more varied by more than 4 per cent. All values refer to per cent water content. The water content of the shale varied from 25 to 50 per cent.

No definite reason has as yet been established for the lack of good correlation in the last test series. All soils tested were inorganic or nearly so. The presence of large amounts of organic material would, of course, upset the calibration curve, since the hydrogen atoms present in the organic material would affect the meter in the same way as those in water.

One possible explanation of the difference may be obtained from a closer examination of the clay particles themselves. It has been shown in recent years, with the aid of the electron microscope and differential thermal analysis, that clay minerals have a crystalline structure. They may be classified into three major groups, based on their lattice structure. These are kaolinite, montmorillonite and illite (Figures 11, 12 and 13). All of these groups have hydroxyl ions in their lattices. Kaolinite has the largest number of hydroxyls, while montmorillonite and illite have about the same number each. These hydroxyls may provide sufficient hydrogen atoms to activate the neutron meter, causing it to indicate more moisture than is actually present. This may necessitate the application of a correction factor to the test results according to the soil type tested. In any event, moisture variations in any one soil type can be successfully followed with the neutron meter, so that even if the exact water content is dependent on a correction factor, variations of moisture content can be detected without this factor. Although considerable work is still necessary to finalize the neutron meter, the results obtained in preliminary tests indicate that it is of considerable practical value.

Other Possible Uses

Another possible use for the neutron meter is to determine the asphalt content of a bituminous

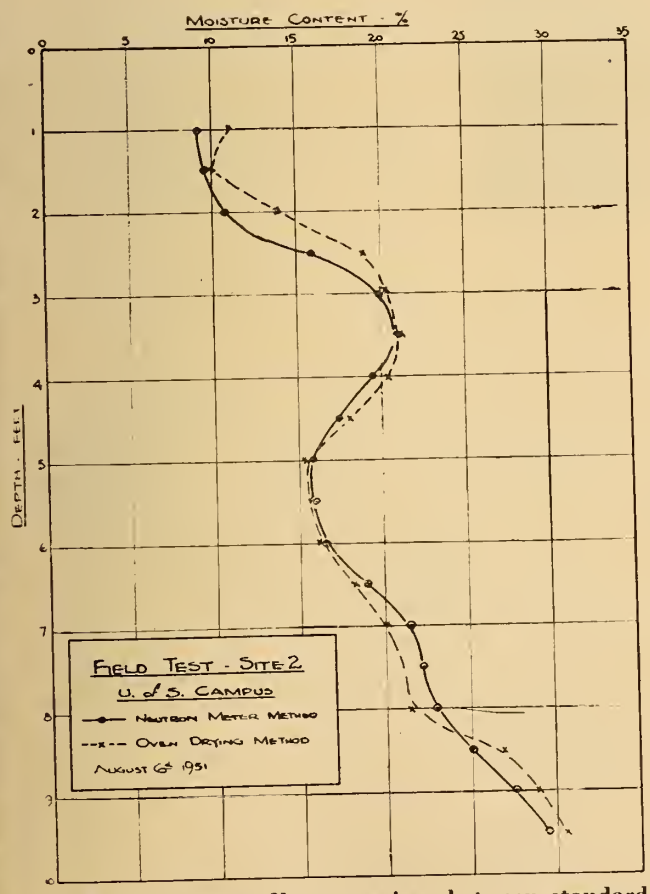


Fig. 8. Moisture profile comparison between standard oven-drying method and neutron meter.

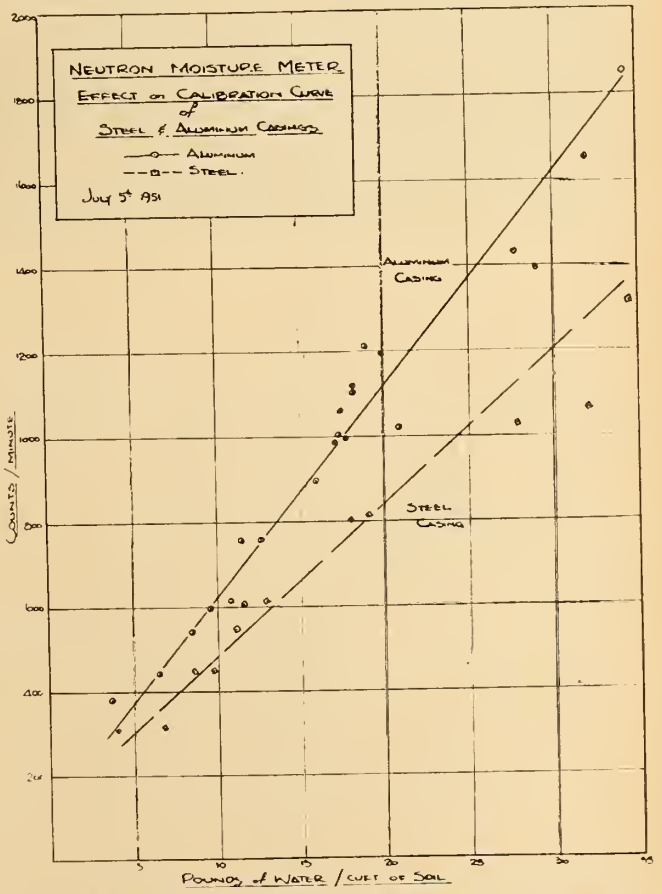


Fig. 9. Effect on calibration curve of steel and aluminum casings for vertical hole.

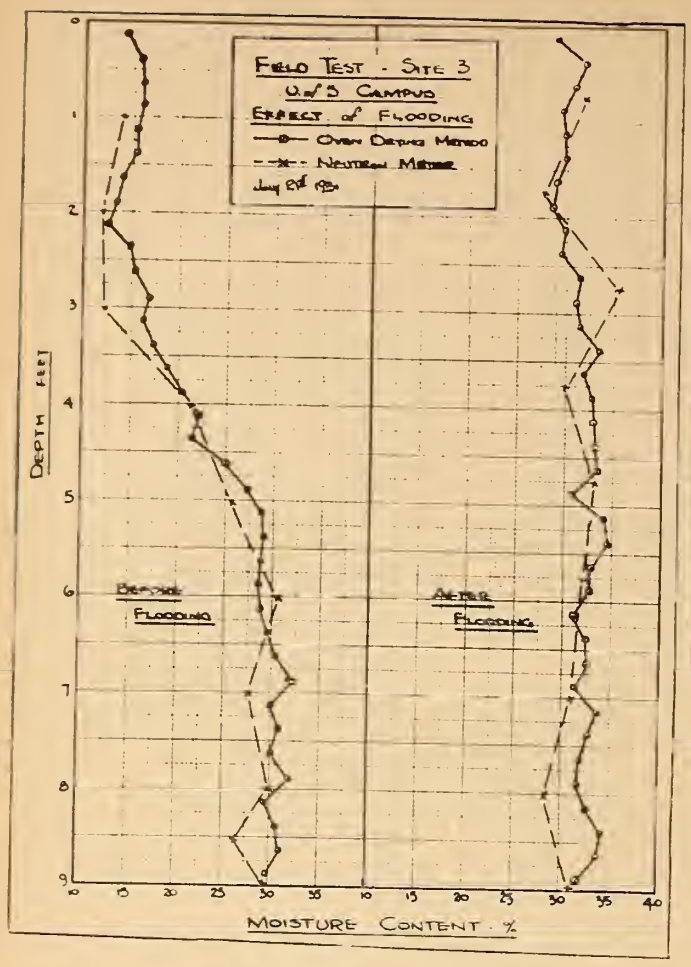


Fig. 10 (left). Moisture profile comparison between standard and neutron meter methods for a field flooding test.

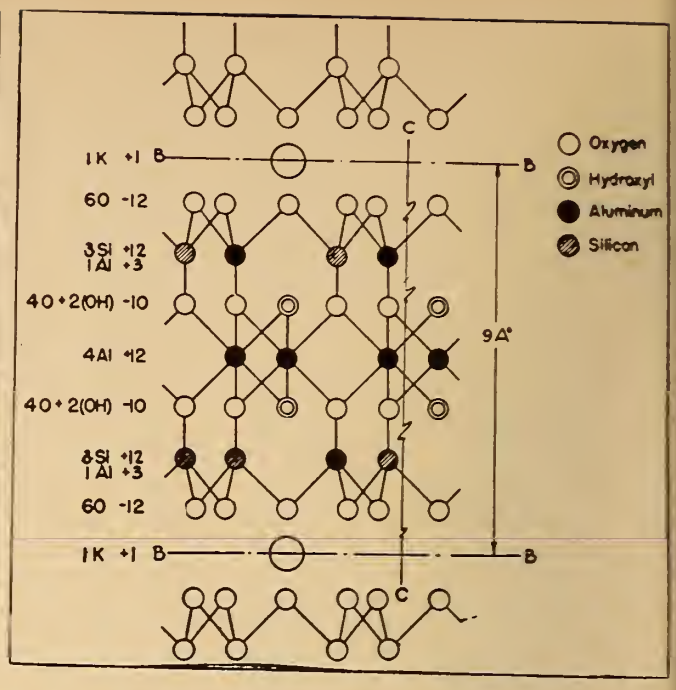


Fig. 11 (right). Diagrammatic sketch of kaolinite space lattice.

pavement mix. Present procedures for this are slow and tedious. The hydrocarbons in the asphalt should provide sufficient hydrogen nuclei to activate the meter in much the same way as does the water content of a soil. A calibration curve could then be established to convert activity of indium foil after a given exposure time, to percent asphalt content. This possible use is already being investigated.

Acknowledgments

The development of the neutron meter was made possible through research grants from the Saskatchewan Research Council and from the Prairie Roadbuilders Section of the Canadian Construction Association. Cooperative assistance in this work was also provided by the Prairie Farm Rehabilitation Administration.

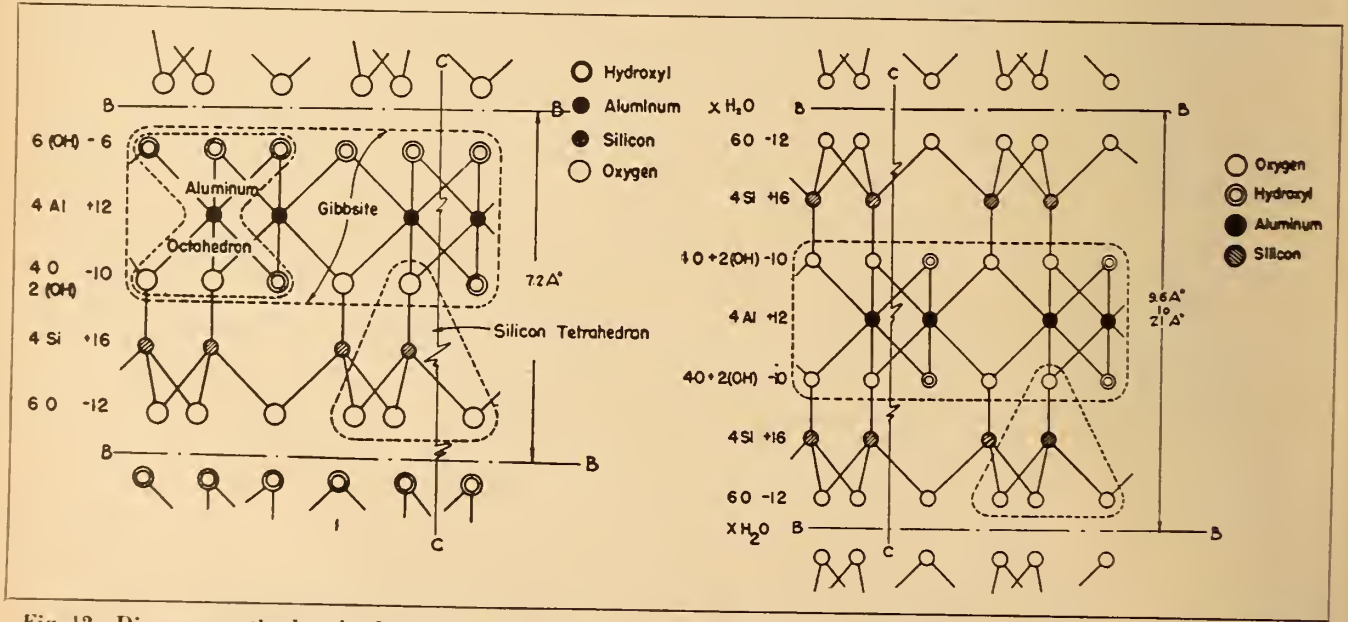


Fig. 12. Diagrammatic sketch of montmorillonite space lattice.

Fig. 13. Diagrammatic sketch of illite space lattice.

Definitions

The following explanation of terms is presented for the benefit of those who are not familiar with nuclear physics terminology.

Indium—a soft white metal which occurs in zinc and lead ores, and is mainly used in bearings. It belongs to the gallium-indium-thallium family in the Group III of the periodic table.

Activity of Indium—In^{115} is stable. On bombardment with slow neutrons it becomes In^{116} which is radioactive, and has two isomers having half-lives of 13.8 seconds and 55 minutes.

Half-life—the time for a radioactive material to decay to half its original activity. It decays to a quarter of its original activity in another half-life, and so on.

Millicurie (*m.c.*)—a measure of activity equivalent to 1 mg. of radium, that amount which undergoes 3.7×10^7 disintegrations per second.

Radium-beryllium neutron source (*Ra/Be*)—a mixture of radium with an excess of beryllium metal powder. The γ particles from radium collide with the beryllium nucleus and eject neutrons.

Absorption cross-section—the apparent area of the nucleus with respect to collisions from a bombarding particle i.e., area expressed in barns, where 1 barn = 10^{-24} cm.

Electron volt (ev)—is the energy acquired by an electron in falling through 1 volt. 1 ev = 1.6×10^{-12} ergs. and 1 Mev = 10^6 ev.

Beta-gamma rate meter—a meter which measures the average rate of decay of a radioactive substance in terms of the β or γ rays emitted.

Isotope—atoms of the same element having different atomic weights are called "isotopes." They have the same atomic number.

Nuclide—a type of atom characterized by a definite structure.

Roentgen—that quantity of X or γ rays which will produce one electrostatic unit of electricity of either sign in 1 cu. cm. of dry air at 0°C. and 1 atmosphere. When 1 roentgen of X-rays is absorbed in 1 gm. of air, the energy gained is 83 ergs.

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1. Report to Committee on Soil Mechanics, National Research Council, December, 1950.
2. The Measurement of Soil Moisture and Density by Neutron and Gamma-Ray Scattering. D. J. Belcher and Associates, Cornell University, October, 1950. √

The Saunders-Roe "Princess" Flying Boat

With the launching in August 1952 of the first of the three Princess Flying Boats, designed by Saunders-Roe and ordered by the Ministry of Supply, Britain now possesses the largest passenger-carrying aircraft in the world. These giant aircraft, costing some $80 millions apiece, will be able to carry over 200 troops a non-stop distance of 3,550 miles (3,000 nautical miles).

These aircraft were first intended for service by B.O.A.C., being later transferred to B.S.A.A. The design allowed for the operation of a non-stop service between London and New York, with its stage length of nearly 3,500 miles and the possibility of continuous head winds averaging up to 90 m.p.h. When plans were later made for the flying boats to be operated by B.S.A.A. it was intended that they should fly on the South American route. The original design incorporated plans for spacious and comfortable accommodation for the passengers, with sleeping berths, cocktail bars and every possible luxury.

Present plans for interior arrangement are based on the use of the aircraft as a military transport. In this connection, it is of importance to note that the three flying boats when in operation could, by virtue of the time saved in flying compared with sea travel, transport in one year as many troops as could be carried by nine ordinary troopships on strategic trooping routes.

The hull of each of these machines is the largest metal structure ever built for an aircraft. In cubic capacity it is equivalent to one suburban train or 3½ Constellation aircraft and into it have gone 2½ miles of longitudinal members, 1,469 square yards of metal plating and three million rivets. As well as being built to resist the force of water when alighting and taxying, it is also built to withstand the intense pressure required to operate at heights of 40,000 feet.

The Princess is a high-wing ten-engined flying boat with single fin and rudder. The all-up weight is approximately 140 tons, but the power weight ratio and the wing loading are such as to ensure exceptional take-off and climb characteristics.

The Princess Flying Boat

Following is a summary of some of the main dimensions and characteristics:

Span	210′-6″ Floats down 219′-6″ Floats up
Length	148′
Height	55′-9″
Wing	
Wingchord	root 30′, tip 11′
Wing thickness	root 5.4′, tip 1′-3″
Wing area	5,000 sq. ft. approx.
Wing loading	63 lb./sq. ft. approx.
Hull	
Height	24′-3″
Beam	16′-8″
Draught	8′
Fin and Rudder	
Height above top of hull	31′-6″
Chord	root 25′-6″, tip 11′
Area	600 sq. ft. approx.
Tail plane	
Span	77′
Chord	root 22′, tip 6′-9″
Area	1,000 sq. ft. approx.

(*Continued on page 24*)

Corrosion in Industry

by

Bruce Levelton

Assistant Research Engineer,
British Columbia Research Council,
Vancouver, B.C.

A paper presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada at Vancouver, B.C., May 7, 1952.

Assessing the potential annual loss to industry through corrosion, the author discusses its causes and prevention. Examples are given of the effect of corrosion on typical lumbering and papermill equipment. Exposure tests are described and theories given for the causes of failure, from which preventive measures are prescribed. Special attention is given to corrosion from oxygen and salt water.

If engineers were able to effect a saving of 1 per cent by improvement of metals, coatings, and practice, the net saving in Canada would be $2\frac{3}{4}$ millions annually, as well as a large amount of critical metals. This is certainly not a high value to aim for.

Corrosion is the direct result of the tendency for metals to revert to their lowest energy level. It is regrettable from an engineer's viewpoint that this most stable state commonly corresponds to the naturally-occurring ore. Consequently iron tends to revert to hematite and magnetite, copper turns into various sulfides and oxides, and so on. Corrosion cannot be completely eliminated, but in all cases judicious choice of metals, coatings and operating conditions will alleviate the severity of attack, and savings in time and materials will result.

Economic and material loss through corrosion of metals is divided into: (1) Direct loss resulting from protection costs and replacement of corroded equipment, and (2) An incalculable, indirect loss through shutdown, over-design, loss of product and efficiency, explosion and contamination.

Direct loss by corrosion is difficult to estimate, although it is amenable to analysis. In general, surveys are incomplete and are subject to personal interpretations. Nevertheless, Dr. Herbert H. Uhlig of the Massachusetts Institute of Technology, one of the world's leading authorities on corrosion, has compiled data which show that the annual cost to the United States is in the neighbourhood of $5\frac{1}{2}$ billions. On the basis of relative populations and industrialization it might be supposed that Canada would suffer approximately 5 per cent of this value or some $275 millions per year.

Indirect losses cannot be estimated, or even guessed. This is particularly true because they include loss of life, explosions and other unpredictable failures. For example, if a building worth $200,000 were protected by a sprinkler system

Bruce Levelton (left), and Chairman W. E. Brown, M.E.I.C., of Hamilton, at the annual meeting session at which this paper was presented.

which had failed due to corrosion when a severe fire occurred, the material loss might be expected to be $100,000 or higher. The possibility of loss of human life in such a fire raises the cost an undeterminable amount. This type of damage normally is classified as resulting from fire, but the fire was the result of the sprinkler system failure which was caused by corrosion.

Overdesign of equipment to take care of corrosion results in the needless loss of appreciable tonnages of metal each year. Because corrosion rates are frequently unknown, the design specifies several times the required thickness of metal to ensure adequate strength and continued performance. This practice is common in pipe lines where the extra thickness is required to prevent early perforation. If 200 miles of 8-inch pipe were reduced in wall thickness from 0.332 inches to 0.25 inches, a saving of 3,300 tons of steel would be made.

In the following text are listed a few examples of corrosion in industry with discussion of the causes and possible preventive measures.

In the Lumbering Industry

A long-standing problem of the lumber industry has been the corrosion of metal piping, cars and tracks in dry kilns. In one plant investigated, the steel piping in kilns drying hemlock was lasting less than one year. At the same time, kiln lumber cars and tracks were being severely corroded and required frequent replacements. The steel piping could be divided into two groups, viz., (1) the heater pipes through which steam was circulated, and (2) sprinkler pipes located immediately below the ceiling of the kiln and above the charge. These were normally dry internally.

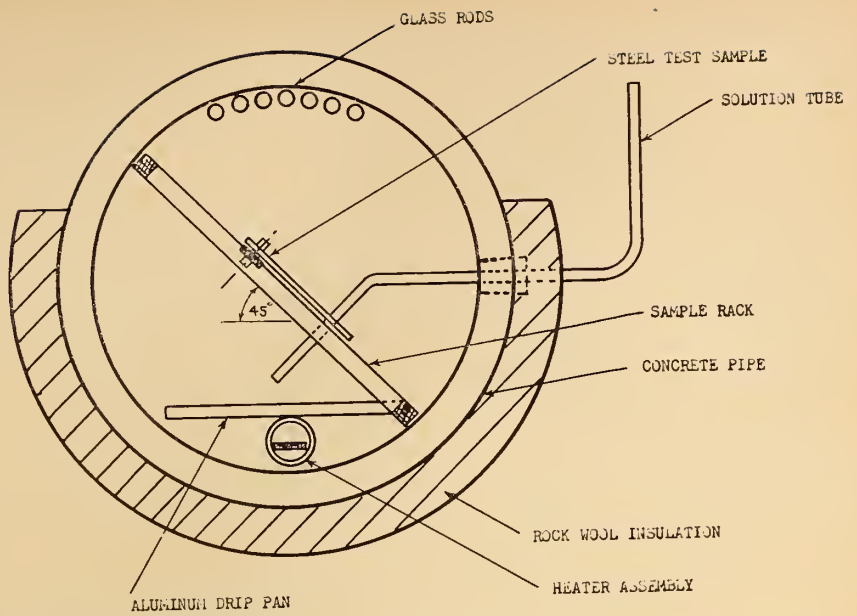

Fig. 1. Diagrammatic assembly of test dry kilns for observing effect of thermal insulation on corrosion.

In normal operation it was found that most severe corrosion occurred on the sprinkler pipes, and on the heating pipes near the top of the kiln. The steam pipes were arranged in vertical banks of horizontal pipe on each side of the kiln. It was the upper pipes of each bank which were corroding. Further, the most severe attack occurred on the upper side of piping, although some cases were noted in which pitting and general transgranular attack had occurred on the underside of piping as well. A six-inch pipe passing through the wall between kilns was observed to have been attacked on a longitudinal strip along its upper

Fig. 2. Mild steel test samples placed in the completely insulated kiln at 85° C. and at pH = 3.0 for 2½ weeks.

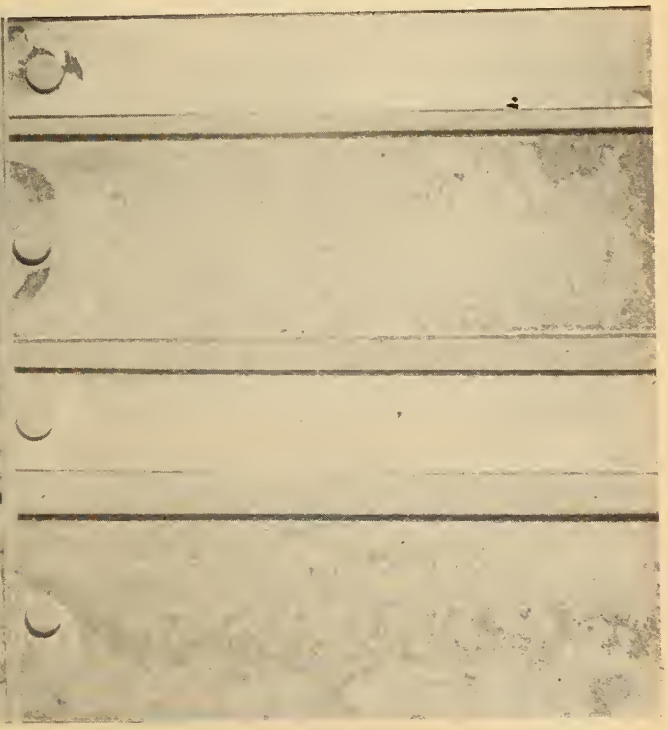

Fig. 3. Mild steel test samples placed in the kiln with top section uninsulated at 85° C. and at pH = 3.0 for 2½ weeks.

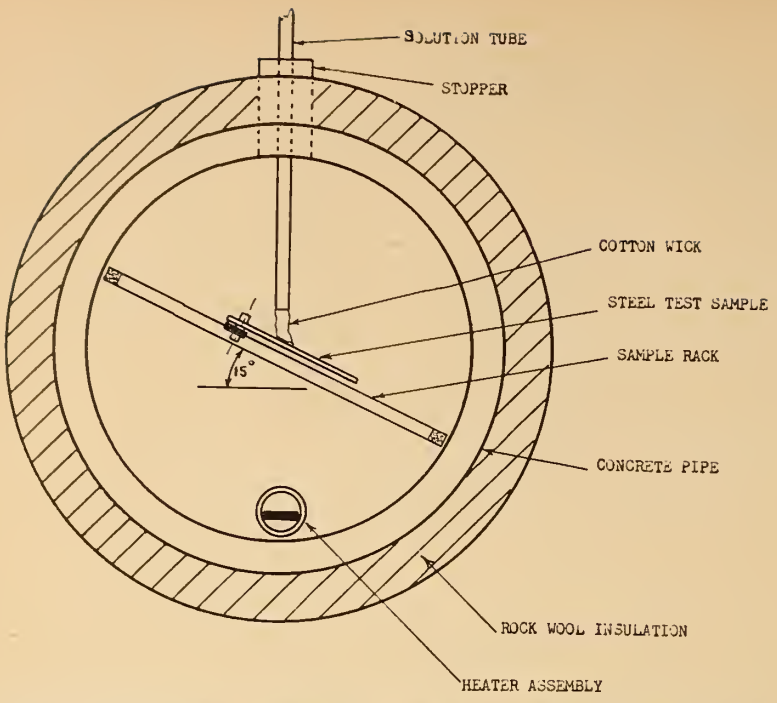

Fig. 4. Diagrammatic assembly of test dry kilns for investigation of efficacy of protective coatings.

Fig. 5. Fractured surface of shaft showing fatigue markings (lower right) and deep corrosion pits (left).

surface, and also on a similar section along its under side.

Kiln cars were severely attacked on the I-beams placed transversely on the cars to support the lumber load. Frequently these beams failed when a load was in the kiln or in process of preparation for the kiln, resulting in breakage, warping and other hold-ups attendant on hand unloading. Rails failed by corrosion of the web, other sections being sufficiently thick to permit considerable weight loss without failure.

Tests on samples of condensate taken from dry kilns charged with hemlock have shown pH's as low as 3.50. This acidity is sufficient to cause serious attack on any steel surface.

Consideration of kiln structure and operation led to the following theory of corrosion. The kiln roof, being uninsulated and losing heat rapidly, was considerably cooler than the kiln floor, and consequently air which was not saturated with moisture at the floor was condensing on the roof. This condensate dripped onto the sprinkler pipes and upper steam pipes, producing an impingement type of corrosion with the corrosive solution standing in the pits to further aggravate the condition. The solution then ran around the pipe and collected in drops on the underside, adhering by surface tension and producing corrosion on the underside of the pipe.

Kiln cars and rails were believed to be attacked during the initial part of the drying cycle, when humidities were high and condensed vapours ran down through the lumber and onto cars and rails.

Accordingly, rather than attempt to protect the piping from condensate, it was decided to eliminate, if possible, the cause of condensation. To evaluate the solution of the problem experimentally, two test kilns were constructed as shown in Figure 1. The kiln shown was insulated only over the bottom half, while the other was fully insulated with three inches of rock wool. Four bare low carbon steel samples were placed in each kiln, as indicated in the diagram. The kilns were maintained at 180°F. throughout the tests by means of a strip heater and thermostat. A solution of formic acid, acetic acid and water of pH 3.0 was fed to the kilns through a glass tube and dripped into an aluminum pan. Both kilns were set up outdoors and their surfaces were subject to variations in atmospheric temperature.

Exposure Tests

Results of exposure tests are shown in Fig. 2 and 3. Fig 2. shows specimens taken from the fully insulated kiln. The narrow strips were surface ground before placing in the kiln while the other two were put in with the original mill scale adhering. No corrosion was evident on these samples. The samples from the partially insulated kiln are shown in Fig. 3 and exhibited considerable attack from drops of condensate which had fallen from the glass rods at the top of the kiln. No such condensation was formed in the wholly insulated kiln.

On the basis of these results, it was concluded that the condensate formed because the uninsulated portion of the kiln was cooled sufficiently by the outside air to lower the top temperature of the kiln below the dewpoint. In the completely insulated kiln, at no point were the walls sufficiently cool to cause condensation, and apparently the acid vapours were not corrosive to steel. Therefore it seems logical to so insulate dry kilns that nowhere

does the air become saturated with moisture, resulting in harmful condensation.

That such insulation should be effective was demonstrated by the fact that the hot steam pipes suffered less corrosion than the relatively cold sprinkler pipes. Apparently condensate dripping onto the top rows of heating pipes was evaporated rapidly, thereby protecting lower rows even though the top rows were seriously attacked. A further value of insulation, of course, derives from the saving of steam for heating the kilns.

No tests were made on the value of protective coatings for the heater pipes because such coatings are in general expensive, and require careful applications. The investigation was made to determine means for eliminating the cause of corrosion rather than protecting kiln construction against it.

To test protective coatings for kiln cars and rails, the kilns were arranged as shown in Figure 4. As before, temperature was maintained at 180°F., but the solution of pH 3.0 was run directly onto the samples through a glass tube and wick. Duplicate specimens of low carbon steel were covered with a number of inexpensive protective coatings. The tests were run for three weeks, at which time the samples were removed, examined, cleaned roughly and recoated.

After a further two weeks under identical conditions, the specimens were again removed and examined.

After five weeks exposure duplicates coated with 170° asphalt, were the only unattacked specimens. Asphalt lends itself to use as a protective coating, first because it is relatively inexpensive and second because it can readily be applied by dipping or hot brushing.

It is not suggested, however, that asphalt would make a suitable coating for steam pipes, since the difficulties of application and its tendency to run at higher temperatures prohibit its use.

In the Paper Industry

A common condition in many industries exists where a metal is subjected jointly to high stresses and a corrosive atmosphere. The stresses may be well below the design limit for the particular machine member and the corrosive conditions relatively mild, yet the two operating jointly can cause mechanical failure.

Such a failure occurred in a grindstone shaft used in a groundwood pulping operation. In this case the grindstone was mounted on the center of the shaft which was driven at one end, and supplied power to two other grindstones through a gear reduction box at the other. The shaft was supported by bearings on either side of the stone. Three separate loads were imposed on this shaft, the drive on one end, the grindstone and pulp log force on the centre, and the power take-off on the other end.

The metal of the shaft was subjected to continuous moisture, followed by periods of inactivity. At all times a plentiful supply of air was available. Probably abrasive material from the grindstone was present in the water and the metal surface became scratched.

Figs. 5, 6, and 7, show the shaft after specimen preparation. Fig. 5 shows how the crack developed on the left hand side and worked inward. This crack shows corrosion pits on its surfaces, indicating that the fault developed over a considerable period. Ultimately, the shaft was sufficiently thinned at the cross section so that under the applied stresses it became fatigued and failed. The fatigue markings show on the lower right portion of Fig. 5.

Fig. 6 shows the outside surface of the shaft. Visible are corrosion pits and corrosion fatigue cracks.

Fig. 6. Outside surface of the shaft showing corrosion fatigue cracks and corrosion pits. Etched in hot 50% HCl.

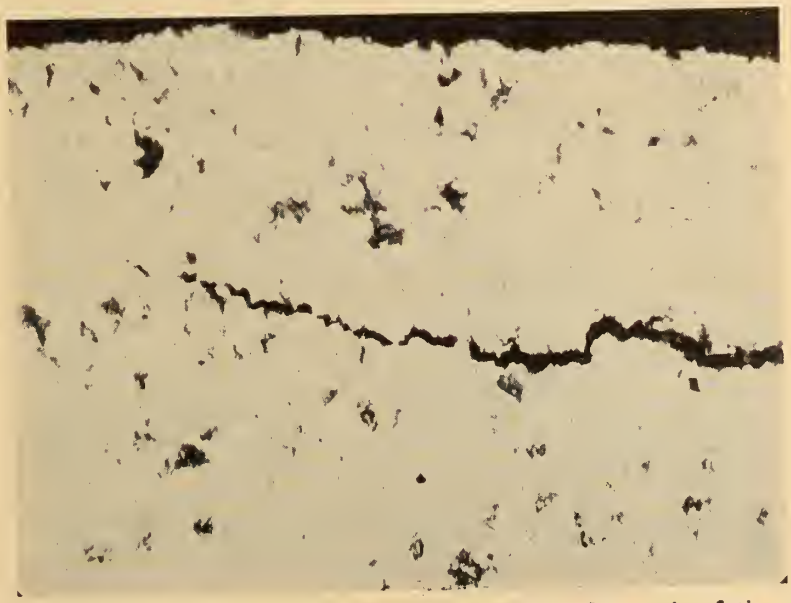

Fig. 7. Microstructure of steel shaft showing typical corrosion fatigue crack. Etched 22% Nital. X 100.

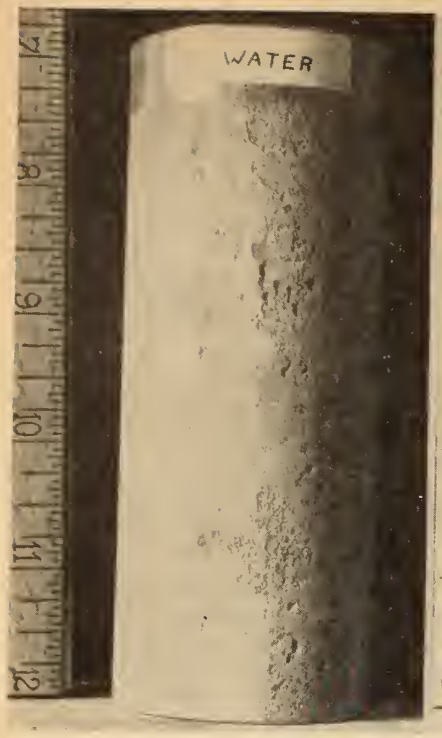

Fig. 8. Section of fire tube which was immersed in water. Cleaned and pickled in 50% HCl at 160° F.

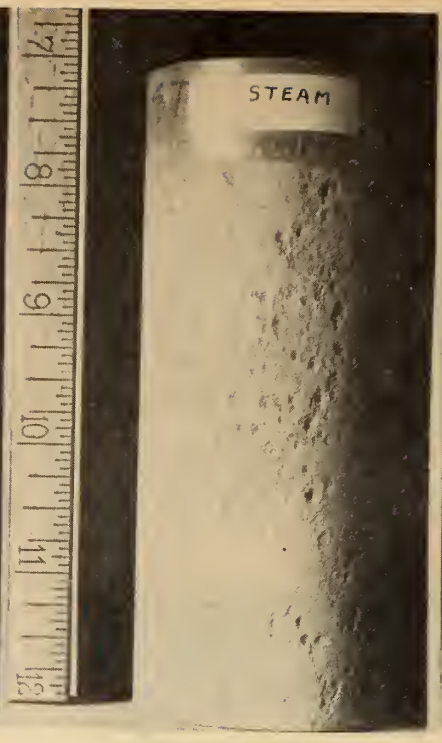

Fig. 9. Section of fire tube surrounded by steam. Cleaned and pickled in 50% HCl at 160° F.

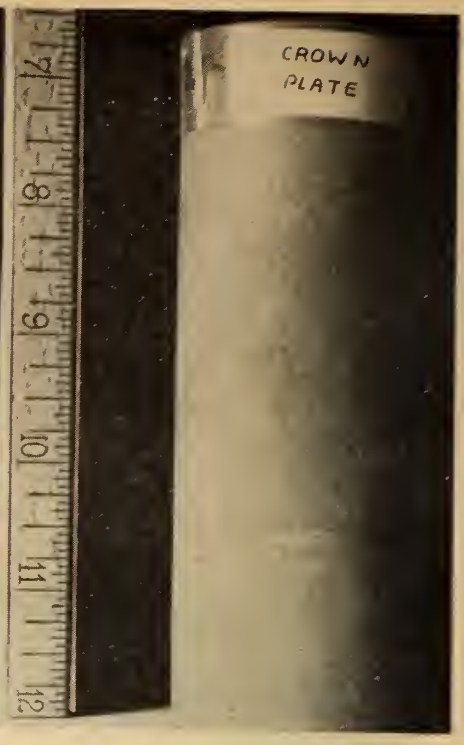

Fig. 10. Section of fire tube passing through crown plate which has been relatively free from steam or water. Note pitted appearance of surface.

It is likely that the pits are the result of oxygen attack, since they exhibit the characteristics of such corrosive attack. In the middle upper left corner can be seen another serious crack developing which follows a line of pits, each of which was previously associated with a small fatigue crack.

Inspection of the steel in the shaft has shown it to be satisfactory in all respects. Fig. 7 shows the microstructure of the shaft and also shows a typical corrosion fatigue crack. The crack is predominately transcrystalline in nature, in accord with general behaviour of any fatigue cracking.

Assumed Cause of Failure

The complete history of this failure is postulated as follows: First, the smooth surface of the shaft was abraded slightly by particles from the grindstone suspended in water. On these scratches corrosive action commenced, resulting in typical oxygen-attack pits. In these pits the stresses caused localized deformations beyond the elastic limit and a work-hardened layer. However, the protective work-hardened layer was anodic to the rest of the shaft and so corroded rapidly, thereby deepening the pits. This effect in turn caused further local fatigue failures which, as before, hastened pitting action. The ultimate effect was that the pits became deeper and narrower and joined with other cracks to sufficiently weaken the shaft so that it failed.

This type of corrosion can be minimized in a number of ways. Plating steel with zinc or cadmium has been found effective in increasing service life, but nickel and chromium coatings are valueless. Nitriding of special steels has also been found useful, these steels containing aluminum, chromium and molybdenum. High chromium steels have shown promise for resistance to corrosion fatigue. Protective paints are used in large amounts, but extreme care must be taken that all pin holes and scratches are eliminated.

Timely inspection of this shaft would have revealed the extent of corrosive attack and permitted replacement of the damaged member before its failure caused production loss and harm to other parts.

Fig. 11. Inside wall of condenser tube showing general pitting attack. Etched 3% Nital. X 84.

Effect of Oxygen

In no situation is corrosion more active than where one section of a metal is hot and the other cold. The corrosion may occur on either the hot or cold section or on both, dependent only on the specific conditions. It is not essential that oxygen be present for corrosion to occur, and examples of such non-oxygen type attack are found in corrosion of steel by hydrochloric acid and various other direct chemical actions. However, more attack is occasioned by oxygen dissolved in water or present in the gaseous state than by an other agent.

Steam boilers are particularly susceptible to dissolved oxygen attack. Rarely are boiler tubes attacked on the fire side, since as a rule combustion gases are relatively non-corrosive. Attack may be severe on the water and steam side, no preference being shown for either medium. In Figs. 8, 9, and 10, are shown sections of a mild steel tube removed from a low pressure (150 pounds) boiler. Attack is of the pitting type, commonly known in these cases as "hot spot" corrosion. The mechanism is that oxygen dissolved in water and in the steam forms bubbles on the tube, usually at a scratch or other imperfection, and these bubbles adhere strongly to the metal. An insulating effect is obtained, the section of the tube under the bubble becomes hot, and a pit forms which is a logical point for further bubble formation and further attack.

The tube sample shown failed in eight months of use, although other tubes had lasted eight years under identical conditions. It can only be surmised that either oxygen above normal concentrations was finding its way into the feed water, or that the surface of the tube contained numerous small inclusions which were anodic to the metal and acted as nuclei for pitting corrosion.

Effect of Salt Water

Fig. 11 is a photomicrograph of the inner surface of an ammonia cooler used in a refrigeration plant. Dry ammonia on the outside of the tubes caused no attack, but the salt water coolant running filmwise down the inside attacked the tube severely. This salt water was pumped to the top of the condenser and discharged freely over the tops of the tubes. It was at first believed that only the very top section of the tubes was being corroded, but subsequent examination showed that the entire tube length was severely pitted.

Table I

Annual U.S. Direct Loss by Corrosion Including Cost of Corrosion Control

1. Paints, varnishes, lacquers, etc.	$ 585,000,000
Labour for	1,460,000,000
2. Phosphate coatings plus labour	20,000,000
3. Galvanized sheet, pipe and wire	136,500,000
4. Tin and terne plate	216,000,000
5. Cadmium electroplate	20,100,000
6. Nickel and nickel alloys—electroplate, other than stainless steel	182,000,000
7. Copper and copper base alloys	50,000,000
8. Stainless Cr-Fe and Cr-Fe-Ni	620,400,000
9. Boiler and other conditioning	66,000,000
10. Underground pipe—maintenance and replacement	600,000,000
11. Oil refinery maintenance	50,000,000
12. Domestic water heater replacements	225,000,000
13. Internal comb. engine corrosion (est. at 60 per cent of wear)	1,030,000,000
14. Mufflers	66,000,000
	$5,427,000,000

Salt water in itself is not corrosive, but if sufficient oxygen is dissolved in it corrosion is much more severe than that produced by fresh water. In this case, the dissolved oxygen content of the salt water was extremely low, far below the danger level. The cold storage plant was close to several fish canneries, and the offal from these canneries plus the usual organic matter present in a large harbour tend to keep dissolved oxygen at a very low level by using it in oxidation processes. Therefore, the only point at which oxygen could enter was at the discharge on the top of the condenser. The water was well aerated there and the flow of liquid down the tubes had the effect of pulling in extra air.

This corrosion can be minimized by flooding the system and reversing the water flow, thereby avoiding any solution or entrainment or air. The use of special alloys is not justified, first because of the increased expense and second because of the danger of galvanic action between the steel shell and alloy tubes.

Summary

In conclusion, it may be said that for every corrosion problem there is a corrective measure which will in some way mitigate attack. For all of the examples recorded in this paper there were solutions. They were not absolute and complete answers to the problems, to be sure, but were answers which in part alleviated deterioration. It is this partial prevention of corrosion which is important, viz., the one per cent that is the percentage about which something can be done. Never before have such efforts been made by industry to control corrosion: every journal has its section on corrosion and every company has its corrosion control problem. They are finding the one per cent in direct savings becomes multiplied many times when converted to savings in increased production, reduced contamination and better design. √

Pre-stressed Concrete

Further progress in the use of pre-stressed concrete in Canada is indicated by the building of the first bridge of this design in British Columbia. This structure is a bridge carrying Marine Avenue over Mosquito Creek in Vancouver North.

The span of the bridge is 60 ft. between supports; width of roadway 48 ft.; width of sidewalks 5 ft.; giving an overall width of 60 ft.

The structural members consisting of stringers, sidewalk slabs and fence posts were pre-cast by the B.C. Concrete Co., and the Aerocrete Co., of British Columbia, and taken by truck to the site.

The stringers, of which there are 20, are 2 ft. 6 in. deep and 60 ft. long. The permissible stress in the concrete was 2,000 p.s.i., and in the steel 120,000 p.s.i. There are 65 five-millimeter (0.2 in.) wires anchored by the Magnel-Blaton System in each stringer.

Tests were made by the Provincial Research Board and proved successful. The bridge was designed by A. L. van den Brandeler, M.E.I.C. and approved for the provincial government by A. W. Sanderson, P. Eng.

It is hoped to give further details of the bridge in a later issue of *The Journal.* √

SEATTLE HIGHWAY VIADUCT and VEHICULAR SUBWAY

by

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Seattle, Washington

The expressway described in this paper is a combination of double-deck viaduct and single-deck viaduct, each designed as a series of three-span rigid structures, and a subway. The subway ventilating system is novel and inexpensive. The whole project will cost some $10,500,000 and take some 35,000 vehicles out of Seattle's business district.

Nearing completion is Seattle's double-deck viaduct, known as the "Alaskan Way Viaduct." This structure with the connecting Battery Street Subway and the lighting contracts recently advertised, will provide a freeway skirting Seattle's congested business and waterfront districts.

Situated between two large bodies of water, Puget Sound on the west and Lake Washington on the east, Seattle has been confined in its growth to a north and south direction. Most of the industrial areas are in the southern part of the city, with large and expanding residential areas in the north. The principal north and south routes pass through the central business district, where the daily flow of traffic has caused unusual congestion. Vehicular traffic increased 74% from 1939 to 1949.

The first step toward a solution of this problem was an origin-destination survey conducted jointly in 1947 by the State Department of Highways and the traffic division of the Seattle engineering department. This showed that, between 9 a.m. and 6 p.m., 50 per cent of the 75,000 vehicles entering the central business district went through it without stopping.

Routes were recommended for two expressways passing through this district. The Alaskan Way route was selected for first development because it could be built faster and at less cost than the other route. The central business district lies on a hillside overlooking the harbour and the new viaduct skirts the foot of this hill. Little condemnation of right-of-way was necessary and the route connects with existing semi-expressways at either end. The traffic survey revealed that six vehicle lanes would be advisable, with interchange to the business district.

A double-deck structure was found to be the best way of providing this facility in the space available, and yet maintaining access to abutting property at ground level. Each of the two decks will carry traffic in one direction, permitting turns from either deck to the business districts.

The present viaduct starts with ramps at the southern terminus, where a traffic interchange will ultimately be built. These ramps lead to the 4,502-ft. double-deck structure, which changes to an elevated transition structure bringing the decks together to form a single roadway leading to a 2,134-ft. subway under seven principal streets and emerging in Aurora Avenue, a total distance of 2.43 mi. of expressway.

Provisions for future ramp connections to the business district have been made where ramps from the 55-ft. high upper deck of the viaduct will be practically level.

The selection of a double-deck structure, while attractive from a traffic standpoint, creates problems not commonly found in structural design. It is necessary to spread the columns to accommodate the lower deck. Adoption of 14-ft. curb lanes and a 12-ft. centre lane, with an additional 1½-ft. curb width, requires a total distance between column faces of 43 ft. At future ramps a 12-ft. acceleration or deceleration lane is added, increasing the clear distance between columns to 55 ft.

Additional problems include special span lengths up to 86 ft., the necessity for railroad clearance under the lower deck and for highway clearance between decks, and design for Zone II earthquake load. In a total of 1¼ mi. of viaduct structure, there is no exact duplication of three-span units. Each three-span unit is a rigid frame.

Early cost studies of structural-steel and reinforced-concrete designs slightly favoured concrete. Material shortages have proved the wisdom of adopting concrete. A total of 35,200 cu. yd. of concrete and about 4,900 tons of reinforcing steel are required in the double-deck portion of the structure. Of this reinforcing steel, about 2,600 tons are 2-in. square bars, rolled and fabricated in Seattle and shipped to the job by truck.

Subsurface explorations consisting of test pits, test borings, test

*Mr. Finke has, since writing this article, resigned his position as city engineer and is now associated with McRae Brothers, General Contractors, Seattle.

piles and pile loadings, disclosed that good foundation could be had with relatively short piles and with shallow footings. Because portions of the viaduct are over filled beach areas, steel piles were selected, with mandrel-driven poured-in-place concrete piles as an alternative.

At Marion St. an existing pedestrian viaduct crosses Alaskan Way at an elevation to provide railway clearance under the existing overpass. Girders for the new vehicular viaduct also provide about the same railway clearance. To pass the pedestrian viaduct through the vehicular viaduct, a unique method is employed. By making this site the junction of two three-span units, end columns could be placed on either side of the pedestrian crossing, in effect widening the opening in a split column. Girders for the vehicular viaduct are 7 ft. 8¾ in. deep. The girder for the short span across the pedestrian viaduct was omitted and the roadway slab was cantilevered out a short distance from each end to span the gap, thus providing headroom over the pedestrian viaduct.

A similar arrangement is at University St. to permit future construction of a pedestrian crossing there, should it become necessary.

A contract awarded to MacRae Brothers of Seattle, at $1,693,911.85, for the first unit comprising the north approach, is now complete. The second unit was let jointly to Morrison-Knudsen Co., Inc., and Rumsey & Co., at $3,691,400, which embraced the main or double-deck part of the viaduct. A third contract was awarded to MacRae Brothers at $1,063,659.25 to build the south approaches. The fourth unit comprising the Battery Street subway and approaches, was awarded to Morrison-Knudsen Co. Inc., on their bid of $2,384,061. The fifth contract, which provides for lighting of the viaduct and for directional signs and sign bridges, was awarded to Northwest Engineering Electric Co. at $148,534. Additional costs include right-of-way at $1,220,000, relocation of underground utilities at $68,484.50, engineering design and subsurface investigations at $356,955.38, to make a total estimated project cost of $10,627,006.

Aerial view of transition section of Alaskan Way Viaduct (Seattle "Times" photo)

Funds for the project are provided as follows:

City of Seattle, estimated	$5,860,625
State of Washington (Motor Vehicle Fund)	$2,459,783
Federal Aid	$2,306,608

Another view of the transition section. The low precast rail gives the motorist a good view of the Seattle waterfront and of Puget Sound.

To make the best use of a limited construction area, Morrison-Knudsen and Rumsey acquired two revolving gantry cranes. These cranes operated along the west side of the viaduct with the gantry spanning one railway track, permitting trains to pass beneath it. The height of these cranes permitted easy handling of materials to the upper deck 55 feet above the ground.

Foundation piles are 53-pound steel H's and Raymond cast-in-place concrete piles. Steel piles were used in the areas where buried beach logs and other refuse might cause difficult driving. The concrete piles vary in length from 20 to 52 feet, and the steel piles from 52 to 70 feet. Timber pile bents were driven to support the lower deck and left in place until the upper deck was completed. Completion of the viaduct will provide a usable structure which can be opened to traffic before completion of the Battery Street subway.

The subway joins the viaduct at the north end and carries the traffic under seven streets in a 2,134-ft., four-lane underground roadway to emerge in Aurora Avenue, the principal arterial road approaching Seattle from the north. This route will become part of U.S. 99 and Primary State Highway No. 1 through Seattle.

The subway is confined within the limits of a 66-foot street and consists of two 25-foot roadways with 3-foot emergency sidewalks separated by a solid dividing wall. The curves at each end of the subway are spiralled and super-elevated for a speed of 45 miles per hour.

To avoid long-time closing of important streets during construction, a tight construction schedule has been adopted. Only two of the seven streets may be closed at one time under this schedule. The desire for speedy construction and possible problems of settlement of the buildings along Battery Street, have led to a unique method of construction.

Construction will be by open cut methods, with the ceiling of the subway serving as the street surface. Steel H piles at 3 ft. 9 in. centres will be driven along each side wall of the subway and these will be braced at the top by transverse reinforced concrete beams which will later carry the surface roadway. Precast concrete beams will be spaced at 15-foot centres and supported at the centre wall by steel piling. Precast concrete liner plates placed between the steel piles where necessary as the excavation is made will protect the adjacent property and building foundations against subsidence.

Test borings and test pile driving disclosed a foundation material of a hard-packed glacial deposit of very fine sand approaching the nature of clay. It was found that steel piling could not be successfully driven through this material without jetting and, even with jetting, could not be driven straight. The answer to this problem is boring a hole for each pile. It was found that a 12-in. auger, with extended rack, could bore a hole to a very close tolerance and that the walls of the hole would stand until a steel pile could be set in and driven. Control of the depth of boring permits attaining the required bearing value of the pile.

Placing of precast concrete beams follows closely behind the pile driving and the cross streets are repaved before making further excavation. Between cross streets, the top deck or ceiling is not placed until after excavation and other work requiring gasoline-driven equipment is completed.

Safety features of the subway consist of a ventilation system automatically controlled by carbon monoxide sampling and recording equipment, an automatic deluge-type sprinkler system, fire extinguishers and hose connections, emergency telephones, traffic control signals and a lighting system.

The ventilation system is unique in that it draws air from and discharges it into the street above by means of axial-flow fans. These fans are 33 in. in diameter, powered by 3 h.p. electric motors, and spaced at 45-ft. intervals in each roadway of the subway. A total of 72 fan units is required. The air is taken from the surface at the sidewalk level and blown into the subway below with sufficient velocity to spread it out across the lower roadway. After mixing with the contaminated air below, it seeks its own outlet through gratings in the centre of the surface street and through the ends of the subway. This system eliminates the need for large and costly ducts, a central blower plant

Looking along the double-deck structure toward the transition to single-deck. Note the split column at the extreme right: two three-span rigid units join here.

and standby equipment common to normal tunnel construction.

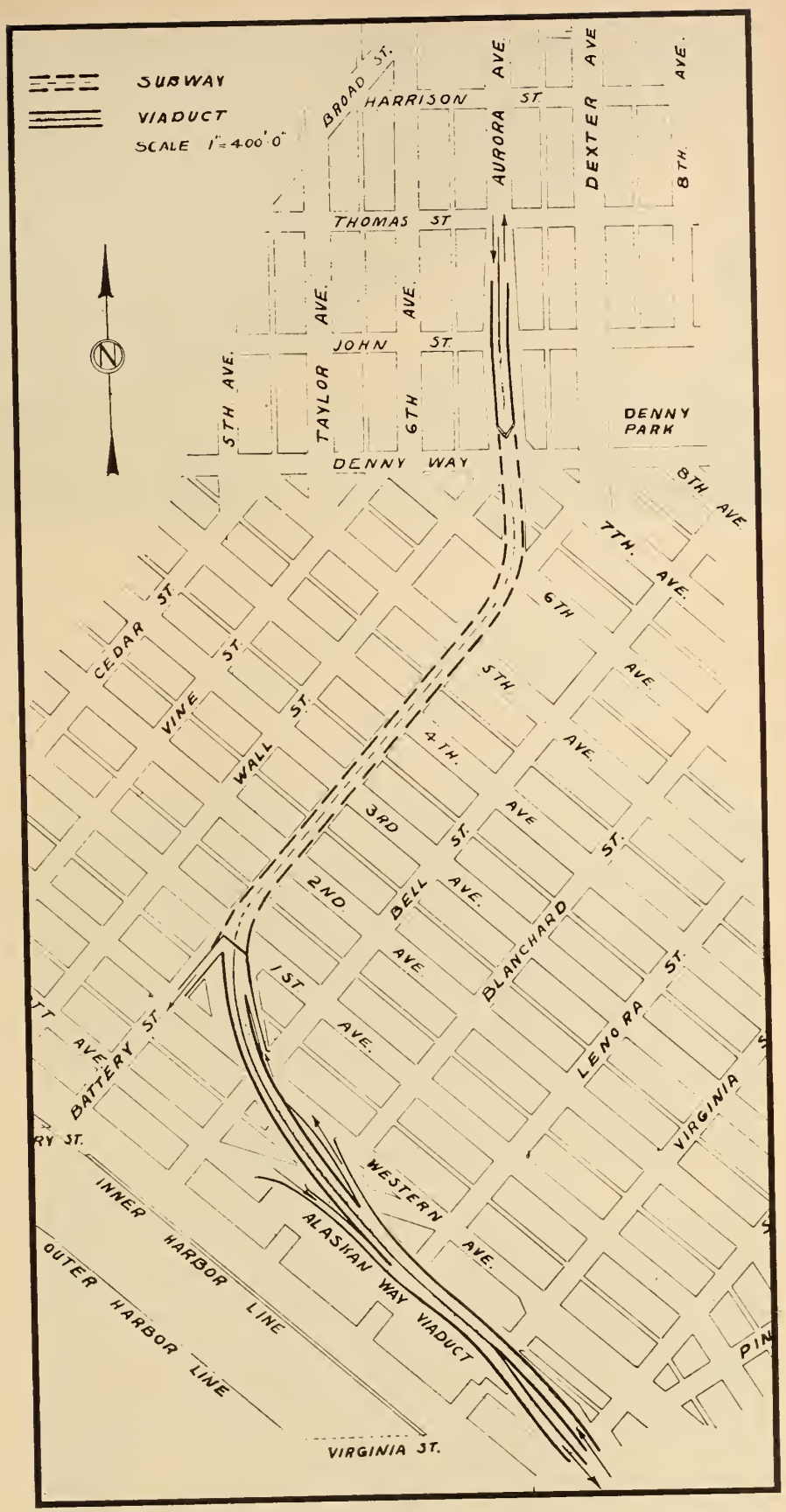
Capacity and performance tests of the ventilation fans were made under simulated conditions. The design provides 265 c.f.m. of air per lineal foot of two-lane subway, which changes the air in the subway every two minutes.

Fouling of the intake air by surface traffic was tested under the most adverse combination of traffic and weather conditions; the greatest concentration of carbon monoxide found was 0.002 per cent, which indicates a rapid dispersal of toxic gases. Adding the exhaust gases from the subway would double the quantity to be dispersed and absorbed by the atmosphere at street level, but the resulting pollution will be well within safe limits.

The ventilating fans are automatically controlled by the carbon monoxide testing and recording equipment located in a central control chamber. When the carbon monoxide concentration reaches two parts in 10,000 in any one of eight separately controlled sections, the fans in that section will start and will operate for two minutes, or until the carbon monoxide content falls below one part in 10,000. Should the build-up of toxic gases continue to four parts per 10,000, a "subway closed" sign will stop traffic at the entrance to that side of the subway. At the same time, a warning will be relayed to the police alarm system. In case of power failure, a "power off" warning is likewise relayed to the police alarm system. From observations of the Lake Way tunnels in Seattle, it is believed that the pumping action of vehicles in the subway will take care of normal ventilation needs, and that the mechanical ventilating system will operate only under emergency conditions caused by stoppage or slowing of traffic.

Closing of this subway in an emergency will detour the traffic to surface streets and will not present the same degree of inconvenience to traffic that would be caused by closing a tunnel through a ridge or under a waterway.

An automatic sprinkler system to operate in sections will be provided. This will be a dry pipe system of the deluge type, controlled by automatic valves operated by heat responsive devices and supplemented by an automatic alarm system to the central control chamber and to the city fire alarm system. It is believed that this is the only vehicular subway or tunnel to have such a system of fire control. The fire



Route of the Alaskan Way Viaduct

which occurred not long ago in the Holland Tunnel in New York, with the resulting damage to the tunnel, loss of vehicles, and potential loss of life, were factors which led to this provision. In addition, at 325-ft. intervals a fire cabinet is located in the centre wall, available to each roadway, with a two-way hose connection and two dry chemical-type

Looking along the lower deck toward the transition section. Note that the inner faces of the columns are clear of the roadway. Vertical clearance is 14 ft. 6 in.

fire extinguishers of 20-lb. capacity.

Emergency escape doors are provided in the centre wall near each fire cabinet, so that persons can escape from one side of the subway to the other. These doors will also be useful to firemen or police in an emergency.

Other emergency equipment consists of telephones in each side of the subway at similar intervals, directly connected to the central control chamber and, in the absence of a guard, to the police department switchboard. At the entrance to each roadway of the subway, "Subway Closed" signs are provided, and in the subway at 200-ft. intervals, there are "Stop Motor" signs provided, both of which are manually operated from the central control chamber. In case of a wreck or other emergency in one side of the subway, the "Subway Closed" signs can be flashed on at both entrances, leaving one side free from vehicles, except that the entrance will be blocked. Police and ambulance vehicles can enter the exit of the clear side and by use of the emergency doors, get quickly to the source of trouble.

Crossing the pedestrian overpass at Marion St. Note the cantilevered roadway slab over the steel footbridge.

Lighting of the subway is provided by fluorescent luminaires placed over each traffic lane at 15-ft. centres. Each luminare will contain two 72-in. fluorescent lamps operating at 430 milliamps. Luminaires will be mounted flush with the bottom of the deck beams at a height of 14 ft. 6 in. above the subway pavement. An average light intensity of 7.5 foot candles with uniform brightness and little glare is expected.

The entrance lighting problem is solved by providing a bank of mercury vapour lamps mounted in floodlights inside the entrance. These are screened from the driver's eye by mounting behind the ceiling beams, and are adjustable for direction of light. An intensity of 100 foot candles at the portal tapers off in 300 ft. to the level of illumination in the subway.

The entrance lights will be controlled by a photoelectric cell to turn

(*Continued on page 21*)

WIND POWER

History and Present Status

by

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A paper presented to the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, May 9, 1952.

Scattered throughout engineering literature, particularly through that of the past three decades, have been various references to the utilization of wind power on a large scale. Interest started in the closing years of World War I and the development of aerodynamic science and modern wind tunnel techniques also dates from this period. This undoubtedly provided an impetus to wind power research in that it provided a means of attacking and solving many of the problems involved.

Man has from the earliest times sought to harness the winds to his use. Wind has been used from time immemorial to drive ships. From a later date it has been used to turn millstones and to pump water. In recent times it has been used to generate electricity. The major interest over the past few decades has been in this last application, more specifically in the use of wind power to generate electricity in blocks large enough to use commercially, and to tie in with existing hydro, steam or diesel generated power.

The best example of such use to date is the 1,000 kw. installation on 2,000-ft. Grandpa's Knob in Vermont. This installation ran intermittently in the early 1940's. Some further information should be available this summer when the 100 kw. unit now being constructed for the British Electricity Authority on the summit of 650-ft. Mynyd Anelog in Caernarvonshire, Wales, is completed. Countries not favored with adequate coal or hydro sources of electricity may well look hopefully to this source of low-cost energy. There are, particularly in the southern hemisphere, a number of countries in this category.

There is of course, a wide field for small isolated plants for pumping water, for generating d-c. power to charge storage batteries, etc. This need is probably well filled by the small units now on the market. Anyone who has travelled through the United States and Canadian west will have observed the large number of such units now in use. There is, however, need of larger units intermediate between these "windchargers" and the large commercial units. It so happens that many areas remote from hydro and from fuel resources are the areas which present relatively constant winds of high average velocities. An interesting possibility for such a larger unit is in the military field. It was in this connection that the author first became interested in the subject of wind power. It might well be that wind power could help to solve difficult logistic problems in connection with the operation of high-power radar equipment in isolated and remote areas.

This is a concise summary of what has been accomplished in the last thirty years in the commercial development of power from the wind. The latest schemes are distinctly novel, but will they be economically practicable in the face of possible competition from atomic power?

As soon as one undertakes a study of the wind and air in motion generally, two major facts emerge. The first is that while available to an almost unlimited extent, the energy content is exceedingly small, the second is that the supply is uneven. Another point to consider is that the wind constitutes a prime mover delivering energy free, and hence no substantial variation in costs can occur after the initial installation is made. It is, however, a puzzling problem to extract this elusive and varying energy on a really scientific and dependable basis.

As mentioned previously, the modern theory of windmills has developed since World War I. The investigators of this period followed three major lines:—

(a) A group typified by Anton Flettner in Germany and J. D. Maderas in the United States sought to harness the Magnus effect. The Magnus effect may be defined as the side thrust exerted by a cylindrical surface revolving in a wind stream. It is similar to the lift effect of an airfoil section, except that the cylinder is revolved, rather than pushed through the air as in an airfoil. This phenomenon had been observed for some time on such spinning objects as projectiles, baseballs, etc., but Professor Magnus was the first to undertake its systematic investigation. The formula for the resulting force is of the general form:—

$$R = 1/2\ C\mu AV$$

where C = a coefficient varying with the rotation-fluid velocity ratio, form factor, etc.
A = projected area of cylinder
V = velocity of fluid relative to body
μ = density of the fluid

The best known example of this effect is undoubtedly the Transatlantic voyage of Flettner's rotorship the *Baden Baden* in 1925, rather than in the field of wind turbines.

(b) An offshoot of the Flettner rotor was developed by Savonius in Finland. Savonius developed an S-shaped rotor, which can be used directly as a wind turbine, or utilized for its Magnus effect, but it is self rotating as compared to Flettner's rotor which has to be driven.

(c) A third, and by far the largest group, worked on various modifications of the high-speed windmill. Contributions were made by Kumme in Germany, Darrieus in France, Krasnovsky in Russia, Thomas in the United States, and by many others.

During this period since World War I a number of actual installations have been made in various parts of the world, and a number of more ambitious ones proposed.

Kumme in Germany in 1920 (1) installed a six-bladed windmill connected to a vertical-shaft generator on the ground at the base of the tower. This installation gave trouble in yaw, i.e., there was a tendency for the turbine shaft to "walk around" the horizontal bevel gear and thus turn itself out of the wind. The ground mounted generator would appear to have numerous advantages, but it is interesting to note that it was not until recently that an installation solving this yaw instability problem has appeared.

Flettner in Germany in 1926 (2) built a windmill using four rotors driven by small electric motors. These were arranged on an outside diameter of 63 ft. 8 in. The rotors were 16 ft. 3 in. long, 35½ in. in diameter at the outer and 27½ in. in diameter at the inner end. A housing at the top of the 108-ft. tower contained a 30 kw. constant voltage generator driven by the wheel through a 100 to 1 transmission. The output could be fed into a local line or used to charge storage batteries.

An improvement in the Flettner rotor was effected by Savonius of Finland (3). In effect, the Savonius rotor is a Flettner rotor sliced in half on its vertical axis, with the two halves displaced from 20 to 70 per cent of their diameter. The device then resembles a cylindrical cup anemometer with some recirculation, in that the cup backing upwind gets some spill from the downwind cup and acts as a second stage. The unit has been used as a self-rotating rotor for utilization of the Magnus effect and as a vertical shaft wind turbine. There has been at least one application of the Savonius rotor as a wave motor. The S-rotor has a fairly high efficiency, up to 30 per cent, but it is inefficient per unit of weight compared to a two-bladed high-speed windmill because all the area swept is occupied by metal.

The most ambitious plan for the utilization of the Magnus effect was that proposed by Julius D. Maderas at West Burlington, New Jersey (4). Six prominent public utility companies sponsored this scheme. It involved the mounting of 15 to 40 fifty-ton vertical rotors on trucks, which would circle around on a 30 ft. gauge track some 3,000 ft. in dia. A component of the Magnus thrust would be parallel to the track and hence would propel the whole assembly round the track. Generators would be connected to the axles and power take off would be by an overhead trolley wire. It would be necessary to reverse rotation of the rotors twice during a complete circuit of the track, otherwise the thrusts produced on opposite semicircles would neutralize each other. At West Burlington a full size rotor was erected on a stationary concrete base. This rotor was 90 ft. high and 28 ft. in diameter. By means of an internal motor peripheral speeds of up to 50 miles per hour could be obtained. Under favourable wind conditions and with this peripheral velocity, the tower showed a translation force of 8,000 lb. at right angles to the direction of the wind. However, no further work was done on this project.

While loath to credit the Russians with anything they have not already claimed, it would appear that they were the first to tie a wind-power unit into an existing network (5, 6), An extensive program of wind research was carried out by the Central Wind Bureau under the direction of V. N. Krasnovsky. An initial experimental unit was erected at a spot in the limelight for other reasons, Yalta on the Black Seas. The wheel, 100 ft. in diameter, drove a 100 kw. generator which fed into the 6,300 v. line of a 20,000 kw. peat-burning steam plant at Sebastopol, some 20 miles away. Propeller thrust was taken by an inclined strut. The unit was automatically controlled in yaw by moving the lower end of this strut around a circular track.

Chronologically we now come to the largest and best engineered experiment in large-scale wind power generation, the Grandpa's Knob experiment in Vermont (6, 7, 8). This unit is the largest built to date, several larger ones having been planned, but never having progressed past the proposal stage. It was installed at Grandpa's Knob in the Green Mountains, about ten miles from Rutland. This ambitious project was financed by the S. Morgan Smith Co., manufacturers of controllable-pitch hydraulic turbines. This firm was anxious to diversify its products and turned to wind turbines as a logical expansion of its activities. Under the direction of P. C. Putnam, it collected a team of eminent scientists and engineers as consultants, and proceeded to design and erect an experimental unit. The generator in this installation was rated at 1,000 kw. Output was 2,300 v., 3 phase, 60 cycles. This was transformed to 44 kv. and tied in with the Central Vermont Public Service Company's lines.

The steel supporting tower was 110 ft. high, with concrete and grillage foundation some 22 ft. deep. The tower-mounted generator, with direct connected exciter, ran at 600 r.p.m. through an hydraulic coupling and an enclosed reducer. The blades were of spot-welded stainless steel, each 65 ft. long by 11 ft. wide, and weighing about 15,000 lb. Rotation speed was 30 r.p.m. The blades were automatically controlled in pitch and were free to cone downward against controllable restraint. This installation was completed in August, 1941, first went on test in October, 1941, and remained on test till February 20, 1943. During this period it was on the line 695 hours and off 192 hours, generating almost 300,000 kwh. The first serious interruption occurred on February 20, 1943, when the downwind main bearing failed. Due to war conditions, it was not until March, 1945, that the unit was again running. When started up again it ran as a routine generating station and generated some 62,000 kwh. until March 26. On the morning shift of that day, in a light wind, one blade let go and sailed about 750 ft. to the ground. This blade broke at a point of known weakness. Subsequent examination showed similar cracks well developed at the same point in the other blade. While the S. Morgan Smith Co. apparently intended at one time to rebuild the unit, it was not again placed in service.

As mentioned earlier, most installations have placed the generator aloft. This has the great disadvantage that the heavy generator and gear box have to be installed and maintained at the top of a tower, with correspondingly increased costs and limitations in size. On

the other hand, a geared system between propeller aloft and generator on the ground, as in the Kumme unit, poses problems in yaw control. A new system, credited to M. J. Andreau of France and going into production in England, promises to overcome both these difficulties. This system is entirely novel in that there is no mechanical connection between the propeller aloft and the ground-mounted generator. An experimental unit embodying these principles is now being constructed for the British Electricity Authority. It has a capacity of 100 kw. and is scheduled to go into operation during the summer of 1952 on the summit of 650 ft. Mynyd Anelog in Caernarvonshire, Wales.

The description which follows is taken verbatim from the leaflet "Harnessing the Wind".

The machine comprises:—

A two-bladed propeller of aluminum alloy sweeping a circle 80 ft. in diameter. The blades are of hollow construction and are provided with exit ports at the tips. The propeller is mounted downwind of the tower with a pintle bearing inside the hub fairing, to allow orientation in accordance with the direction from which the wind is blowing.

A supporting tower, 100 ft. in height, having a vertical duct capable of passing a large volume of air with the minimum of obstruction. The tower is built up of steel girders and plates and is supported by cables.

An air-driven turbine at ground level with vertical shaft, direct coupled to an alternator wound to deliver three-phase power into the British national network.

These components are assembled to provide a continuous air passage from the turbine intake to the tips of the blades. Wind impinging on the propeller causes rotation to begin, the only retarding force being the slight friction of the two roller bearings in the hub. As the speed increases the propeller starts to discharge air from the blade tips by centrifugal force and to act as a centrifugal blower. The air so discharged is replaced by air entering the turbine intake. This induces a drop in pressure across the turbine sufficient to set it in motion. At full rated output the pressure difference is 1 lb. per square inch and 1,000 cubic feet of air per second is passing through the system.

The controls are automatic. Electrical controls keep the alternator and the network which is being supplied in step. They also operate an air valve to bypass the turbine and admit air directly to the vertical duct. When the valve is open the turbine cannot operate, even though the propeller is still rotating. Hydraulic controls, developed for aircraft, change the pitch of the blades to suit the speed of the wind and ensure that the propeller turns at constant speed, 100 revolutions a minute. Light winds need a fine pitch, heavy winds and starting require that the pitch be coarsened. Winds exceeding 75 miles per hour require that the blades be feathered and the propeller braked to a standstill with the blades halted in a vertical position. These controls are operated by wind pressure on a speed-sensitive device mounted on the upwind end of the hub fairing.

It is hoped that the experience gained with this installation will enable plants up to 1,000 kw. to be designed.

These remarks have been confined to descriptions of installations which were either actually completed or had considerable experimental work devoted to them. A number of much more imposing installations never passed the proposal stage (9, 10). Data available on the economics of wind power generated electricity are rather sketchy. The best analysis is in P. C. Putnam's book "Wind Power". Extensive consideration could be given to combination hydro and wind power, or to steam and wind power. These look to be the most logical form of development. Whether wind power will advance to any great extent in the future, or whether the need will be obviated by nuclear development only time will tell.

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SEATTLE HIGHWAY VIADUCT AND VEHICULAR SUBWAY

(*Continued from page 18*)

on in the daytime and off at night. A similar system of entrance lighting has proved successful in the Lake Way tunnels. The effect of driving from the bright sunlight outside to the relative darkness of the subway will be comparable to driving into the shadow of a tall building.

A control chamber, located at the mid-point of the subway, will be the key point from which the subway will be operated. With no large blower plant, this chamber will be a compact unit containing the carbon monoxide sampling and recording equipment and a control panel for handling all emergency controls. An observer at this point can watch the traffic in both roadways of the subway. It is anticipated that a single guard will be stationed here during peak traffic hours, and that emergencies at other times will be handled by the police and fire departments on call from the alarm system.

Maintenance work will be handled by the city's regular maintenance crews, with one or more specially trained men.

Construction of the Battery Street subway will complete the north approach to the Alaskan Way Viaduct. Completion of the entire project involves an extension of the viaduct structure to the south, and the construction of four ramps to the central business district. Funds for this work have not yet been made available.

Design work and preparation of plans and specifications was done by the engineering department of the City of Seattle. Ralph W. Finke, city engineer, and H. W. Tyler, principal design engineer; R. M. Murray was design consultant. Checking and approval of plans and specifications were done by the Bureau of Public Roads and the State Department of Highways. Supervision of construction is being performed by the State Department of Highways with Corwin A. Pilon, resident engineer, in immediate charge. √

INDUSTRIAL VENTILATION

Prepared by The Engineering Committee, Canadian Fan Manufacturers Association, Windsor, Ont.

Ventilation is defined by the American Society of Heating and Ventilating Engineers as "the process of supplying or removing air, by natural or mechanical means, to or from any space. Such air may or may not have been conditioned."

Many factors govern the need for removing or exhausting air from industrial plants. In general, the collection and removal of heat, dust, gases, fumes and industrial wastes is to protect the health of workers, improve working conditions and prolong the life of plant equipment. In some cases the controlling factor may be to reduce fire hazards arising from combustible dusts, or the prevention of explosions from vapours or gases. In most exhaust systems mechanical means or the use of fans will be required.

When air is exhausted from an enclosed space, it is obvious that a negative pressure will be produced within that space. This pressure causes the air without the space to flow inward around openings. In warmer climates where buildings require little or no heat, the leakage is usually through open doorways or windows and generally presents no serious problem.

On the other hand, in colder climates, where heat is required and doors and windows are closed for several months of the year, leakage to replace the amount exhausted will usually offer difficulties. In a relatively tight type of building where infiltration of the air does not equal the amount exhausted, the exhaust system will function improperly from lack of sufficient volume. Or, in a more loosely constructed type of building where leakage and exhaust are in balance, drafts from increased infiltration of outside cold air around windows and doors will cause physical discomfort to workers.

It is axiomatic, therefore, that when air is exhausted from an enclosed space, supply or 'make-up' air must replace the amount removed. Likewise, it is evident that in buildings requiring heat and having an exhaust system, dependence cannot be placed entirely on leakage of outside air to provide the make-up air required for replacement of air exhausted. In such cases a more positive means is needed to regulate the volume of make-up air, and to temper it when necessary for the comfort of workers.

Many articles have been written on the subject of industrial ventilation covering a wide range of typical problems. In the short space allotted here, no article can hope to discuss all phases of this important subject. The scope of this article, then, is purposely limited to the general relationship of exhaust and make-up air, and the bearing it has on the heating load.

Heating Load

In the design of a heating system, the maximum amount of heat loss for a building is based on maintaining a specified inside air temperature for the outside weather conditions prevailing in the locality. The procedures for calculating heat losses are well known, and will be found in most engineering handbooks on heating. The heat load for an industrial building may be stated in the following general formula:

> Heat losses by transmission through walls, glass, floors, ceiling or roof + heat for normal infiltration of air + heat required to replace air mechanically exhausted − gains from heat generated from industrial sources.

The general formula may be subject to modification under certain conditions. For example, when the "heat required to replace air mechanically exhausted" is greater than the "heat for normal infiltration of air", the infiltration factor may be disregarded.

Heat required to replace air mechanically exhausted has been frequently overlooked in the design of new buildings, with the result that steam boilers, steam and return mains, traps and pumps were not large enough to carry adequately the total heat load of the buildings. In older industrial buildings when changes in process work requires the installation of a mechanical exhaust system or systems, the additional load imposed on the heating system generally has caused overload on the steam plant, resulting in lower room temperatures.

This relation of exhaust air to the heating system is extremely important. Unless provision is made to furnish heat for this source of loss, the building will be improperly heated. In extreme and prolonged cold weather, the lack of heat may compel the plant to close down.

It is not enough for the engineer to be familiar with the building materials to be used in the structure, the heat transmission coefficient of these materials and the design factors for outdoor weather conditions and inside air temperature. He will need additional information on the industrial processes, and whether or not mechanical exhaust systems will be required. To compute the amount of heat required for make-up air to replace air mechanically exhausted from a building, the following formula may be used:

$$H = \frac{c.f.m. \times (t\text{-}t_1) \times 60}{55.2}$$

where— H = b.t.u. per hour required for make-up air.

$c.f.m.$ = Cubic feet of air per minute at 70° F.

t = Room temperature.
t_1 = Entering or outdoor temperature.

Exhaust Systems

To collect and remove heat, dust, gases, fumes and industrial wastes arising from industrial processes, requires a specific design for means of collecting at or near the source, a further means of conveying the air outside the building, a mechanical means of producing the exhaust, and in many cases provisions to prevent contamination of the surrounding neighbourhood. These means generally require hoods, ducts, fans, motors and may require collection again on the outside. The exhaust system may be either the central or the multiple unit type. In the former, a single fan is employed to serve the exhaust system, in the latter, the number of individual systems will depend largely on whether the sources of collection are scattered, independent or intermittent.

Multiple type exhaust systems usually provide flexibility of operation, save power and economize on the heat required for make up air. Design data for hoods, ducts, collectors and other factors of exhaust systems will be found in engineering hand books, pamphlets issued by industrial commissions, or may be obtained from fan engineers.

Typical industrial processes generally requiring mechanical means of removal from the source include such operations as buffing, grinding, polishing, pickling, washing, degreasing, plating, welding, painting and abrasive cleaning. There are also other well known operations where gas, vapours, dust and wastes must be removed from machinery in wood working shops, paper mills, chemical plants and foundries. The foregoing listing is by no means complete; rather it is representative of the standard operations encountered in industrial ventilation.

The amount of air to be exhausted from typical processes is fairly well standardized. Knowing this volume, the design engineer can determine the amount of heat required for make-up or supply air. For grinding, buffing, polishing and wood working machinery an excellent reference is the New York State Code, which represents good practice for pipe sizes and velocities of the air. For other typical processes Table I will be a helpful guide. It is furnished through the courtesy of the Propeller Fan Manufacturers' Association, Detroit, Michigan, U.S.A.

To determine fan capacity required, multiply area of hood or slot in square feet by intake velocity to obtain c.f.m. moved. The data below covers average conditions.

Total air movement resulting from the figures in Table I is based on average velocity over the entire open face of the hood or grill, and in case of exhaust through side slots, on slotted areas covering both sides of the tank or canopy.

Table I — Intake Velocities for Air with Various Processes

Process	*Type of Intake*	*Intake Average Velocity*
Aluminum Furnace	Enclosed hood, open one side	150– 200 f.p.m.
	Canopy hood	200– 250 f.p.m.
Brass Furnace	Enclosed hood, open one side	200– 250 f.p.m.
	Canopy hood	250– 300 f.p.m.
Chemical Laboratory	Enclosed hood, front opening	100– 150 f.p.m.
	Down draft, table type	150– 200 f.p.m.
Degreasing	Canopy hood	150 f.p.m.
	Slotted sides, 2 in.-4 in. slots	1500–2000 f.p.m.
Electric Welding	Portable hoods, open face	200– 250 f.p.m.
	Open front booth	100– 150 f.p.m.
Foundry Shakeout	Down draft, grill table	250– 450 f.p.m.
	Open front booth	150– 200 f.p.m.
Flour, grain, wood dust	Canopy hood	500 f.p.m.
	Side slots, 3 in.-4 in.	2000–2500 f.p.m.
Metal Spraying	Open front booth	150– 200 f.p.m.
Paint Spraying	Open front booth	100– 175 f.p.m.
Paper Drying Machine	Canopy hood	250– 300 f.p.m.
Pickling Tanks	Canopy hood	200– 250 f.p.m.
	Slotted sides	250 c.f.m. per sq. ft. of tank surface
Plating Tanks	Canopy hood	225– 250 f.p.m.
	Slotted sides	250 c.f.m. per sq. ft. of tank surface
Rubber Macerator	Canopy hood	200– 250 f.p.m.
	Slotted sides 2 in.-4 in. slot	2000–2500 f.p.m.
Steam Tanks	Canopy hood	125– 175 f.p.m.
Varnish Tanks	Canopy hood	225– 300 f.p.m.
	Slotted sides 2 in.-4 in. slot	2000–2500 f.p.m.

Make-up or Supply Air

The need for positive means of regulating the volume of make-up air and the tempering of it is largely dependent upon climatic conditions. In southern zones, neither volume nor heat will require regulation. On the other hand, in Canada where the heating season is prolonged, both volume and heat for make-up air will need to be under control. But regardless of climate, the air exhausted must be replaced either by a supply system or by providing easy entrance for make-up air.

In the design of a make-up air system, certain fundamentals should be observed. These fundamentals are enumerated in "Industrial Health Engineering" by Allen D. Brandt, as follows:

1. Short circuiting of make-up air must be prevented, as much of the air as possible should pass through the zone or over the sources of contamination.
2. A combined supply and exhaust system is preferred with a slight excess of exhaust if there are adjoining occupied spaces, and a slight excess of supply if there are no spaces.
3. The rate of ventilation produced by a combination of supply and exhaust is not the sum of both; it is the rate of the one having the greater capacity.
4. Drafts from make-up air must be prevented, particularly near supply outlets.
5. Air velocities due to location of supply air must not disturb the air flow at local exhaust hoods.

There are three acceptable means for make-up or supply systems as follows:

1. *Heating and Ventilating Unit* — A factory-made, encased, assembled unit consisting of fan and motor with or without heating coils. The unit may discharge the

air directly from the fan outlet or may be connected to a duct system to carry the air to certain zones.

2. *Unit Heater* — A factory-made, encased, assembled unit consisting of fan, motor and heating coil discharging the air directly into the space. If the unit heater is furnished with a centrifugal fan, a duct system may be connected.
3. *Field Assembly Unit* — Consists of standard parts to be erected in the field. These parts are fan, motor, heating coil, casing and duct system if required.

The choice of means will depend largely upon building space, how well the source of contamination is localized and the kind of industrial process. Provision should be made to control the temperature of the air leaving the make-up unit to prevent overheating when the weather moderates, or to insure adequate heat under extreme conditions. Steam as a heating medium is generally desirable. In colder climates, adequate provision for condensate removal must be made to prevent the heating coils from freezing.

To summarize, whenever an industrial exhaust system is installed, the following factors will need to be considered:

1. Provision for a make-up air system to replace air exhausted, or in southern zones by providing easy entrance to the air.
2. Provision for heating make-up air in cold weather.
3. Selection of proper size equipment for make-up or supply system.
4. Determination of capacity of heating system, not only to heat the building but also to heat the make-up air.

A well balanced industrial system, combining both exhaust and make up air properly heated, provides for the physical comfort of the workers by eliminating cold drafts and uneven temperatures. It also helps to maintain quality of work as well as output and tends to reduce sickness. Efficiency of workman is essential in modern production.

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4. "Industrial Ventilation Guide", Propeller Fan Manufacturers' Association.
5. "Fundamentals Relating to the Design and Operation of Exhaust Systems", American Standards Association.
6. "Heating, Ventilation and Air Conditioning Code", Industrial Commission. State of Wisconsin.
7. "Rules Relating to the Spray Coating of Motor Vehicles", Board of Standards and Appeals, State of New York.
8. "Rules Relating to the Removal of Dust, Gases and Fumes", Board of Standards and Appeals, State of New York. √

THE SAUNDERS-ROE PRINCESS FLYING BOAT

(*Continued from page 7*)

Cruising speed.....380 m.p.h. (330 knots)

Payload — The aircraft carries a payload of 40,000 lb.

All-up weight.....315,000 lb. (140 ton)

Empty weight.....190,000 lb. (fully equipped—i.e. less payload and fuel.)

Range — 5,500 miles in still air (4,800 nautical miles) with full tanks.

Power Plants

Ten Bristol "Proteus" III propeller turbine engines arranged in four coupled pairs and two single out-board units.

Propellers

De Havilland Type 4+4/6000/6+7½ constant speed. The outer single units drive reversible pitch propellers. Each propeller is 16'-6" in diameter.

The propellers will initially be of the duralumin type but hollow steel blades will be used when available.

Fuel

Kerosene. 14,500 gallons of usable fuel (58.7 tons) will be carried in four integral tanks positioned between the engine units. No rivetting is used on tank walls, but nuts and bolts are sealed with Bostik 606. The tanks are sub-divided by baffle plates to reduce fuel sloshing.

Anti-icing

Leading edge thermal anti-icing on all surfaces. Heat is taken from heat exchangers round the jet pipes of the outer engines Kerosene combustion burners will be used in the tail unit. Air is taken through an intake in the dorsal fin, heated and circulated through leading edges.

Pressurization

The double bubble hull is pressurized to a differential of 8 lb. p.s.i. at 40,000 ft., using a 60 lb. compressor in each wing driven from the appropriate inboard engines. The pressurized volume is 15,000 cubic feet.

Powered flying controls

Manual control is not satisfactory for controlling an aircraft of the size and weight of the Princess. So a system of electric-hydraulic powered flying controls has been evolved whereby normal movements of the pilot's controls actuate power units, which in turn transmit the desired movement to the control surfaces. All the control surfaces are of the plain flap type.

Floats

Retracting to form the wing tip, a originally patented by Saunders-Roe Ltd.

Beaching chassis

A main chassis is fitted on each side of the hull mid-section joint. Each main chassis has four 4 ft. diameter wheels in line athwartships. A two wheeled bow chassis with three point attachment is fitted.

Beaching or launching can be carried out at a total weight up to 200,000 lb. and this provides an ample margin over the tare weight with all equipment on board. √

MARK YOUR ENGAGEMENT PAD NOW!

"E.I.C. Annual Meeting

Halifax, N.S., May 20-21-22"

Full details in the *Journal* at an early date!

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

E.C.P.D. in Europe

There is an international engineering conference known as the European and United States Engineers Conference, dubbed "Eusec". Membership in it includes one society from Belgium, Denmark, Finland, France, Italy, Norway, Sweden, Switzerland, the three British institutions of civil, mechanical and electrical engineers and the Founder Societies in the United States.

The Conference of Commonwealth Engineering Institutions of which the Institute is a member is tied into Eusec by the participation of its associates, the three British institutions. The two conferences along with the Pan American Conference to which the Institute also belongs, are closely allied in their personnel programs and activities. Between the three of them they pretty well cover the world.

Eusec at its meeting last year at the Hague decided there should be a special conference dealing with engineering education. It was agreed that the Engineers Council for Professional Development (E.C.P.D.) should arrange the program as far as North American participation was concerned. And so it is that from January 12th to 17th the representatives from the several countries will meet in London to discuss this important subject.

E.C.P.D. will be represented by three delegates, headed up by the chairman Colonel L. F. Grant of Canada. The others are Dean Thorndike Saville, New York University, and Dean Willis R. Woolrich, University of Texas, president of American Society for Engineering Education.

While in England Past President Grant is holding a reception for E.I.C. members in the British Isles, and for the officers of other societies. This will make the third reception of this kind, the others having been in 1946 at which president J. B. Hayes received the members, and in 1950 when president-elect J. A. Vance represented the Council of the Institute. The first reception was held at the Dorchester Hotel, and the second at the Headquarters of the Institution of Civil Engineers on Great George Street. The third will be at the Headquarters of the Institution of Electrical Engineers on Savoy Place.

It will be interesting to get the reports of the education conference. It is hoped they can be reported in whole or in part in *The Engineering Journal.*

ASME-E.I.C. International Council December Meeting

On the occasion of the annual meeting of the American Society of Mechanical Engineers at New York, the members of the ASME-E.I.C. International Council held their second meeting of the year on December 4 last.

The Institute representatives were Dr. O. W. Ellis, chairman; and John G. Hall, both of Toronto; G. N. Martin, W. F. A. Benger (representing W. A. Newman), and H. G. Thompson (acting as secretary for Dr. L. Austin Wright), all of Montreal. The representatives of the ASME were Prof. A. G. Christie, Baltimore; A. C. Pasini, Detroit; E. S. Theiss, Kent, Ohio; W. R. Trusler (representing R. R. Service) Toronto; C. E. Davies, New York. Also attending as observers were R. J. S. Piggott, president, ASME; L. F. Grant, field secretary, E.I.C.; E. Hartford, executive secretary, ASME; and C. R. Davis.

Principal items for discussion at

Cover Picture

Our cover picture this month illustrates coils of aluminum industrial roofing sheet at the Kingston plant of the manufacturer.

Photo courtesy of Aluminum Company of Canada Limited.

the meeting were proposals for closer co-operation between ASME members in the Montreal and Toronto areas and the corresponding E.I.C. branches, and requests for more Canadians to be appointed to ASME Committees. The dates and locations of the various meetings of both organizations to be held during 1953 were reviewed, and plans made for each to notify members of the other in adjacent territories. Consideration was also given to the desirability of furnishing all members of both societies with copies of the joint agreement. Costs are to be prepared in this connection and the matter given further consideration at the next meeting.

The final item of business was the election of officers for the ensuing year. The new chairman is to be Prof. A. G. Christie, professor emeritus of the Department of Mechanical Engineering, Johns Hopkins University, Baltimore, Md. A. C. Pasini, of Detroit, Michigan, a director at large of the ASME was elected vice chairman, and C. E. Davies, secretary of ASME will serve as secretary of the Council during the ensuing year.

The next meeting of Council is to be held in Montreal during May or early June, 1953, at the call of the chairman.

The Record Continues

Once again Ecole Polytechnique in Montreal has set the pattern for student enrolment in the Institute. Each year it is a pleasant duty to report the result of the membership campaign carried out there.

This year 128 applications were submitted after the campaign. This brings the total membership in the four senior years to an average of 80.6 per cent. There are a few members in the first year of the five-year course but this percentage figure is worked out only on the final years.

It is interesting to note that membership for the second year equals 69.0 per cent of the total enrolment. For the third year, 87.6 per cent; for the fourth year 90.6 per cent and for the fifth year 81.5 per cent. The total number of students in the four years is 396. Of these 319 are student members of the Institute.

This is indeed a remarkable showing. The campaign was carried out by Pierre Brosseau who is in the 5th year and Camille Gagné who is in his 4th year. These are the college representatives of the junior section of the Montreal Branch.

The showing at Ecole Polytechnique is all the more noteworthy in that the student enrolment at other Canadian universities has been suffering a decline not only in numbers but in percentages. The senior years in all colleges are getting smaller and therefore it is to be expected that the total student membership in the Institute will decrease from the very high maximum which was established a few years ago. It is hoped that with the increasing enrolment at all universities which is now evident, the numbers will steadily increase.

Distinguished Russian Engineer Guest of the Institute

Many members will have noted in the Canadian press, late in the month of November, a news item about the death of Doctor Lomonossoff who was living in Montreal. It was this newspaper announcement that first brought to the Institute the outstanding career of this man who had become familiar to all members of the staff.

Doctor George Vladimir Lomonossoff presented himself at the Headquarters of the Institute about a year ago. As a member of the British Institution of Mechanical Engineers he was entitled to certain guest privileges with the Engineering Institute. His sole interest in the Institute was a desire to use the library. This privilege was granted to him readily and he became a very frequent visitor.

Doctor Lomonossoff never talked about himself. He never told anyone of his background and of course no one was rude enough to intrude into his private affairs. It is regrettable that the man's history was not better known while he was alive and with us.

The press report reveals that Doctor Lomonossoff built the world's first diesel electric locomotive. This is not one of the ordinary Russian claims of a "first" to which we have become accustomed but was a genuine one established a good many years ago.

Born in Gjatsk, western Russia, Dr. Lomonossoff, like his father and grandfather, was an officer of the Imperial Guard, and a graduate from the First Moscow Military School. He earned his engineering degree at the Institute of Transport, St. Petersburg (now Leningrad).

His connection with railways began in 1897 when he delved into the mechanical workings of locomotives. The Russian state railways obtained his services in 1909 and he became president of the locomotive experimental bureau for all Russian railways, specializing in development of methods for the scientific testing of locomotive performance. He built the first dynamometer car on Russian railways.

Water was a major problem when the doctor was superintendent of motive power for the Tashkenit Railway in 1909. The road was a desert railway serving Russian Turkestan and he and Prof. Alphonse Lipetz set out to design a diesel locomotive as answer to the scarcity of water and oil.

The two got a 900 h.p. locomotive to the design stage when Dr. Lomonossoff was transferred to St. Petersburg and appointed professor at the Institute of Transport.

In 1923 Dr. Lomonossoff was working with a Russo-German development board and had a chance to complete his diesel locomotive.

Dr. Lomonossoff retired in 1927. Two years later he went to the U.S. as consultant to Baldwin Locomotive Co., and he later became research associate at the California Institute of Technology.

Living in Britain Dr. Lomonossoff came out of retirement to act as consultant to the British War Ministry on the shipment of lend-lease supplies to Russia during the war. He and his son, Lt.-Col. George Lomonossoff were awarded the George Stephenson prize in 1944.

Besides his son George, of Montreal, Dr. Lomonossoff is survived by a second son, Nicholas, by his first marriage, in Moscow.

As we suggested, Doctor Lomonossoff was a familiar figure at Headquarters; he spent hours and hours, day after day doing research in the reading room, studying early developments in engineering, particularly in relation to his own country in the pre-revolutionary days.

Although Doctor Lomonossoff was a very quiet and retiring gentleman and volunteered no information about himself, the staff and particularly those in the library, became very fond of him and looked forward to his many visits. He had certain little habits which were noted carefully and which endeared him just that much more to the staff.

Two of these little habits were related to a tiny pearl handled penknife and a box of pencils. No modern gadget in the form of a pencil sharpener was of any use to him in transferring his thoughts to paper. A carefully hand whittled point, with the shavings meticulously placed in a tiny square of paper, tucked away for that purpose, did a far better job. He used to tuck away in a corner of one of the bookshelves, where it could be found easily the following morning, his old black leather fold-over brief case, literally worn thin, and white with years of use and travel.

This quiet, modest, little man will be missed around Headquarters. No longer will he be seen poring over maps and atlases with a particular interest as would be expected, in European Russia as shown in the Times Atlas of nineteen hundred.

It is too bad that he did not tell more about himself so that he may have been more appreciated by those who had the opportunity of associating with him in the library. He possessed to a deep degree that modesty which so becomes a person of great achievement.

His unforgettable kindly look, his charming old-world manners and the sparkle in his eye will not soon be forgotten at Headquarters, but it is sad to realize that acknowledgement was not given of his character and his accomplishments, while he was here to appreciate it.

Presidential Tour

Starting out from Montreal on October 4, the president remained "in the field" continuously until December 11, except for a break of about a week at the end of October. It was probably the longest presidential tour on record. Other presidents have covered almost the same territory on one trip but today the increase in branches makes it a much greater task in terms of time.

In all Dr. Stirling met with 27 branches, 3 branch sections, 25 executives, 7 universities, 2 colleges (R.M.C. and Carleton), 2 Council meetings, 1 military school and 1 Rotary Club. His mileage on this one tour amounted to 10,327 and he delivered 36 speeches (and all of them good). In all he spoke to about 4,600 members and friends of the Institute.

The tour included every branch in Ontario and the four western provinces. To cover the distance in the time available it was necessary to do considerable flying. In and around western Ontario the shorter distances made it advantageous to motor from branch to branch, and as usual members in the area provided the transportation.

Added Stops

As well as visiting all the branches the president held meetings at Brandon, Manitoba, Prince Rupert, B.C. and Prince Albert, Sask. In fact he also spent a day (Sunday) at North Battleford, Sask. renewing old friendships. It was here that he started his professional career in 1912. The occasion turned out to be almost a civic holiday, because many of his old associates are still there, and made a great "to do" about his visit.

On all this great journey the president did not travel alone. In the first place he was accompanied throughout by Mrs. Stirling who added greatly to the members' enjoyment of the presidential visit. Through western Ontario he was accompanied by the assistant general secretary Colonel H. G. Thompson. At Winnipeg he was joined by Mr. and Mrs. E. B. Jubien of Montreal who were with him at every meeting from there to the coast and back, with the exception of Prince Rupert and Prince Albert. At Vancouver the general secretary joined the party for the balance of the tour, including the Council meeting at Edmonton.

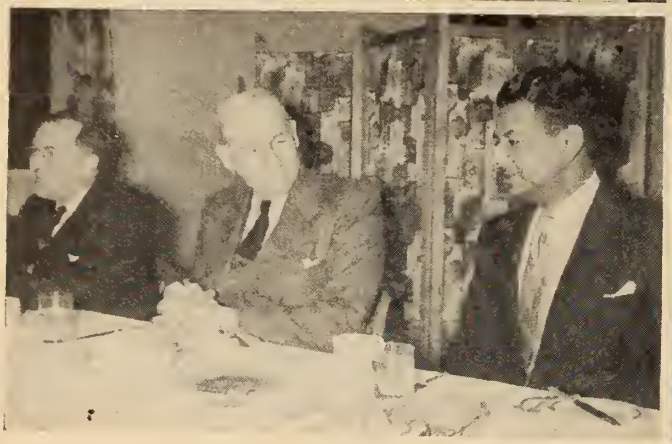
Outstanding Events

It is both dangerous and unfair to make comparisons but there were some events too outstanding to pass over without comment. For instance the air flight over Edmonton and the oil fields would be unique in any man's diary. For over an hour the

Nipissing and Upper Ottawa Branch

At right. The president presents the charter to G. L. Hood, chairman of the new Branch.

Below. Head table for the inauguration. Left to right: E. R. Smallhorn, Montreal; E. R. Eaton, Sudbury; Jacques Benoit, Montreal; Mrs. Carruthers, Toronto; I. R. Tait, Montreal; the president, G. L. Hood, Mrs. Stirling, Councillor A. K. Grimmer, Mrs. G. L. Hood, C. D. Carruthers, Toronto; and M. A. Montgomery, Kitchener.



party enjoyed one of the most pleasing and informative flights that could be imagined, and in perfect weather. To see almost at one sweeping glance, all the oil fields of that area, the new chemical and mineral industries and their relationship to Edmonton was a lesson in geography and the development of national resources beyond description. The party was greatly indebted to the Air Officer Commanding Air Commodore Kerr for making the tour possible, and also to certain officers of the branch whose bright idea it was to spend the morning this way.

Again the president followed the example of his predecessors and spent a day at the Royal Canadian School of Military Engineering at Chilliwack, B.C., and again it was a great experience. Also he laid a wreath on the Sapper's Cenotaph. Colonel F. A. McTavish, D.S.O., received the president and his party which included the officers of the Vancouver Branch, and showed them over the school and the various field activities. The visit concluded with a delightful dinner (with the ladies present) in the officers' mess.

Small But Good

Three of the most enjoyable meetings of the whole itinerary were held before quite small groups. For the first time in history the president made a stop at Brandon, Man. It

Edmonton

Top left. The executive meets with the president. At one end of the table there are, left to right: H. L. Roblin, C. A. Davidson, C. E. Garnett, N. J. Allison, H. W. Tye, E. B. Jubien.

Top right. The president presents certificate of honorary membership to Dr. John A. Allan.

Centre left. The president dines with executive of student engineering society. Left to right: Dean R. M. Hardy, the president, and A. Majid Ibrahim, president of the society.

Centre right. The E.I.C. student prize is presented to Michael Stephen Dubas, by Dr. Stirling.

Bottom. Preliminary to the "bus ride" over Edmonton. In the group are: Group Captain G. H. Fenton, Group Captain M. P. Martin, C. A. Davidson, B. F. Willson, chairman, N. J. Allison, vice-chairman, J. L. Pulford, secretary-treasurer, and Dr. Stirling.

s a great day for everyone — and particular the Stirlings and the biens. This stop was a last minute rangement requested by wire by e local group, and made possible the fact that the president's itinary had no functions arranged in innipeg for that particular Sunay. The members surely arranged full and happy program on ort notice.

The second occasion was at Prince lbert, Sask. Here too the number engineers is small but their hearts e large and so also is their loyalty the cause. "P.A." as it is referred locally has an E.I.C. organization perating as a section of the Saskatchewan Branch. There is a chairan, a secretary-treasurer and a mmittee. Thus it was possible for e president to meet with the fficers and members of the section. n fact it was one of the most inresting and useful business meetngs of the whole trip, so much so hat it overran its time substantialy, much to the displeasure of the adies who were waiting for the ocial program to begin. At the inner there were 28 in attendance. There is a fine group of engineers in he enterprising northern city and it vas an inspiration to meet with hem.

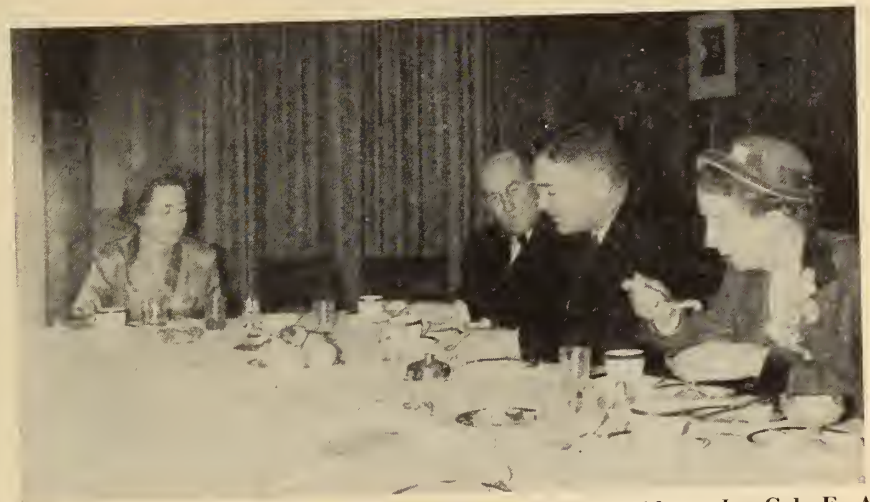
The third "non branch" meeting vas at Prince Rupert. Here a group f about 30 joined with the presilent's party for a dinner meeting. t was strange to note that almost one of these engineers had been here for any length of time. The inlustrial development was new in the area and the engineers had come in to build the plant and to operate it. Some of those who were with the government, had been there for three years or more, but there were not many of them. Here indeed is a new cell of life for Canada, which will continue to grow and to help push back the frontiers further and further.

Crowded Day

At Saskatoon perhaps the program was the most intensive of all. At 10 a.m. there was a press conference at the university. Then at noon the president spoke to the Rotary Club. At 2.30 p.m. there was a meeting with the faculty of the university and at 4 the president spoke to the students. At 5 there was a meeting with the executive of the undergraduates society and then at 6.30 the branch meeting began. It was in the form of a reception and a buffet supper.

Each year the university arranges for the president and his party to meet with the faculty informally.

The president at Chilliwack. Left to right, S. Lefeaux, H. Libby, P. Frattenger, Lt.-Col. F. A. McTavish, the president, S. H. DeJong, and E. B. Jubien.



At Chilliwack. Head table, Mrs. McTavish, the president, Lt.-Col. F. A. McTavish, and Mrs. Stirling.

At Vancouver. The president presents the E.I.C. prize to Lawrence L. Bockhold.

Saskatoon

Prince Albert

Prince Rupert

Saskatoon, Prince Albert, Prince Rupert

(photos on opposite page)

Saskatoon (first three photos). 1. The president speaks to Rotary. Allan Tubby is on his left. 2. The students were interested in what the president had to say. 3. Lyle Frank Wiebe receives his E.I.C. prize from the president.

Prince Albert (next four photos). 1. General Secretary L. Austin Wright, President J. B. Stirling and W. F. Hayes, chairman of the Section. 2. The meeting began at the home of W. D. Smith. Here he is with his lovely daughters. 3. This picture includes W. F. Hayes, Mrs. Stirling and Mrs. Hayes. 4. Left to right, Mrs. L. C. Ward, Junius Jonsson, Mrs. Jonsson, the president, and L. C. Ward.

Prince Rupert (last two photos). 1. Head table, left to right: V. T. B. Williams, the president, R. H. Garrett, Mrs. Stirling. 2. A general view of a jovial group.

William N. Carey, executive secretary of the American Society of Civil Engineers winds the clock presented by the Institute to the Society on the occasion of its 100th anniversary. This picture appeared in the New York Times on November 9.

Subjects related to the Institute, to the profession, to the university and to employment are discussed in considerable detail. It is a splendid idea, permitting the visitors and the members of the staff to exchange ideas, to ask questions, to make suggestions and generally to review the year's developments in the profession and to look ahead to another year.

The details of the various meetings will be reported in due course in the branch news, along with a certain number of photographs. This account is set down now just as an overall picture of what the president has been doing. It will be agreed that he has been busy.

Early in 1953 he will be visiting in Quebec and the Maritimes.

News of Other Societies

The Montreal Chapter of the **Society for Advancement of Management** announces that its fourth annual industrial engineering conference will be held in the Sheraton-Mount Royal Hotel in Montreal on Friday, March 20, 1953.

Prominent speakers will discuss subjects relating to the theme of the conference, "Second Industrial Revolution — Productivity".

Information on this industrial engineering event may be obtained from D. R. McLennan, conference co-ordinator, Northern Electric Co. Ltd., 1261 Shearer St., Montreal.

Several meetings of the **Canadian Electrical Association** are planned for early 1953. The schedule for Eastern Zone divisions is as follows: engineering and operating division, January 15, 16, 1953, Nova Scotian Hotel, Halifax, N.S.; sales division, January 22, 23, General Brock Hotel, Niagara Falls, Ont.; and the general division, at Mont Tremblant Lodge, Jan. 29, 30. The Western Zone engineering, general and sales divisions will meet at the Palliser Hotel, Calgary, Alta., February 23-27, 1953.

The **American Concrete Institute** (18263 W. McNichols Road, Detroit 19, Mich.) will hold its 49th annual convention at the Statler Hotel, Boston, Mass., February 17-19, 1953. Sessions are planned to discuss standards, foundations, research in concrete, specifications, and specialized use of concrete, design problems, vibration of concrete, precast concrete, and durability of concrete.

Correspondence

Fees in Pounds Sterling

I would like to express my appreciation of the Institute's gesture recorded in *The Engineering Journal* for October under the heading "Fees in Pounds Sterling".

The uncommercial nature of this welcome easement of one of the burdens and irritations of international finance is more than vindicated by the clear evidence it gives of the fellowship there is between professional engineers and indeed between the peoples of the Commonwealth.

S. R. Banks, M.E.I.C.,
Banbury, Oxon, England.

Elections and Transfers

At the meeting of Council held at Edmonton, Alta., on December 6, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

D. J. Appleby, *Buckingham, Que.*
C. E. Barkworth, *Toronto*
H. Baron, *Montreal*
C. E. Baynon, *Deep River*
D. O. Blake, *Toronto*
R. J. Cassidy, *Montreal*
R. O. Darling, *Port Alice, B.C.*
J. Dorochowicz, *Belleville*
E. M. Gordon, *Fredericton*
D. F. Jeffrey, *Sudbury*
M. Konforti, *Montreal*
F. C. Kresz, *Toronto.*
J. C. Litster, *Toronto*
P. R. Maitland, *Vancouver*
W. G. More, *Ottawa*
J. B. Newman, *Toronto*
P. G. Pap, *East Angus*
Esther Rabkin (Miss), *Ottawa*
D. W. Richardson, *Hamilton*
O. A. Schmidt, *Elora, Ont.*
G. J. Trudeau, *Arvida*
R. E. Taylor, *Calgary*

Juniors:

U. P. Burke, *Glace Bay.*
H. N. David (Miss), *Montreal*
D. P. Duffy, *Sudbury*
A. A. H. Gillespie, *Hamilton*
H. A. Hatch, *Sherbrooke*
D. B. Hislop, *Sarnia*
J. T. Laba, *Montreal*
R. O. Marshall, *Hamilton, Ber.*
J. H. McCracken, *Toronto*
J. N. Ross, *Vancouver*
R. Senyk, *Welland*
M. E. Spear, *Fort Erie*

Transferred from the class of Junior to that of Member:

S. G. Anderson, *Winnipeg*
G. S. Ballantyne, *Winnipeg*
F. S. Brown, *London*
D. Feldman, *Montreal*
J. K. Gordon, *Ottawa*
A. G. Gray, *Ottawa*
A. Kielland, *Arvida*
N. W. Life, *Wallaceburg, Ont.*
J. M. Martel, *La Sarre, Que.*
A. F. Ness, *St. Catharines*
J. S. Newman, *Montreal*
G. A. Seward, *Chicago*
R. J. Smith, *Montreal*

Transferred from the class of Student to that of Member:

E. M. Powell, *Sudbury*

The following Students were admitted:

McGill University

I. Akerman
G. W. Armstrong
P. M. Audette
J. A. Baudot
L. R. Bergeron
M. L. Blostein
C. Bourgeois
D. D. S. Bowles
R. D. Boyd
C. R. Bradley
G. A. Brewerton
I. B. Bruce
S. Campanelli
E. A. M. Chadwick
D. A. Chamberlain
G. B. Church
E. A. Clark
J. A. Mahomed
M. K. Malloy
L. H. Masters
R. F. Meadley
C. J. Mullally
L. D. Macdougall
R. T. McGee
J. G. McGibbon
A. R. McKay
D. E. McKercher
G. Nadon
G. V. Novotny
J. J. Paquin
F. A. Patterson
D. C. T. Pei
T. J. Popiel
J. S. Pringle
E. E. Costanzo
F. L. Davis, Jr.
L. G. J.Delicaet
P. N. Dufresne
J. A. Edge
M. Furst
G. M. Gauthier
H. S. W. Goodwin
F. T. Graves
J. U. J. Guevremont
B. A. B. Hall
J. S. L. Haslett
J. B. Haworth
G. A. Helm
R. G. Hunter
N. Issaris
L. D. A. Jackson
R. P. Jaeggin
T. W. Johnston
N. Jonas
W. E. Jubien
T. Kern
C. M. Kleniewski
A. P. Kornachuk
A. Kraulis
L. K. Kwan
G. Ladouceur
C. Lafkas
S. Lake
J. Landriault
P. B. Langballe
V. B. Laurin
A. J. LeBlanc
P. A. L'Ecuyer
G. Legault
P. G. Levasseur
M. Litwin
D. Louizos
A. Pusarauskas
C. Rankin
K. C. Read
J. W. Redston
G. M. Reid
R. E. Richter
R. C. Riordon
G. Roch
G. R. Ross
F. Rumscheidt
T. A. Rutley
C. J. Smir
M. D. Schneider
M. S. Slivitzky
G. L. V. Springate
J. A. Stephenson
B. H. L. Tache
R. Tang-Fong
J. K. Taylor
V. Themelis
J. M. Thompson
L. B. Torobin
P. T. Tsuk
N. Valentine
D. Van Eyken
E. van Walsum
M. C. Vezina
A. Vuchkovic
R. W. Ward
P. A. Webb
J. Weiss
A. S. White
R. H. Wickens
W. M. Wonham
F. Wood
D. H. Wood
B. H. Woodman
Z. B. Wowk

Ecole Polytechnique

P. Alepin
R. Arsenault
C. Barbeau
C. Barre
P. T. Beauchemin
C. Beaumier
B. Beauregard
R. Berthiaume
A. Bisaillon
J. Boileau
C. Boisvert
H. Boucher
P. G. Boucher
C. Bourgault
B. Boyer
M. Brillon
P. Brillon
J. G. Carrier
L. B. Cauchon
H. Chabot
J. Chartrand
N. C. Clement
J. R. Comtois
C. Cote
M. J. Cote
J. L. Courtemanche
J. P. R. Cyr
M. Dagenais
Y. Dagenais
L. Darveau
C. David
P. de Guise
Y. Desjardins
J. G. Desormeau
J. A. I. Desmarais
C. G. J. Donaldson
J. R. D. G. Dufresne
G. Dupaul
J. Dupont
L. Dupuis
R. Francoeur
R. Gariepy
B. Gauthier
Y. Girard
A. Godin
J. Godin
I. Gorup
P. Gosselin
J. M. Goyette
L. O. Grenier
A. Guimond
M. Hebert
J. Henault
A. Hodekeyser
C. Hotte
J. Hotte
J. Houle
J. L. Jarmin
G. Y. M. Joncas
H. P. Lafontaine
E. Lair
J. M. Lair
J. Y. Lalonde
B. Lanctot
M. Langlois
F. Lapointe
R. Laporte
L. Larose
J. Larouche
J. P. Laurencelle
P. Lauriault
J. P. Lebeau
J. Leconte
P. C. C. Lefrancois
G. Legault
G. R. Leonard
J. L. Leroux
P. Y. Levesque
H. L'Heureux
P. Loiselle
J. C. G. Lortie
J. L. Major
A. Marceau
J. Marquet
J. P. Meloche
G. Messier
M. Miron
C. Morin
J. M. Morin
R. Neron
M. Normandin
C. Ostiguy
J. C. Ouellet
L. M. Ouellet
J. Paradis
M. Parent
P. H. Payette
J. Pellerin
C. G. Perras
N. Pham
G. A. Perreault
B. Platonoff
M. Pouliot
M. Prevost
A. Quenneville
J. P. Remillard
J. J. G. Richard
A. Roberge
J. Roquet
C. Rouleau
R. Roy
Y. Roy
P. Schiettekatte
G. Seguin
R. Shooner
J. A. Simard
R. Simard
R. Takacs
R. Therrien
R. Tougas
A. Tousignant
J. Tremblay
L. Tremblay
R. Tremblay
G. Turcotte
J. P. Vaillancourt

University of British Columbia

A. J. MacDonald
W. R. Tracey
D. R. McKay

Queen's University

W. J. Halliwell
J. E. Wilson
K. J. Perry

University of Alberta

E. R. Brushett
D. B. Campbell
D. J. Cote
M. W. Carlson
R. C. Edlund
D. A. Harris
R. E. Hollies
G. A. Jones
D. H. Pollock
K. M. McMillan
W. F. Wells

University of New Bruntwick

R. E. Burridge
R. C. Campbell
Y. Chartier
G. L. Leclerc
R. I. MacDormand
J. W. Roman

Ottawa University

L. Begin
G. G. Belec
J. H. Corbeil
C. D. Dallaire
M. L. de Varennes
J. Drouin
A. Gagne
J. J. Gribbon
R. Lacroix
L. Lambert
C. A. Landry
V. Langlois
R. B. Lemay
B. A. Masse
L. Morris
J. Mulvenna
L. Parent
R. Parent
F. Proulx
C. Theberge
P. H. Trudel

Royal Military College

B. B. Hercus
L. V. Ursel

University of Manitoba

M. A. Ford

University of Toronto

A. I. Butler

G. M. Tibshirani, *Niagara Falls, Ont.*
G. R. Banz, *Toronto, Ont.*

Applications Through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

Alberta

Member:

G. C. Walker

Juniors:

M. E. Carlson
T. E. Milner

Junior to Member:

R. W. Underhill

Saskatchewan

Junior to Member:

H. C. Mollard

Manitoba

Junior to Member:

A. F. Thomson

Nova Scotia

Member:

V. R. VanRiper

Junior to Member:

H. M. Anderson
J. R. Cameron
C. A. Campbell
D. C. Johnson
D. F. Kirk
M. G. P. MacMillan
G. F. Mader
H. S. Ogilvie
J. W. Pertus
F. T. Peters
W. A. G. Snook
R. F. Tanton
D. K. Teasdale
R. F. Titus

Student to Member:

G. A. MacLeod

Personals

News of the Personal Activities of Members of the Institute

H. Ross MacKenzie, M.E.I.C., who was deputy minister of highways for the Province of Saskatchewan for the past 13 years retired this year, and is living in Vancouver.

Employed by the Department of Highways since 1912, Mr. MacKenzie has been attributed much of the Province's economic growth due to the moulding of its highway system into its present pattern. In 1918 he drew up what might be called the province's first road map and he has been connected in some way with the construction of virtually every mile of highway in the province. On his retirement the press commented that in 1912 with a team of horses, Mr. MacKenzie could travel 35 miles a day. Twelve years later, with the dawning of the modern age, a model T could make it from Saskatoon to Regina in about 16 hours. Now Saskatoon is only four hours away by road and Winnipeg eight or ten.

Mr. MacKenzie was born in Pictou County, N.S., and graduated from Pictou Academy in 1904. In the succeeding years he went to normal school and became a teacher. From 1909 to 1913 he worked toward his engineering degree at the University of Toronto. Newly graduated, he returned to the highways department where he had worked the previous year.

From 1913 to 1919 he was a highway inspector with the Board of Highway Commissioners and for the next 10 years, chief field engineer for the Department. In 1929 he took the post of chief engineer, supervising all construction. He became deputy minister in 1939.

In addition to the job of deputy, Mr. MacKenzie has been a member of the Highway Traffic Board since 1932, and since 1946 a director of the Saskatchewan Transportation Company, a provincial crown corporation.

He has been a councillor and a chairman of the Saskatchewan branch of the Engineering Institute, chairman of the International Highway Association, president of the Association of Professional Engineers of Alberta, and a director of the Canadian Good Roads Association.

Col. H. G. Thompson, D.F.C., E.D., M.E.I.C., has been appointed honorary lieutenant-colonel of the 2nd Technical Regiment, R.C.E.M.E., it was recently announced by Lt.-Col. L. Martin, M.B.E., M.E.I.C., officer commanding the Regiment.

Colonel Thompson, who is the assistant general secretary of the Engineering Institute, is widely known in Canada for

Col. H. G. Thompson, M.E.I.C.

his activities in military, professional and industrial circles. His broad experience and wide acquaintanceship within the profession, forms an excellent background for his new appointment. His work for the R.C.E.M.E. Corps is well known, and he has been referred to on many an occasion as the Daddy of the Corps.

Colonel Thompson was born near London, Ontario, and in 1922 was graduated from the University of Toronto with the degree of B.A.Sc. in mechanical engineering. For several years following graduation he worked in the heating, ventilating and steam power plant field, as applied to industrial plants, particularly pulp and paper and power. Later he became in succession department head, branch manager and manager of various companies dealing with the design and operation of steam power plants. From 1932 to 1934, Colonel Thompson served on the staff of the Engineering Institute in Montreal as editor of indices of the Engineering Catalogue.

In 1937 he was selected to organize and command the first Canadian Reserve Army Field Workshop, with the rank of major and ordnance mechanical engineer. On the outbreak of war in 1939 this unit was mobilized to full strength, Major Thompson being promoted to the rank of lieutenant-colonel, and proceeded overseas with the First Canadian Division under General McNaughton. At the end of 1940 Colonel Thompson was invalided home and early in 1941 was appointed chief ordnance mechanical engineer at Defence Headquarters in Ottawa, with the rank of colonel.

In January 1942 he went to the Middle East as technical observer for the Canadian Army. In June he returned to England where he served successively as deputy director of Ordnance Engineering Services and of Mechanical Engineering at headquarters of the First Canadian Army. After having supervised the formation of the Royal Canadian Electrical and Mechanical Engineers Corps (R.C.E.M.E.) in the Canadian Army overseas, Colonel Thompson was returned to Canada in August 1944 to become director mechanical engineering at Army Headquarters, Ottawa, where he remained until the end of the war.

In 1945 Colonel Thompson was awarded the Medal of the Engineering Alumni of the University of Toronto, for outstanding achievement in the field of engineering. Following his retirement from the active army at the end of the war he rejoined the active reserve in command of the shops in the Toronto area and during this period assisted in organizing the R.C.E.M.E. Corps Association, of which he served as president for the first three years.

Col. Thompson has been a member of the Association of Professional Engineers of Ontario, the Canadian Institute of Mining and Metallurgy, the Institute of Mechanical Engineers, and the

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American Society of Mechanical Engineers for many years. Last year he served as chairman of the Ontario section. He has as well been a vice-president of the Engineering Alumni Association of the University of Toronto since his return to civil life.

Dr. Karel R. Rybka, M.E.I.C., consulting engineer, Toronto, has been chairman of the Committee on Frequency Conversion of Domestic Fuel Oil Burning Equipment. The Committee, constituted in March 1952 to investigate the conversion of oil burners under the frequency standardization program of the Hydro Electric Power Commission of Ontario, issued its report on November 6, 1952.

Frederic R. Duncan, M.E.I.C., solicitor and professional engineer, has been a member of the Committee appointed by the City of London, and **Victor G. Smith,** professor of electrical engineering, University of Toronto, was appointed to the Committee by the Hydro-Electric Power Commission of Ontario. Dr. Rybka was the nominee of the Association of Professional Engineers of Ontario, acceptable to both parties.

The report of the Committee showed that all details, large and small, physical and mental, covered by the conversion from 25 cycle to 60 cycle electricity, were thoroughly investigated.

There had been owners' complaints and manufacturers' disagreements and an adverse report from certain disgruntled citizens submitted by the City of London to the Commission chairman. These had to be investigated and studied.

Numerous field and laboratory tests and studies were made. These clearly showed that the methods used and results obtained met the complete approval of the Canadian Underwriters Association.

The report discussed the various points raised and disposed of them in clear and concise fashion. A number of recommendations were made with a view to improving the results of future conversions through technical changes, educational programs and psychological corrections. In conclusion the report expressed the unanimous opinion of the Committee that a great deal of credit was due the Commission for its efforts in saving the people of Ontario a large sum in the methods adopted for oil burner conversions.

R. B. Jennings, M.E.I.C., supervising engineer for Ontario of the Trans-Canada Highway with headquarters in Toronto, has been transferred to the chief engineer's office at Ottawa, and appointed prior construction engineer of the Trans-Canada Highways, Department of Resources and Development.

J. H. Johnston, M.E.I.C., has been appointed chief maintenance engineer for the Department of Highways of Alberta, at Edmonton. He had been assistant superintendent of maintenance for the Department of Public Works in Edmonton since 1948. Earlier he was district engineer for the Department at Peace River, Alta.

W. G. Milne, M.E.I.C., has been appointed president and managing director of N. Slater Company, Limited. Mr. Milne has been associated with the Company for 22 years, and has been vice-president since 1928 and a managing director for the past several years.

E. W. Wood, M.E.I.C., has been appointed principal of the Provincial Institute of Technology and Art in Calgary, Alta., succeeding Dr. James Fowler who retired on December 18.

Mr. Wood obtained his scientific training at the Mechanical Training Establishment (Admiralty) in Portsmouth, England, passing the Admiralty higher educational tests in 1926. He served for four years in the Royal Navy.

In 1930 Mr. Wood joined the Provincial Institute of Technology and Art as an instructor, and in 1936 was appointed head of the machine shop department.

Mr. Wood was on loan in 1940 from the Institute staff to supervise the Dominion Provincial Youth Training Centre at Lethbridge under the War Emergency Training Program. In February 1941, he joined the Royal Canadian Navy as lecturer in marine engineering and later in that year he was appointed to the Mechanical Training Establishment at Esquimalt. In 1943 he was transferred to Ottawa and in 1945 he returned to Calgary with the rank of commander.

He was appointed shop director of the Institute of Technology and Art in 1946, and goes to his new post from that of vice-principal.

W. A. B. Saunders, M.E.I.C., head of the department of aeronautics, has been named vice-principal of the Provincial Institute of Technology and Art in Calgary, Alta.

Mr. Saunders begins his seventh year on the staff of the Institute and his second year as head of the aeronautics department.

A native of Calgary, he was educated at Crescent Heights high school and spent two years at the Institute. He graduated in civil engineering from the University of New Brunswick in 1941 and in 1951, received his M.Sc. degree from the same university.

He served with the R.C.A.F. during the war, in the first two years of which he was an aeronautical engineering officer on loan to the British Air Commission. In this capacity he was stationed in Los Angeles as resident technical officer. Toward the end of the war he was a flying instructor.

Herve A. Gauvin, M.E.I.C., has accepted the position of general manager of Clare Bros. and Company Limited, in Preston, Ont.

He was formerly superintendent of A. Belanger Limited, Montmagny, Que., and earlier worked with the Provincial Department of Roads, as a division engineer.

F. R. Coleman, M.E.I.C., has resigned from the staff of the Nova Scotia Technical College to accept an appointment on the staff of the University of New

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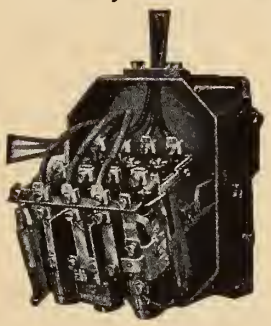

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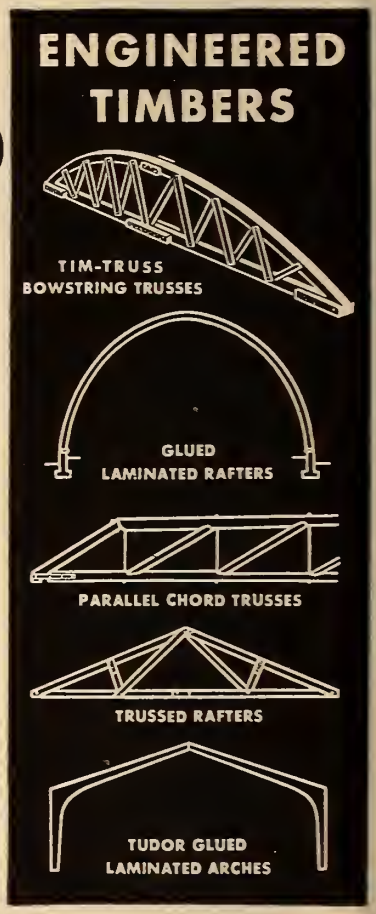

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Brunswick as assistant professor of mechanical engineering.

Professor Coleman is a 1933 mechanical engineering graduate of N.S.T.C. He joined its staff in 1949, after having done consulting work for three years at Dartmouth, N.S.

Esther Rabkin, M.E.I.C., operates the Technical Translation Services, Ottawa, Ont.

Miss Rabkin who was born in Russia, received a B.Sc. degree in electrical engineering from the University of Alberta in 1935.

Upon graduation she joined the Canadian General Electric Company in Toronto to work in the lamp engineering, testing and design department. She was in charge of the life test department for three years, and served later on the switchgear engineering and industrial control divisions of C.G.E. at Peterborough.

In 1942 Miss Rabkin entered the signals, research and development division of the Department of National Defence in Ottawa, and from 1944 until 1946 she was engaged in electronics research in the Department. The next year Miss Rabkin joined the National Research Council in Ottawa and was connected with the technical information and translations department there until 1951 when she opened her own offices in Ottawa.

T. C. Main, M.E.I.C., of the Edmonton consulting firm of Main, Rensaa & Minsos, has announced the completion of arrangements to form a separate joint company with Sandford, Fawcett and Partners of London, England, to design and supervise the construction of public utilities in Canada.

Mr. Main will be in charge of the joint-organization's Canadian office in Toronto.

C. E. Craig, M.E.I.C., has rejoined the Aluminum Company of Canada, Limited, in the sales development division, Montreal, after two years' service as production manager of the Aluminium Company of South Africa (Pty.) Limited, Pietermaritzburg, South Africa.

J. K. French, M.E.I.C., has been transferred by the Continental Can Company of Canada Limited to Burnaby, B.C., from Montreal where he was assistant plant manager.

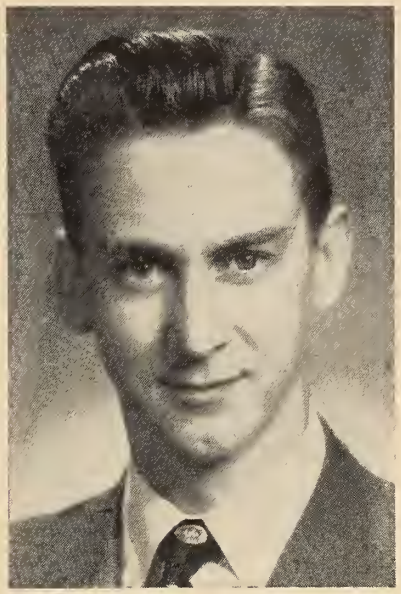
Mr. French is a mechanical engineering graduate of McGill University, class of 1940. He joined the Company in 1946, after serving overseas on the staff of the deputy director of mechanical engineering, First Canadian Army.

W. K. Sharpe, M.E.I.C., is senior sanitary engineer in Truro, N.S., of the Public Health Engineering Division of the National Dept. of Health and Welfare. He was previously director of the Division of Sanitary Engineering for the Department at Charlottetown, Prince Edward Island.

T. L. B. Hamlin, M.E.I.C., is assistant district engineer at Blind River, Ont., in the Municipal Roads Branch of the Department of Highways. He was previously office engineer and draughtsman with the Department in Sudbury, Ont.

C. D. MacKintosh, M.E.I.C., is consulting engineer with the Canadian Pacific Railway Company in Vancouver. He was previously consulting engineer with the Pacific Great Eastern Railway in Vancouver. After being associated with C.P.R. as division engineer at Victoria, Mr. MacKintosh was made engineer in charge of the new Nanaimo Terminus of C.P.R. in 1947. He was appointed engineer in charge of the Esquimalt and Nanaimo Railway, Vancouver, in 1949.

R. W. Lister, M.E.I.C., has been appointed manager of the Canadian Westinghouse Company's Niagara district sales office in Hamilton, it was announced recently



R. W. Lister, M.E.I.C.

by J. W. Kerr, M.E.I.C., manager of the apparatus division sales department. Mr. Lister was previously sales engineer at the Company's Windsor office.

He joined the Canadian Westinghouse Company's graduate student training course upon receiving his engineering degree from the University of British Columbia in 1947, and since 1949 he has been in charge of important industrial and central station assignments in the Edmonton and Windsor areas.

Roland Collins, Jr.E.I.C., is now employed by the Defence Research Board at Valcartier, Que. He was previously with the Aluminum Company of Canada, Montreal.

Mr. Collins graduated in 1951 from Laval University in chemical engineering.

P. H. Lavallee, Jr.E.I.C., is with the Saguenay Telephone Company in Chicoutimi, Que. He has worked previously in the traffic department of the Bell Telephone Company of Canada in Montreal, Sherbrooke, Que., and at Belleville, Ont., and Kingston, Ont.

Mr. Lavallee is a 1946 electrical engineering graduate of Laval University.

J. N. Buckley, Jr.E.I.C., is associated with the Ideal Welding Company Limited, Toronto.

Mr. Buckley is a 1949 graduate in mechanical engineering of the University of Manitoba.

G. S. Boa, Jr.E.I.C., has joined the Steel Building Sales & Supply Limited, Toronto, as sales engineer. He was previously with the Dominion Bridge Company Limited in Toronto.

Mr. Boa is a 1946 engineering graduate of the University of Toronto.

E. D. McCormick, JR.E.I.C., has been appointed assistant township engineer at Cooksville, Ont. He was previously associated with the Montreal Engineering Company.

Mr. McCormick obtained his civil engineering degree from the University of New Brunswick in 1949.

R. L. Schleihauf, JR.E.I.C., has joined Fiberglas (Canada) Limited in Toronto. He was previously assistant supervisor of Ore Plant No. 2 of the Aluminum Company of Canada Limited in Arvida, Que.

G. H. Bradley, JR.E.I.C., is associated with the Steel Company of Canada Limited in Hamilton as electrical buyer in the purchasing department. Mr. Bradley entered the Company as a graduate trainee after receiving his B.Sc. degree in mechanical engineering in 1948 from the University of Saskatchewan.

V. C. Larson, JR.E.I.C., is now associated with the Imperial Oil Limited in Calgary, Alta. He is at present on a one-year training course with the Carter Oil Company in Tulsa, Oklahoma, and will return to Calgary upon completion of the course.

Mr. Larson is a 1950 graduate in engineering physics from the University of Alberta.

J. H. Goar, JR.E.I.C., has been appointed sales engineer in charge of the Canadian Westinghouse Company's Windsor office.

J. H. Goar, JR.E.I.C.

Mr. Goar joined the Company as a graduate student after receiving his B.Sc. degree from the University of Manitoba in 1948. During the war he served as flying officer with the R.C.A.F.

F. C. Hamata, JR.E.I.C., is employed as project engineer with Missouri Valley Dredging, the firm which is presently engaged in installing a submerged pipeline crossing under the Fraser River near New Westminster, B.C. This crossing is a link in the Trans-Mountain Pipeline now under construction from Acheson, Alta., to Burnaby, B.C.

Mr. Hamata was formerly associated as construction supervisor with Braid, LeBrun, McKinnon, construction engineers in Bowidji, Minn.

He is a 1949 civil engineering graduate of the University of Manitoba.

J. S. Denis, JR.E.I.C., is now with the Canadian Chemical Company Limited in Edmonton. He was formerly at the Celco Plant, Celanese Corporation of America, at Narrows, Va. Earlier he worked with the International Nickel Company of Canada in Sudbury.

Mr. Denis received his chemical engineering degree from the University of Alberta in 1949.

G. S. Sugiyama, JR.E.I.C., is now employed by Green, Blankstein, Russell & Associates in Winnipeg. He was previously with Morrison, Hershfield, Millman & Huggins in Toronto.

Mr. Sugiyama graduated with a B.Sc. degree in mechanical engineering from the University of Manitoba in 1949.

F. E. Everett, JR.E.I.C., has accepted the position of plant engineer of Ronalds Printing Company in Montreal. He was formerly with Canadian Vickers Limited in Montreal, and earlier, with G. D. Peters and Company of Canada Limited in Montreal.

Mr. Everett is a 1944 mechanical engineering graduate of McGill University.

R. J. Hallawell, JR.E.I.C., is on leave from the Steel Company of Canada, Hamilton Works, where he has been a construc-

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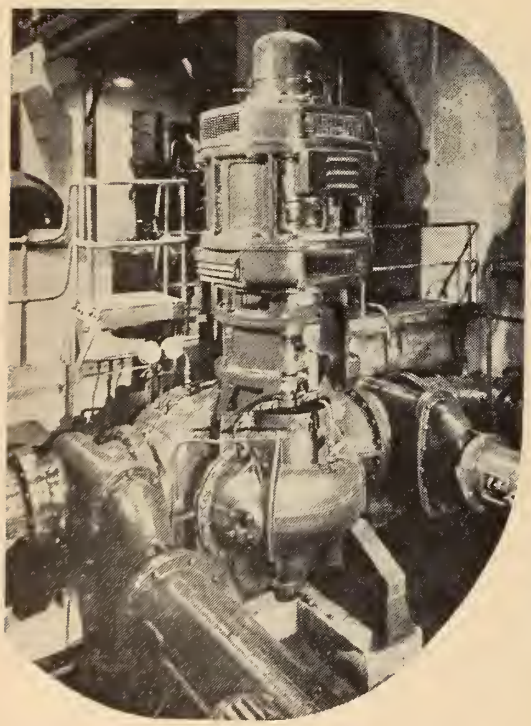

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tion engineer, to pursue graduate study at Harvard University. He is studying soil mechanics under Dr. K. Terzaghi and Dr. A. Casagrande, leading to a M.Sc. degree in foundation engineering.

Mr. Hallawell received his B.A.Sc. degree in civil engineering from the University of Toronto in 1947.

H. P. Lorimer, JR.E.I.C., is now with the McColl-Frontenac Oil Company Limited in Montreal.

Mr. Lorimer obtained his B.Sc. degree in civil engineering from the University of Manitoba in 1949 and his M.Sc. degree from McGill University in 1952.

V. A. McGregor, JR.E.I.C., is assistant engineer in the signal engineer's office of the Canadian National Railways in Winnipeg. He was formerly in the general engineering department of the Aluminum Company of Canada in Montreal, and with the Dominion Tar and Chemical Company at Beauharnois, Que.

Mr. McGregor is an electrical engineering graduate of the University of Manitoba, class of 1950.

Robert Neil Morrison, S.E.I.C., winner of the Engineering Institute of Canada (1952) Prize, has been awarded a Rhodes Scholarship, it was announced by Dr. J. S. Hodgson, secretary of the Province of Quebec selection committee of the Rhodes Trust. He is one of 11 persons selected from Canada to receive the award, entitling the winner to a minimum of two years' study at Oxford.

The awards are made under the will of Empire Builder Sir Cecil Rhodes to students showing scholastic and athletic ability, a sense of unselfishness, fellowship and leadership, among other qualities. Under the terms of the will the scholars must be all-round men.

Mr. Morrison, who is in his final year in mechanical engineering at McGill University, was born in 1931 and attended high school at La Tuque, Que., where he helped to organize the student council. He also organized the school paper and served as its editor for two years. He was active in the Boy Scout movement and served as assistant cub master.

Upon graduation from high school he won an entrance scholarship to McGill University and has held scholarships during his four undergraduate years there.

Mr. Morrison is president of Phi Epsilon Alpha, the honorary engineering society at McGill. For the past two years he has been student representative of the Engineering Institute of Canada and has been a leading spirit in the campaign for student members at McGill through which about 125 applications were received.

He is a member of the Scarlet Key Society and acted as their stadium manager for the 1952 football season. In addition, Mr. Morrison is on the Douglas Hall residence council and on the Plumbers' Ball Committee. He is also a member of the Student Society awards committee.

As an engineer, Mr. Morrison is planning a career in industry, but intends to broaden his studies at Oxford by reading for a B.A. in philosophy, political science and economics.

He will leave for England in the fall and will return to Canadian industry upon completion of his post graduate study.

F. R. MacKenzie, S.E.I.C., has joined the engineering division of the Imperial Oil Limited in Sarnia, Ont. He graduated last year from the Nova Scotia Technical College in chemical engineering.

R. C. Legge, S.E.I.C., is associated with the Husky Oil & Refining Limited at Lloydminster, Sask. He was formerly assistant city engineer for Swift Current, Sask.

R. B. Erb, S.E.I.C., is entering upon a two-year post graduate course at the College of Aeronautics, Cranfield, England. His special field of research will be aerodynamics.

Mr. Erb graduated in civil engineering from the University of Alberta last year.

G. H. Groves, S.E.I.C., has joined the staff of American Potash & Chemical Company in Trona, California, as production engineer. He worked as assistant plant engineer for the Standard Felt Company, Pasadena, Calif., after graduating in 1952 in mechanical engineering from University of Manitoba.

P. G. Kindersley, S.E.I.C., is an engineer on the staff of the Foxboro Company Limited in Ville LaSalle, Que.

Mr. Kindersley is a graduate in mechanical engineering from McGill University, class of 1952.

J. H. Thomson, S.E.I.C., who graduated in 1952 from the University of British Columbia is a junior engineer with Central Mortgage & Housing Corporation in Vancouver, B.C.

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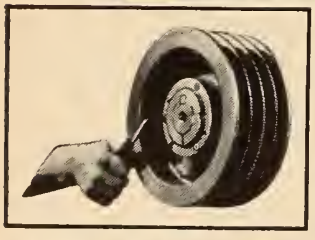

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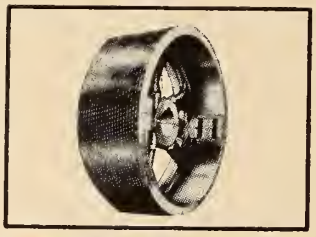

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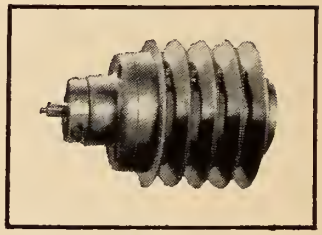

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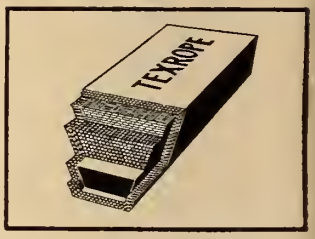

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In addition, you get the extra engineering skill that comes from having more industrial V-belt installations than any other manufacturer.

Next time you need a V-belt drive or replacement V-belts for an existing drive, contact your nearest authorized *Texrope* drive dealer or CA-C Sales Office for immediate shipment from stock. We will be pleased to assist you.

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☐ Literature on *Magic-Grip* sheaves.
☐ Pre-engineered *Texrope* Drive Bulletin.
☐ Handbook on Care of Rubber V-belts.

Name

Company

City Province

52-CAK-5

R. E. Power, S.E.I.C., has been employed with Montreal Engineering Co. Ltd., Montreal, since his graduation in May, 1952, in civil engineering from the University of New Brunswick.

R. D. Carpenter, S.E.I.C., is employed in the plant engineering department of the A. V. Roe Canada Limited at Malton, Ont. He was previously with the Fraser-Brace Engineering Company Limited at Isle Maligne, Que.

M. E. Coutts, S.E.I.C., has been employed by Bailey Meter Company Limited in Winnipeg as sales and service engineer, for the past 19 months.

Mr. Coutts received his B.Sc. degree in mechanical engineering from the University of Manitoba in 1951.

Marcel Brophy, S.E.I.C., has joined the engineering department of Electric Reduction Company in Buckingham, Que.

Mr. Brophy is a 1951 civil engineering graduate of McGill University.

W. J. N. Throop, S.E.I.C., has joined the manufacturing department of the Northern Electric Company in Belleville, Ont. He was previously with Crane Limited in Montreal.

Mr. Throop is a 1951 engineering graduate of the University of Toronto.

R. B. McCormack, S.E.I.C., is a junior engineer in the overhaul and supply division of Canadian Pratt & Whitney Aircraft Company Ltd. in Longueuil, Que.

Mr. McCormack is a 1951 mechanical engineering graduate of the Nova Scotia Technical College.

W. A. H. Filer, S.E.I.C., has been employed for the past year with the Toronto, Hamilton & Buffalo Railway in Hamilton, as a transitman in the engineering department.

Previously Mr. Filer was a field engineer with the Frid Construction Company in Hamilton, after receiving a civil engineering degree from the University of Toronto in 1951.

R. J. O'Sullivan, S.E.I.C., is now with the Canadian International Paper Company in Hawkesbury, Ont. He was previously with the New Brunswick International Paper Company in Dalhousie, N.B.

Mr. O'Sullivan received his civil engineering degree from McGill University in 1951.

H. A. Dare, S.E.I.C., is a junior civil engineer with Sprostons Limited, a subsidiary of the Aluminum Company of Canada at Mandeville, Jamaica.

Mr. Dare had followed the training course with the Aluminium Company of Canada in Montreal before his transfer.

He is a civil engineering graduate of the University of British Columbia, class of 1951.

Visitors to Headquarters

C. A. Meadows, M.E.I.C., Toronto, Ont., December 4, 1952.

Donald Stevens, Woodstock, Ont., December 11, 1952.

James A. Vance, M.E.I.C., Woodstock, Ont., December 11, 1952.

Ralph Kendall, M.E.I.C., Halifax, N.S., December 15, 1952.

Gerard L. Jolicoeur, M.E.I.C., Ottawa, Ont., December 17, 1952.

R. B. Griffiths, M.E.I.C., Ottawa, Ont., December 17, 1952.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Frank Frederick Griffin, M.E.I.C., former manager of the property department of the Winnipeg Electric Company, died on August 8, 1952, in Victoria, B.C., where he had retired one year previously.

Mr. Griffin was born in Toronto in 1882 and received his early education in Winnipeg. He graduated from McGill University in electrical engineering, receiving his B.Sc. degree in 1907. During his summer vacations from 1903 to 1906 he was employed as assistant engineer with the irrigation department of the Canadian Pacific Railway Company in Calgary, becoming resident engineer after graduation.

In 1910 Mr. Griffin joined the Washington Water Power Company in Spokane, Wash., as assistant superintendent of construction, and was appointed superintendent the following year.

Returning to Winnipeg in 1913, Mr. Griffin opened his own offices as consulting electrical engineer.

During World War I Mr. Griffin served with the Ministry of Munitions in London, England. At the close of the war he joined the Minnedosa Power Company as general superintendent and in 1920 he entered the Algoma Steel Corporation at Sault Ste. Marie.

In 1922 Mr. Griffin joined the Southern Canada Power Company at Montreal and later became engineer in charge of construction of the Hemmings Falls Power Plant, and was later appointed assistant plant manager.

Mr. Griffin was transferred in 1930 to the Northwestern Power Company, a subsidiary of the Winnipeg Electric Company, as supervising engineer at the Seven Sisters Power Development. In 1947 he was appointed manager of property, taxation and insurance for the Winnipeg Electric Company, a position he held until his retirement in June, 1951.

Mr. Griffiin was a keen sportsman and hobbyist. His greatest hobby in later life was that of building and operating an amateur radio station VE4KF in Winnipeg. He was also greatly interested in bird life.

He joined the Engineering Institute as a Student Member in 1907, transferring to Associate Member in 1913, and to Member in 1940. In 1950 he attained life membership.

James Cundiff Nash, M.E.I.C., who had completed 35 years of service this year with the Canadian Westingthouse Company Limited in Hamilton, died on May 14.

Mr. Nash was born in St. Joseph, Missouri in 1886 and received his early education in Windsor, Ont., and in London, Ont. He completed his studies in electrical engineering in 1910 at the University of Toronto, and in 1912 he received his B.A.Sc. degree in mechanical engineering from the same university.

After graduation he enrolled in the Canadian Westinghouse Company Limited training course and upon its completion, he joined the Hamilton Hydro Electric System.

Shortly after the outbreak of war in 1914, he enlisted with the Canadian Army Service Corps, proceeding overseas in 1915. Upon his return to Canada in 1919, he rejoined the Hamilton Hydro Electric System. Later that same year he returned to the Canadian Westinghouse Company Limited. During his 35 years' service with this firm, he was mainly engaged in transformer design.

During the last war, Mr. Nash served voluntarily with the Hamilton Civil Guard, a civilian defence organization.

Photography was a life-time hobby with Mr. Nash and he was an active member of the Hamilton Camera Club.

Mr. Nash was a member of the Association of Professional Engineers of Ontario and the American Institute of Electrical Engineers.

He joined the Engineering Institute of Canada as an Associate Member in 1922, transferring to Member in 1939.

James Munro Bailey, JR.E.I.C., of Victoria, B.C., was accidentally drowned on September 12 in the Clearwater River, Wells Gray Provincial Park while planning a bridge.

Mr. Bailey was born in Yellow Grass, Sask., in 1922 and received his elementary and high school education there.

During the war he served as a pilot with the Royal Canadian Air Force with the rank of flying officer.

At the close of the war, Mr. Bailey enrolled in the University of British Columbia and received his B.A.Sc. degree in civil engineering in 1949.

Upon graduation, Mr. Bailey joined the staff of the Parks and Recreation Division of the British Columbia Forest Service.

Mr. Bailey joined the Engineering Institute as a Student Member in 1949, transferring to Junior Member in 1951.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMICAL DEVELOPMENT engineer recent graduate preferred, required in Montreal. Duties would consist of development work of a junior nature in products such as latex, reclaimed rubber and possible cements. File No. 4438-V.

CIVIL

DESIGN AND FIELD ENGINEERS required by a firm of engineers and builders specializing in prestressed and precast concrete throughout Canada. Several years experience in reinforced concrete is required. Position offers salary, participation in company hospitalization and pension plans and eventual bonus. Applicants should give full details including age, education, experience, marital status, salary requirement. Personnel interview will be arranged with selected applicants. File No. 4436-V.

GRADUATE CIVIL ENGINEERS required with a minimum of five years experience in the heavy construction industry, some with field experience. Work consists of the following, project liaison, progress scheduling, quantity take-off or requisitioning. Salary ranges from $400.00 to $600.00 per month. File No. 4443-V.

CIVIL ENGINEERS required, field engineers of all types, construction superintendents, assistant superintendents and engineering administrative personnel on all levels. File No. 4443-V.

ELECTRICAL

TWO ELECTRICAL ENGINERS required one a recent graduate interested in designing electrical conductors, the other experienced in plant electrical maintenance. Southern Ontario Town. File No. 4440-V.

ELECTRICAL ENGINEERING graduate for established manufacturer of electrical signalling equipment located in Ontario. Sickness and accident insurance plan, pension plan, five day week, pleasant surroundings. This man should be capable of engineering work involving design and manufacturing problems, engineering correspondence, and preparation of instruction manuals. File No. 4444-V.

ELECTRICAL ENGINEERS with experience in communications and television system engineering required by a large organization in Montreal. Salary commensurate with ability and experience. File No. 4447-V.

MECHANICAL

MECHANICAL ENGINEER required for plant engineering department of medium size manufacturer. Duties include design and installation of new equipment, improvement and modification of existing equipment, constructional engineering and project cost estimates. Southern Ontario town. File No. 4440-V.

MECHANICAL ENGINEER required by large organization in Montreal. Duties include supervision of construction and building facilities with general mechanical problems involved. Age range 30 years. File No. 4449-V.

MISCELLANEOUS

ENGINEERING SALES POSITION available in promotion of original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and North Western Ontario and north western Quebec. Progressive training for suitable applicant. Mechanical maintenance or mill experience desirable. Submit record of education, experience with reference and photograph. File No. 4437-V.

SALES ENGINEER required to sell rust preventatives, cutting oils and drawing compounds for Canadian manufacturer to large industrial accounts. Chemical or mechanical engineer preferred with some industrial experience, but this is not essential. Guaranteed salary and expenses with profit sharing arrangement. File No. 4439-V.

IRON MINE MANAGER required. Open pit iron mine in production requires competent manager capable of increasing production, improving mill operations and shipments. Reply stating qualifications, record of employment and starting salary. Outstanding opportunity. File No. 4441-V.

SALES ENGINEER required to establish an Edmonton Branch Office for a well-known Canadian industrial company handling boiler water treatment, combustion controls and industrial instruments. Applicant should have sound knowledge of chemistry, so as to be capable of being trained in its application to boiler water conditioning and should preferably be acquainted with boiler instruments and controls. Territory to be covered is Alberta, Saskatchewan, and N.W.T. This position will be permanent, and on a salary basis. State sales experience and qualifications. File No. 4442-V.

DESIGN ENGINEER OR senior mechanical draughtsman required by manufacturer in Ontario of pipe and bolt threading machinery. File No. 4445-V.

APPLICATIONS ARE INVITED for the position of Town Engineer for a rapidly expanding town in Ontario. Present population approximately 3,500. Applicants must have practical experience in the supervision of construction and maintenance of waterworks, sewers, roads and sidewalks. Age, experience, references and salary expected must be included in applications. File No. 4446-V.

SENIOR ESTIMATOR required to join a growing concern that offers excellent opportunity. Applicant should be able to take off quantities accurately and have pricing and general contractor's office routine experience. Salary commensurate with experience and ability. File No. 4448-V.

MECHANICAL OR MINING ENGINEER, recent graduate required as plant engineer in Ontario, for organization with head offices in Montreal. Age 25 to 30 years. Salary range $350.00. File No. 4450-V.

TWO METALLURGISTS recent graduates, to undergo training in production methods of large organization. Location, short distance from Montreal. File No. 4451-V.

ENGINEER required to act as control engineer for paper mill located in P.Q. Applicant should have instrumentation experience not necessarily in pulp and paper. The job also entails steam plant work, therefore a knowledge of combustion, steam generation and drying is desirable. File No. 4452-V.

TECHNICAL REPRESENTATIVE required. Applicant must be Canadian by birth or of British origin and familiar with Canada as the result of 5 or 6 years residence with University degree in engineering. Good general engineering experience; experience of diesel engines and/or heavy earth moving desirable but not essential. Age 30 to 35 years. Personality is of great importance. Future prospects in view of the stability of the company are excellent. File No. 4453-V.

REFRIGERATION ENGINEER required by large manufacturer of home appliances in Montreal to do design and development work on refrigerator units. Applicant should have at least three years experience in domestic refrigerator unit engineering, and be able to carry out the work with a minimum of supervision. Graduate in Mechanical engineering preferred, age 25 to 40 years, salary according to qualifications. File No. 4454-V.

INDUSTRIAL ENGINEER required by large container manufacturing firm in Montreal. Applicant should have experience in development overhead and operating labor standards, time study, job evaluation, cost reduction, etc. Personality and ability to deal with people important. This company is expanding in Canada and the opening holds definite future opportunity. Man under 30 preferred. File No. 4455-V.

INDUSTRIAL ENGINEER, preferably bilingual, with good knowledge of accounting. File No. 4358-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

JUNIOR CHEMICAL ENGINEER required for paper mill in Province of Quebec. Duties consist of various laboratory tests, some calculation, paper measurements, analysis of samples, miscellaneous tests as to quality of the board and newsprint and also make up standard solutions. File No. 4390-V.

CHEMICAL ENGINEER required in a plant producing heavy inorganic chemicals in South Western Ontarlo. The initial employment will consist of routine laboratory work in the control laboratory including some investigation of plant operations. This period would continue from one to three years depending partly on local conditions and partly on the aptitudes of the individual. This period would logically be followed by work as technical assistant in operating sections and supervisory positions. File No. 4407-V.

GRADUATE CHEMIST or chemical engineer with thorough grounding in physical chemistry, postgraduate training and relevent experience desirable. Duties to conduct both research and investigation of practical problems in the combustion of gas turbine and jet engine fuels, to assume some responsibility in the guidance and supervision of thls work. Salary dependent on qualifications and experience. File No. 4410-V.

CIVIL

CIVIL ENGINEER and instrument man required by a young contracting company specializing in sewers and water works, also some building and roadwork. One with some capital to invest in the business preferred. Good opportunity for an ambitious man willing to work. Please state age, graduation, experience, references and salary expected. File No. 4377-V.

CIVIL ENGINEER required to act as Out Island Development Engineer Duties to supervise contractors for, or to personally execute the construction of: country roads, small buildings, small water works, landing and piers, also surveying and estimates for the above works. Salary £700 p.a. plus £450 additional salary. Subsistance allowance for travel away from area of residence. Passage expenses up to £78 each for officer and wife and up to two children. Location Bahamas. File No. 4399-V.

CIVIL ENGINEER required for permanent position with good prospects of advancement is open for experienced man. Experience in the design and construction of sewers and other municipal works is desirable. Starting salary $270.00 to $380.00 per month depending upon qualifications and experience. Salary is supplemented by cost of living bonus of approximately $30.00 per month. Apply giving full particulars to File No. 4408-V.

CIVIL ENGINEER to act as sales engineer for well established Canadian company. Applicant must be bilingual. Products include reinforcing mesh along with metal-built products. Customers include architects, engineers and contractors. File 4433-V.

CIVIL ENGINEER to act as superintendent on construction projects. Prefer man with 3 or more years experience, under 35 years of age and a graduate of a Canadian university. Substantial base salary and a good yearly bonus. A pension and insurance plan is available after 2 years employment.. File No. 4417-V.

ELECTRICAL

GRADUATE ELECTRICAL ENGINEER with two or three years experience in product design. He should preferably be familiar with the content of J.A.N. specifications to enable him to work as a member of an electronic components standardization group. In addition he should be capable of exercising supervision over two or three electrical layout draughtsmen and have a good working knowledge of high frequency networks and pulse circuiting. He should be willing to locate in Ottawa. Salary will be commensurate with qualifications. File No. 4384-V.

ELECTRICAL SALES ENGINEER wanted for Toronto area with experience in commercial and industrial lighting equipment to contact electrical jobbers, architects, consulting engineers. Good salary and commission plus car allowance and expenses. Excellent opportunity for intelligent and aggressive man. File No. 4394-V.

ELECTRICAL ENGINEER required to act as assistant to the manager of special contract department for manufacturer located in Ontario. Applicants should be only of high calibre and have some commercial or retailing background. File No. 4415-V.

ELECTRICAL ENGINEER required for the design and layout of specialized equipment in a pulp and paper mill. Applicant should have majored in power preferably test course graduate. Desirable experience in test course or short design experience with an electrical manufacturer or period of service as an electrician in an industrial plant or work as a designer in a consultant's office. Salary $325. per month. File No. 4419-V

SALES AND SERVICE ENGINEERS for large X-Ray equipment manufacturers. Graduate electrical engineers or men with good background in electricity and electronics. Training programme and car provided with good starting salary and advance later to commission arrangement. For full particulars apply to File No. 4423-V.

MECHANICAL

MECHANICAL DESIGN ENGINEERS are required by a firm of consulting engineers in Vancouver. Four engineers are required preferably with a minimum of three years experience in design or operation of Kraft pulp or newsprint mills. State experience and salary desired. File No. 4381-V.

MECHANICAL ENGINEER required as assistant superintendent for a mechanical plant—400 employees. manufacturing steel and iron castings general machine work and light structures. Please reply in confidence, giving full details. File No. 4385-V.

JUNIOR MECHANICAL ENGINEER required in Montreal. Applicant should be bilingual with some experience in heating and ventilating equipment. File No. 4388-V

GRADUATE MECHANICAL ENGINEER required by well established Canadian manufacturer. An excellent opportunity for young graduate engineer to train as sales engineer. Apply stating age, name of university and scholastic attainment to File No. 4392-V.

RECENT MECHANICAL ENGINEERING graduate required in Toronto. Applicant should have preferably paper mill experience. Salary range $350 per month. File No. 4413-V.

MECHANICAL ENGINEER required by Montreal district office of the civil service commission to supervise the inspecting and testing of armament components. Salaries depend upon qualifications. File No. 4416-V.

MECHANICAL ENGINEER required for old established concern in South East Ontario within 70 miles of Toronto. Applicants must be interested in design work as applied to materials handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance profit sharing and pension plan available. Apply stating experience education and remuneration. File No. 4418-V.

MECHANICAL ENGINEER with some practical shop experience for estimating department by Montreal light sheet metal work plant. Salary commensurate with experience. File No. 4420-V.

MECHANICAL ENGINEER required in Montreal, well versed in various types of textile machinery and capable of designing new equipment and remodeling old equipment. File No. 4422-V.

INDUSTRIAL ENGINEER preferably mechanical with 3 or more years of industrial engineering experience in industry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment, materials handling, plant layout, and other aspects of factory operation. He will also learn to make time studies to establish production standards for wage incentive installation. The starting salary range is $4,000 to $4,500. There are good opportunities for advancement. File No. 4424-V.

JUNIOR MECHANICAL ENGINEER required by world wide organization with head office in Ontario. Applicants must be under 30 years of age and interested in tool and product design. Those successful will be given extensive training in the overall operation of the company for a period of at least 12 months. Age experience, marital status and salary expected should accompany letters of application. File No. 4426-V.

SALES ENGINEER on machine tools required by well known Canadian manufacturing concern with branches from coast to coast. Preference shown to mechanical engineer 25 to 35 years of age with sales experience and proven ability. Unusual opportunity for man with executive ability. File No. 4426-V.

MECHANICAL ENGINEER required as assistant to mechanical superintendent in large Eastern Canadian Brewery. Duties will include assisting supervision of maintenance and installation of pumps, motors, steam boilers and refrigeration systems, etc. This is a junior posiliton and no experience is required. Salary open. File No. 4427-V.

MECHANICAL ENGINEER required by large organization with head offices in Montreal. Candidates should be recent graduates with approximately two years experience. They should have a knowledge of general mechanical design and installation of plant equipment. Training as project engineer to eventually be responsible for major installations. File No. 4432-V.

MECHANICAL ENGINEER for plant located in Southern Ontario. Candidates

MUNICIPAL ENGINEER WANTED

for the

CORPORATION OF THE IMPROVEMENT DISTRICT OF ATIKOKAN

Applicotians will be received by the undersigned far the position of town engineer for the ropidly exponding Town af Atikokon: Present populatian approximately 3,500.

Applicants must have practicol experience in the supervision of canstruction and maintenance of woterworks, sewers, raads and sidewolks. Age, experience, references and salory expected must be included in applicatians.

F. A. COX, Sec'y.-Treas.
Improvement District of Atikokan, Atikokan, Ontario.

Engineers, Architects, Physicists, Chemists, Geologists

are Required for Technical Departments of the

GOVERNMENT OF CANADA

SALARIES $3,000 to $7,200, depending on duties and qualifications

MECHANICAL ENGINEERING	ELECTRONICS and POWER	CIVIL ENGINEERING
Patent Examination (53-1957) to $4,220	Patent Examination (53-1954) to $4,220	
Instructors for Royal Military College (53-2006) to $3,620	Instructors for Royal Military College (53-2002) to $3,620	Instructors for Royal Military College (53-2004) to $3,620
Communications Research and Development Ship's Machinery and Power Equipment Armament Design and Development Heating and Ventilation Design (53-1201) to $6,220	Communications Research and Development Armament Testing and Control Equipment Communications Specifications Weapons Control Design and Development Procurement and Production Lighting and Power Equipment Design and Specifications (53-1151) to $6,220	Design of Buildings and Other Structures Specification Writing and Cost Estimating Municipal Engineering Construction Supervision and Inspection (53-1250) to $6,220
Engineers in Training (53-1200) to $4,220	Engineers in Training Electronics and Power (53-1150) to $4,220	56 Engineers in Training (53-1250) to $4,220
CHEMICAL ENGINEERING	**MINING AND METALLURGICAL ENGINEERING**	**ARCHITECTURE**
Patent Examination (53-1952) to $4,220 Metal Corrosion Studies (53-2152) to $4,880 Instructors for Royal Military College (53-2003) to $3,620 Junior Engineers in Industrial Waters (53-1401) to $4,880	Patent Examination (53-1957) to $4,220 22 Junior Engineers for training in Ore Dressing, Physical Metallurgy, Mineral Economics (53-1500) to $4,880 Mineral Economics and Utilization (53-1501) to $5,580	Chief Architect for Naval Shore Establishments and Services Four Architects for Army Accommodation Design Specification Writers Design Draftsmen Junior Architects for Training (53-1001) to $7,200
PHYSICS	**GEOLOGY and MINERALOGY**	**SURVEYING**
Instructors for Royal Military College (53-2005) to $3,620	Geological Survey of Canada (53-1900) to $5,260	Land Surveyors with Provincial or Dominion Certificates (53-1301) to $5,260
Engineers for Training in Communications, Metallurgy and Survey Equipment (53-1650) to $4,220	Spectro Chemical Analysis, Petrography, X-Ray Diffraction Analysis, etc., in Mines Branch (53-1550) to $4,880	Junior Engineers, Civil, Mining, Forest, etc., for training (53-1300) to $4,220
Geophysics in Dominion Observatory (53-1800) to $4,880 Patent Examination (53-1955) to $4,220		Graduates in Mathematics or Physics or Personnel with Experience in Survey, for training (53-1700) to $3,600

FURTHER INFORMATION

Available from the Secretary, Civil Service Commission, Ottawa; Executive and Professional Division; National Employment Service Offices and University Placement Offices.
Write for Information Circulars. Please quote bracketed numbers shown for each field of specialization above.

PETROLEUM ENGINEER

for the
Saskatchewan Petroleum Industry
$273.-$348.

A variable cost of living bonus is paid in addition to the above stated basic salary. Current cost of living bonus is $9.60 per month.
To perform research work, involving field activities, on gas and oil reserves.
Require university graduation in a related field such as geologist, petroleum, chemicol or mechonical engineering.
Position will be filled as soon as a suitoble applicant is obtained.

Write for opplication forms to:

The Public Service Commission,
328 Legislative Building, Regino.

should be recent graduates with preferably some manufacturing experience and knowledge of rubber. Initiative and mature judgment are, of course, requisites. Duties would include coordination and supervision of engineering details in connection with an expanding programme. File No. 4432-V.

MISCELLANEOUS

CHIEF AERONAUTICAL ENGINEER required in Western Canada organization engaged in the conversion repair and overhaul of airframes and aircraft instruments. Candidates must have graduated from a recognized school of engineering and have professional qualifications which permit membership in the Association of Professional Engineers of Alberta. Seven to 10 years experience in the design of repair schemes, modifications and prototype installations for aircraft of 19,000 lbs. weight and up. Thorough knowledge of stress analysis and airframe designing. Must be capable of effectively supervising an engineering staff consisting of two other graduate engineers and 6 to 8 draughtsmen. Experience in jet aircraft preferred. Age 40 to 50 years. File No. 4389-V.

DESIGN ENGINEERS required by large organization in Ontario. Experience in the fields of radar and microwave communications. File No. 4395-V.

GRADUATE ENGINEERS, either experienced or inexperienced for training as time study men in time standards and methods department of large manufacturer in Ontario. File No. 4396-V.

ENGINEER REQUIRED by American manufacturer of paper and cellulose products to act as Canadian representative. Applicant should have 3 to 10 years successful sales experience preferably in the industrial packaging field. Willing to consider Canadian citizens only. File No. 4397-V.

DISTRICT SALES MANAGER for Vancouver and B.C. required for sale of motors, transformers, switchgear and rectifiers. Preference will be given to someone having both engineering and sales experience. This is an excellent opportunity for the right man. Salary will be attractive and in keeping with the experience offered. All replies treated in confidence. File No. 4401-V.

MECHANICAL, ELECTRICAL AND ELECTRONICS ENGINEERS, mechanical and electrical draughtsmen, preferably with aircraft or aircraft equipment experience, required by leading airline to work in Montreal and/or Winnipeg. Salary dependent upon qualifications and experience. File No. 4402-V.

SALES ENGINEER required by manufacturer of construction equipment. Applicant should be graduate engineer and preferably single. Territory Montreal and area. File No. 4404-V.

CITY IN WESTERN Canada requires an assistant planner. Duties under the planning director and in collaboration with specialist colleagues, to conduct a variety of planning studies and surveys in developing a general plan for the area and to present findings in concise reports appropriately supplemented with maps and statistical data, to perform related design including subdivision and administration as assigned. Graduate in architecture or civil engineering. File No. 4409-V.

SALES ENGINEER (Graduate) required by Montreal district office of nationally-known company. Preferably with general experience in power engineering with utility. Some knowledge of underground cable practice desirable. File No. 4414-V.

SALES ENGINEER bilingual required by leading tank and truck tank manufacturer. Sales office in Montreal and Toronto. Should have at least two years experience on the road. Salary commission, expenses and good bonus. File No. 4420-V.

ENGINEERS REQUIRED for military projects and commercial products, in the communications and radar field, to organize and co-ordinate all engineering aspects. Work will include the technical supervision of manufacturing and testing of such electronic equipment. Previous manufacturing experience required. Technical wartime experience a definite asset. Salary to be commensurate with experience. Willing to consider Canadian citizens only or those capable of being cleared for work on defence contracts. File No. 4421-V.

ENGINEERS REQUIRED for the electronic design of specific circuits used in communications and radar equipment both for commercial and military applications. Experience required: one to 5 years. Technical wartime experience a definite asset. Salary to be commensurate with experience. Willing to consider Canadian citizens only or those capable of being cleared for work on defence contracts. File No. 4421-V.

ASSISTANT TO COMMISSIONER of works and buildings required by Western School District. General duties will include assessment of buildings to determine repairs, supervision of the repair programme, and responsibility for caretaking and maintenance of schools, all under the direction of the commissioner of works and buildings. Applicants should have preferably training and experience in the maintenance of buildings, knowledge of mechanical and structural engineering and successful experience in dealing with personnel. Salary range $5,250.-$6,250. Letters of application should give full details of education, training, age and include references. File No. 4428-V.

CHIEF ENGINEER with proven record of extensive experience in structural design required by well established organization located in large community about 100 miles from Montreal. Responsibilities will include supervision of drafting department. Good salary offered to right man. File No. 4430-V.

MAINTENANCE ENGINEER required to work more or less on his own in connection with general plant maintenance. The duties would consist of setting up a regular and routine programme for the periodic overhauling and mainenance of motors, switches and other electrical equipment. Location Southern Ontario. File No. 4434-V.

COMPETENT ENGINEERING DRAFTSMEN are required for a newly formed plant engineering group in a large pulp and paper mill in Newfoundland. Excellent opportunity for acquiring all-round engineering experience with good salary under good conditions. Single men preferred. Please submit detail of training and experience, with recent photograph preparatory to an interview during the last week in January, 1953. Employment to start February 1, 1953 or as soon thereafter as possible. File 4435-V.

Situations Wanted

GRADUATE MECHANICAL ENGINEER, age 40, 15 years in industry, hydraulics, internal combustion, maintenance, production control, management, now employed looking for opportunities in foreign assignment. File No. 140-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1947 graduate with additional university training in psychology, guidance and counselling; also short factory courses in foremanship, methods and human relations. Age 26, married. Over two years in chemical industry on process development and plant engineering. One summer as temporary assistant engineer on oil refinery expansion. Presently employed as a technical instructor. Available in July. Location preference Western Canada or Ontario. File No. 1014-W.

CIVIL ENGINEER, P.E.Q., Queen's, 1936, desires spare time design work. Montreal district. File No. 1532-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., B.A., B.Sc., age 37, married, two children, veteran, R.C.E., bilingual, experience in concrete and steel design, supervision of construction. Sales ability. Looking for an opening on fee plus percentage basis in the sale of structural steel, reinforcing steel, structural steel products or products related to cement. Location central or eastern preferred File No. 2140-W.

PROFESSIONAL ENGINEER and land surveyor, M.E.I.C., available. Experience includes steel plant layout and construction, power houses, large office buildings, mine surveying, land surveying with considerable office experience in draughting and estimating. File No. 2153-W.

ENGINEERING REPRESENTATIVE for Canadian territory available. Interested in sales, installation and maintenance in the fields of instrumentation and electronic control equipment. Graduate in electrical engineering from large Canadian university, diversified experience, multilingual. Considerable travel experience. Member of Engineering Institute of Canada, Institute of Radio Engineer, age 39, married. Willing to undergo short company training programme. File No. 2635-W.

MECHANICAL ENGINEER, M.E.I.C., since graduation from Queen's University in 1936 have had the following experience: 10 years diversified engineering in plants of primary metal producers, embracing instrumentation, design, production, maintenance, and administration; 3 years work in applied and fundamental engineering research; currently employed in petroleum industry on design of refinery utilities, but am interested in capitalizing on previous experience in work at administrative level. File No. 2966-W.

ELECTRICAL ENGINER, B.Sc.E.E., P.Eng. (Ont.), 5 years experience in electrical manufacturing, internal control and technical sales. Presently completing M.Comm. course in business administration at nights. Desirous of increasing scope of responsibility towards administrative side. File No. 2975-W.

CIVIL ENGINEER, Jr.E.I.C., married, presently employed, with 5 years experience in all types of structural design, field work and sales, desires first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to future partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

SALES ENGINEER

We require two aggressive civil or mechanical engineers to sell road machinery in Northern and Eastern Ontario.

Preferably married, age 30-35 years. Apply by letter with full particulars as to education, military service, sales experience, etc.

J. D. ADAMS LIMITED,
PARIS - ONTARIO.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., (McGill, 1949), B.Sc. 1947, age 25, married. 3 years experience as a structural designer, mostly on bridges. Experienced in re-inforced concrete, steel, and timber design. Desires position with future anywhere in Canada where design experience will be an asset. Presently employed in the Maritimes. Available on approximately one month's notice. File No. 3097-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., age 38. Presently in charge of the electrical engineering section of a chemical plant, has extensive practical experience in the design, layout and construction of explosion proof electrical equipment used in the petroleum industry desires position with more responsibility. Available on month's notice. Western Canada preferred, but would consider going abroad; multilingual with extensive travel experience. File No. 3155-W.

MECHANICAL ENGINEER, McGill 1949, desires position as plant engineer or assistant plant engineer in any field of manufacturing. Experience consists of two years with pulp and paper industry on design, installation and maintenance, and one and one-half years as project engineer on oil refinery construction. Age 26, married. File No. 3219-W.

CIVIL ENGINEER, M.E.I.C., available for part time work in Montreal (evenings and weekends), 12 years experience in design and detailing of reinforced concrete and steel structures (industrial buildings, hospitals, schools, apartment houses). File No. 3315-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 29, married, without children, desires position with advancement possibilities in Montreal area. Would also consider offer leading to future partnership. One year with large paper company on design and construction of electrical installations. Also some experience on instrumentation and control. At present with leading electrical manufacturer as junior project engineer. Available on reasonable notice. File No. 3310-W.

CIVIL ENGINEER, Jr.E.I.C., age 28, married, 1 child, with 5 years varied structural experience with architects, contractors, and concrete and steel fabricators, in design, estimating, detail, field supervision and liaison desires position with responsibility leading to future partnership in progressive concern. Or would consider sales development and/or administrative position with a firm that can offer the right incentive and advancement to an ambitious engineer. File No. 3340-W.

WORKS MANAGER, 19 years diversified experience in heavy industry including maintenance, inspection, design, production, administration and over five years as works manager of large mechanical plant. Graduate mechanical engineer, presently employed but interested in more responsible position offering scope to introduce improvements including cost reduction and the promotion of sound employer-employee relations. Location preferably Quebec Province but would go elsewhere in Canada dependent on nature of position offered. File No. 3355-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc., 1949, twenty-four years old, married, two years service with the Canadian Hydrographic Service and 1½ years construction work in Labrador. Position in construction work preferred, but will consider others. File No. 3429-W.

ELECTRICAL ENGINEER, S.E.I.C., University of Manitoba, 1951, age 32, and a veteran of World War II. Experience as hydro plant operator and plant engineer, also some experience in electrical draughting, design and installations. Desire job pertaining to the field of electrical design and draughting. Would also consider good maintenance position. Western Canada location preferred. File No. 3562-W.

CIVIL ENGINEER, M.E.I.C., B.Eng., 1942 graduate, age 34, small family. Eight years' experience in plant engineering in pulp and paper industry, experience covers maintenance, construction, plant design. Desires position in Ontario or Wester Canada, preferably in pulp and paper industry. File No. 3817-W.

GRADUATED MECHANICAL ENGINEER (1948, Germany), M.E.I.C., desires part time employment in Montreal for evenings and week-ends. Detail design, draughting, tracing. Experiences: Maintenance of diesel engines, detail design and draughting in centrifugal pumps. Tracing of piping layouts and power plant installations. File No. 3900-W.

MECHANICAL ENGINEER, M.E.I.C., age 33, married, graduated 1948 (Germany). Experience: expert labour certificate in engine building, 7 years maintenance and supervision of ship diesel engines (30-900 h.p.), 2 years plant layout, time and motion study, production planning, 1 year detail design and draughting on centrifugal pumps. Presently, since March, 1951, employed by Centrifugal pump manufacturing firm, desires more progressive position in Montreal. File No. 3900-W.

GRADUATED MECHANICAL AND ELECTRICAL ENGINEER, Jr.E.I.C. Austrian immigrant, fluent in English and French, seeks maintenance or plant engineering position in textile, paper or chemical industry. 3 years experience as project engineer and field work supervisor in planning, maintaining and erecting of heating and air conditioning plants, piping and thermo electric power stations. File No. 3945-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 honours graduate, age 25, married. One year's experience in administrative and supervisory work and 19 months machinery design experience. Interested particularly in design and development work, plant engineering and production work. Location irrelevant. File No. 3975-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling. File No. 3981-W.

CHEMICAL ENGINEER, M.E.I.C., M.A.I. Ch.E., P.Eng. (Ont.), (Chem. and Met.) BA.Sc., (Toronto), M.Sc. (Queen's), wishes responsible position in development work in chemical or allied fields. Four years directing staff of 25-30 in commercial research in inorganic and metallurgical technology (unit operations, ion exchange, solvent extraction, analytical), four years in less responsible positions. Experienced in economic studies and estimating, plant design, statistical techniques and pilot plant operations. Age 31, married. File No. 3994-W.

ELECTRICAL ENGINEER, 27 years of age, veteran, graduate of Manitoba, 1950, completed Canadian Westinghouse Test Course. Desires job of technical aspect in Western Ontario or Western Canada. File No. 4021-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.A.Sc., University of Toronto 1950, age 25. Desires position with metal stamping concern in planning and development field. Experience includes practical stamping knowledge as well as extensive training in basic steel industry. File No. 4049-W.

CIVIL ENGINEER, M.Eng. (Liverpool, 1938), age 35, married, at present airport engineer, Kallang, Singapore, seeks position with consultant or contractor, preferably in British Columbia. Arriving in Vancouver Feb., 1953. Experience in adminsitration, planning, design and construction of reinforced concrete structures, roads, runways, building schemes, marine works. File No 4050-W.

REGISTERED PROFESSIONAL ENGINEER, "Civil", M.E.I.C., 2nd class stationary engineer, 10 years mechanical and electrical experience, 20 years on construction, 11 years chief engineer for the largest merchantile firm in Canada. Full or part time employment. Vicinity of Toronto. File No. 4054-W.

ENGINEERING PHYSICIST, Jr.E.I.C., P.Eng., project engineer with 4 years experience, product and equipment design and development; production supervision and quality control. Desires position directing improvement of efficiency, methods, and productivity of established processes; developing new processes through design into controlled production. Able to carry full responsibility. File No. 4056-W.

GRADUATE CIVIL ENGINEER, Honours, aged 29, with both design and field experience, requires position in Montreal. Excellent designer-draughtsman with the bulk of experience in reinforced concrete. Experience in writing specifications. Has also done a little mechanical draughting. Available beginning of December. File No. 4057-W.

MECHANICAL AND INDUSTRIAL ENGINEER, B.E. (Mech. & Elect.), Jr. E.I.C., P.Eng., with four and a half years experience in electrical manufacturing, including production control, machine loading, time and motion study, standards, incentive systems, plant maintenance problems, etc., desires to change present position to one of greater responsibility where initiative can lead to further advancement. Age 30, married, veteran, willing to locate anywhere if position suitable. Available on reasonable notice. File No. 4058-W.

MECHANICAL AND CHEMICAL ENGINEER. British subject presently working in the U.S.A., seeks progressive position in Canada. Age 30, married, B.Sc. (Eng.), 1st class honours (London, 1945), M.E. (Yale, 1950), G.I. Mech.E. Apprenticeship, followed by five years' industrial research and plant engineering with major British chemical company. Presently completing a three year project of research at the Massachusetts Institute of Technology. Widely interested in the engineering aspects of the process industries, with specialized experience of heat transfer, fluid flow and thermodynamics. File No. 4059-W.

ELECTRONICS ENGINEER, Jr.E.I.C., P. Eng., age 42, married, 15 years experience in systems engineering, communications engineering and radio navigational aids including radar with Canadian Government, desires industrial employment. Fully familiar with administration and execution of Government contracts and prototype acceptance procedure. Very considerable experience in preparation of specifications for defence contracts. Interested in design and production. File No. 4060-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B. Eng., McGill 48, desires responsible position with construction firm operating in Canada. Age 29, veteran, married, four years experience with large company, in charge of various construction projects; diverse experience in the construction of buildings, roadways, sidings, etc. Proven administrative abilities. Previous experience includes extensive field survey work, also some estimating. Available on reasonable notice to present employer. File No. 4064-W.

ELECTRICAL ENGINEER, B.Eng., Power Course, McGill 41, M.E.I.C., P.Eng., Que.

Engineer-Planner

CITY OF VANCOUVER (COMP. 0-139). To perform traffic studies and to design highway parking systems. Qualifications: Degree in Civil engineering with considerable experience. Preferably experience in highway and traffic problems or the equivalent. Salary: $357. to $428. per month. Application forms may be obtained from and returned to the Personnel Director, Room 210, City Hall, 453 W. 12th Ave., Vancouver 10, B.C.

Age 33, bilingual, married. Eleven years experience maintenance, operation, construction and administration hydro-electric generation, transmission and H.V. distribution. Desires position at management level with utility or manufacturer offering opportunity for advancement. Eastern Canada location preferred but not governing. File No. 4066-W.

STRUCTURAL DESIGNER, A.M.I., Struct. E. (G.B.), 15 years varied experience in England and Canada in: design of reinforced concrete work in steam and hydro-electric power plants, industrial containers, bridges, framed buildings, steel mills and water purification plants; design of structural steel in factory and office buildings and steel mills and many forms of temporary work in steel and timber; supervising and directing construction, estimating quantities of materials; surveying and taking charge of staff of designers and draftsmen and general contractors office administration duties. Age 36 years, English, married, family, seeks responsible position with opportunity for advancement. Locality preference flexible. File No. 4067-W.

MECHANICAL ENGINEER, S.E.I.C., U.B.C., 1952, age 22, single, desires position with a firm in Eastern Canada. Interested in design or production of railway and highway equipment and air conditioning design. File No. 4068-W.

CONSTRUCTION SUPERINTENDENT of an electrothermic zinc plant and chief of maintenance of the same plant; with over 15 years of mechanical engineering and field construction experience in the army and in civilian capacity. Veteran of World War II, British army. British subject. Seeks opportunity along allied lines in Canada. File No. 4069-W.

CIVIL ENGINEER, B.Eng., Nova Scotia Technical College, 1952, S.E.I.C., age 27, married. Seeking employment in Eastern Canada (preferably Maritimes). Some construction experience. File No. 4070-W.

EXECUTIVE AVAILABLE, P.Eng., M.E.I.C., B.A.Sc., age 38, family. Offers direct administration experience at a high level of responsibility in a large chain-retail merchandising operation, combined with teaching experience, university administration, and background of electrical engineering followed up by technical experience in the electronic-instrument field. Present location southern Ontario but willing to move. Interested in management of a medium-sized industry with growth possibilities dependent on capable administration and promotion; or employee relations and personnel administration, production-sales liaison, or cost control in a large organization which also provides opportunity for advancement. File No. 4075-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., McGill 1950, desires part time work in Sherbrooke, P.Q., evenings and weekends, detailing concrete reinforcing including bar lists, quantity take-offs also structural steel detailing. File No. 4076-W.

CHEMICAL ENGINEER, 29, B.Sc. (Eng.), 2nd class honours, University of London, England (1952), desires a junior position. Has no industrial experience, willing to learn. Most interested in chemical engineering design work or plant production control. Location Ontario preferred. File No. 4077-W.

MECHANICAL ENGINEER, B.Sc. (M.E.), Jr.E.I.C., P.Eng., 28 years old, two years experience in oil piping, site drainage and plumbing design, also two years general machine shop experience seeks employment in Western Canada in any of the above fields which offer a good opportunity for advancement. Presently employed in Ontario but must move west for reasons of wife's health. File No. 4081-W.

CIVIL ENGINEER, B.Sc., B.A. (Mathematics), M.E.I.C., 36, married. Two years with army (R.C.E. officer). Three years experience in reinforced concrete and structural steel design of factories, schools, hospitals and bridges. Four years in charge of a general design office involving structural, mechanical, heating, ventilating and architectural design; sewer and water services; road construction; preparing estimates, writing specifications, drawing up of contracts and general supervision of construction inspection. File No. 4082-W.

GRADUATE ENGINEER, M.E.I.C., age 55, bilingual, married, residing in Quebec City, seeks additional accounts for technical representation on a reasonable fee basis, would sell strictly on commission or buy on his own. Ex-R.M.C. professor and Quebec Department of Mines Engineer. File No. 4083-W.

ELECTRICAL ENGINEER, U. of Man. 1949, Jr.E.I.C., age 26, married with no children desires position with Canadian railroad in mechanical or locomotive maintenance staff. At present employed by Canadian railroad as diesel supervisor. Previously employed by major locomotive manufacturer as service engineer. Thoroughly experienced in all phases of electrical and mechanical maintenance of General Motors, Montreal Locomotive and General Electric diesel electric locomotives. Desires position of responsibility where theory and practical experience will be an asset. Available on approximately one month's notice. File No. 4084-W.

QUALIFIED ENGINEER desires part-time detail or design work in Montreal, evenings and week-ends. Experienced in medium and heavy machine design also refinery and boiler house piping layouts. 10 years experience. Satisfaction guaranteed, hourly rates. File No. 4085-W.

CIVIL ENGINEER, S.E.I.C., Manitoba 1952, age 31, 2 children. 6 months in maintenance dept., 5 months as instrumentman, 4 years radar mechanic in R.C.A.F., 19 months training as machinist apprentice. Would like job in design office or with any concern where out of town travel is at a minimum. Any phase of engineering including manufacturing and service work where hard work and competence are rewarded. File No. 4086-W.

ELECTRICAL AND MECHANICAL ENGINEER, Jr.E.I.C., graduate, 4 years in electronics as project engineer on broadcastnig installations. Seeking position in industrial research and development. File No. 4087-W.

EXPERIENCED PLANT MANAGER available, M.E.I.C., P.Eng., desires a position where administrative ability to organize and manage a plant can be put to full use. A qualified electrical, electronic engineer used to design and manufacture of all types of precision equipment, electric motors to radio remote and gyro controlled equipment for ships and aircraft. Experience in building new plant recently, starting up production, labour relations and all phases of plant management and control. Prefer Montreal location, second, Toronto. Married, age 41, perfect health, highest references will prove business ability. File No. 4088-W.

CIVIL ENGINEER, S.E.I.C., (McGill, 1952), seeks employment in design of reinforced concrete and steel structures for consultant firm. Location, Montreal preferred but not governing. Sound knowledge of field practices and methods. Presently employed. Available on reasonable notice to present employer. File No. 4089-W.

ENGLISH ENGINEER, 33, member of Inst. Mech. Eng., engineering diploma, 14 years experience chemical, civil and mechanical engineering. Emigrating early 1953, seeks appointment as industrial or mechanical engineer, preferably B.C., Ontario or Quebec. Fluent knowledge technical and commercial French and Italian. File No. 4091-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., P.Eng., Grad. I.C.E., Queen's, Northern Ireland 1948, married, aged 28. Experienced in general contracting in Northern Ireland, tunneling and water works engineering in the Far East, and heavy building construction in Canada. Desires work, preferably in connection with hydraulic engineering, anywhere outside Canada. File No. 4097-W.

CHEMICAL ENGINEER, B.Sc., Laval 1953, age 24, married, available at the end of April, 1953. File No. 4098-W.

1951 U.B.C. GRADUATE electrical engineer, S.E.I.C., requires employment in Western Canada preferably. Two years manufacturing experience in carrier telephone, 2 years maintenance and installation of radio communication equipment. 6 months telephone installation, 6 months commercial wiring. Age 30, married. File No. 4100-W.

Attention, Members

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned

TELEPHONE PLATEAU 5078

Except in special cases all interviews will be arranged between the hours of 9 and 12.

News of the Branches

Activities of the Forty-one Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. Lusk, Jr.E.I.C.,
Secretary-Treasurer

Dr. Stirling's Visit on October 14

The first meeting of the Belleville Branch for the new season was the occasion of the presidential visit of Dr. J. B. Stirling.

The meeting was held at the Queensway Hotel in Trenton where the president addressed the Branch on the subject "Recognition of the Engineering Profession". Dr. Stirling pointed out that the number of engineers in the country had increased greatly but that recognition of the profession had lagged. He urged that the engineers themselves stimulate a greater consciousness of their profession.

Dr. Stirling pointed out that through the Engineering Institute of Canada, Canadian engineers were recognized on the international and national level. The Institute is a member of the Engineering Council for Professional Development, of which various American societies are members. This year Lt. Col. L. F. Grant, an eminent Canadian engineer, is chairman of this organization. Canadian engineers are also represented by the Institute on Commonwealth and Pan-American organizations.

On the national level, the citizens of the country recognize the ability of our military engineers through their war exploits. Several engineers have obtained prominent positions with the federal government. The speaker deplored, however, the lack of recognition of the civil engineers who are constantly waging a battle for more power, steel, aluminum, etc.

On the civic level, there is very little recognition of the profession. Dr. Stirling urged that the engineers participate in civic affairs, service clubs, and other civic organizations. The speaker felt that the start on the road to public recognition was to render unpaid public service in the engineer's own community.

In closing, Dr. Stirling stated that public relations or legislation will not raise the status of the profession but that the engineer himself through public service can bring about a true recognition of the profession.

Dr. Stirling was introduced by Mr. S. S. Sillitoe and thanked by Mr. J. C. R. Punchard. Mr. G. A. Bradford was chairman. Other head table guests included Col. and Mrs. H. G. Thompson from Montreal and Mr. R. L. Dobbin and Mr. A. L. Killaly from Peterborough.

C.I.L. Tour in Kingston

The meeting of the Belleville Branch held on November 10, took the form of a tour through the Nylon Division of Canadian Industries Limited at Kingston.

Prior to this tour, members of the Branch journeyed to Kingston and enjoyed dinner together in that city.

Arrangements for the tour were made by Mr. G. T. Andrews, M.E.I.C., associated with the Kingston Branch of the Institute. The visit to this plant was most enlightening to all members of the Branch whose interest in nylon was certainly quickened by the capable explanation of the various processes provided by officials of the Nylon Division

Central British Columbia

H. L. Topham, Jr.E.I.C.,
Secretary-Treasurer

Executive Meeting, November 24

The meeting of the executive was held on the afternoon of November 24 in the Water Rights Office in Kamloops, and was honoured with the presence of Dr. J. B. Stirling, president of the Engineering Institute, and Mr. E. B. Jubien, a past-councillor of the Montreal Branch.

The Central British Columbia Branch officers included H. Hatfield, chairman; H. Topham, secretary-treasurer; R. Bigg and M. Zirul, committeemen; F. McCallum, chairman of the student guidance committee, and M. Wade, Branch councillor.

After the reading and adoption of minutes of the meeting of September 19, there was discussion of the matter of admitting Branch affiliates. It was decided to continue the present policy, and that affiliate fees for 1953 be raised to correspond with the increase of the Journal subscription rate.

Mr. McCallum, chairman of the student guidance committee, presented a summary of the work of this group for the past year, which was undertaken in each of the larger centres within the Branch boundaries.

The secretary-treasurer presented a letter received from Mr. G. Page, secretary-Treasurer of the Canadian Committee on Counselling in Engineering and Science. The contents of this letter were thoroughly discussed and Mr. McCallum was appointed temporary joint counsellor for this group, until the Branch executive could arrange a joint meeting with the local branch of the B.C. Professional Engineering Society.

The secretary-treasurer was instructed to forward a copy of the Annual Report to Mr. Page for the information of this committee, giving an outline of the student guidance work undertaken by the Branch during the past year.

The chairman then invited Dr. Stirling to discuss any points which he would care to present to the Branch. Dr. Stirling outlined the changes in the by-laws which are proposed, and emphasized that they should be studied by the executive and brought to the attention of all members of the Branch, at the next general meeting.

Cornwall

L. H. Snelgrove, Jr.E.I.C.,
Secretary-Treasurer

R. L. Blackett, M.E.I.C.,
Branch News Editor

Presidential Visit November 3

On Monday, November 3, the annual dinner dance of the Cornwall Branch was held at the Cornwall Golf and Country Club in honour of the visit of Dr. J. B. Stirling. Photographs taken on this occasion were included in the December issue of the Journal.

Branch chairman B. T. Yates presided at the meeting. Dr. Stirling, introduced by Drummond Giles, spoke briefly to the assembled engineers and guests. He described some of the highlights of various engineering conventions he has attended since taking office. He also commented on the great hospitality shown him by the various branches across Canada.

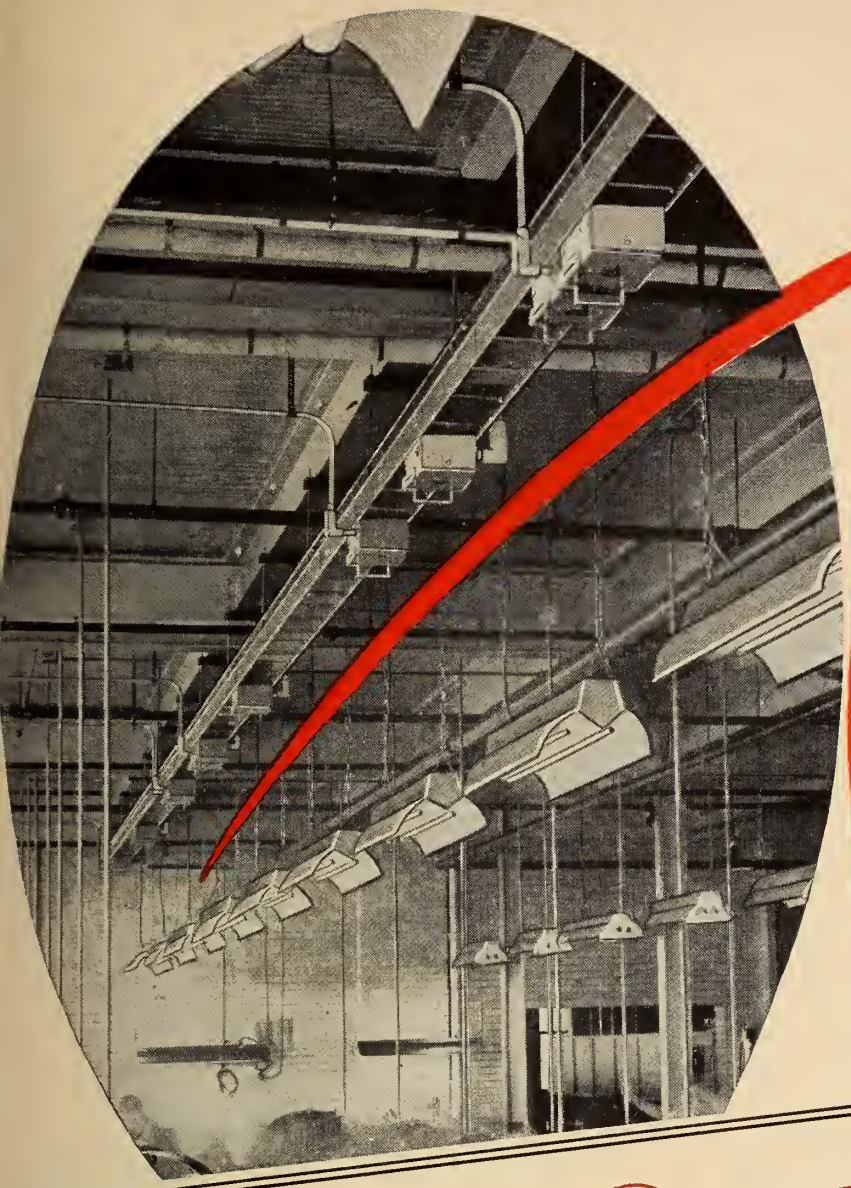
He stressed the importance to the engineering profession of engineers taking part in unpaid public service. This is a benefit both to the public and the engineer. Many localities have had the advantage of such professional public service. He advised the student engineers to forget social security and to concentrate on their work, with confidence that advancement and security would follow automatically.

Donald Ross-Ross thanked Dr. Stirling.

Guests and members at the head table included Mr. and Mrs. Drummond Giles, Mr. and Mrs. Jack Morris, Mr. and Mrs. L. Snelgrove, Mr. and Mrs. B. T. Yates, Mr. D. Ross-Ross, Mr. A. Terry and Mrs. J. B. Stirling.

Following the dinner an enjoyable dance was held. The club was decorated for the occasion with crests, and with displays of various mechanical devices. The ladies were the recipients of numerous favours; the door prize was won by Mrs. J. Summerskill, and the spot dance prizes were won by Mrs. R. L. Blackett and Mrs. Frank Markham.

During the afternoon Mrs. Stirling was entertained, with the wives of the



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EJ

Branch executive, at a luncheon given by Mrs. B. T. Yates.

Hamilton

J. A. Reid, jr.e.i.c.,
Secretary-Treasurer

F. S. Gue, jr.e.i.c.,
Branch News Editor

I. T. Thwaites and Dean D. S. Ellis Address Meetings

The November meeting highlight was a talk by Mr. J. T. Thwaites, manager of electronic research and development for the Canadian Westinghouse Company. Mr. Thwaites is well known as an entertaining and technically excellent speaker, and did not disappoint the Branch in his development of the theme, "This Electronic Age". The members were given fascinating glimpses of electronic developments not likely to come forcibly to the attention of an engineer not occupying Mr. Thwaites' vantage point in this specialized field.

On December 11, Dean D. S. Ellis, of Queen's University, addressed the Branch on "Hydraulic Problems of Lake Levels". This has been a pressing problem during 1952, when high water in the Great Lakes has caused millions of dollars of property damage. The subject was thoroughly and authoritatively discussed. Dean Ellis pointed out that many persons building on marginal lands during low-water years, through either optimism or ignorance of the lakes' habits, or both, cannot make stick claims for damages against any government or human agent.

Executive Meeting

In an executive meeting held December 5, Branch Chairman E. T. W. Bailey, brought to the attention of the executive the possibility of an Engineers' Club or Professional Men's Club in Hamilton, patterned along the lines of several existing clubs in other cities. The report was for information only, and no action was taken at this time, although keen interest was expressed by those present.

Edmonton

John L. Pulford, jr.e.i.c.,
Secretary-Treasurer

Presidential Visit

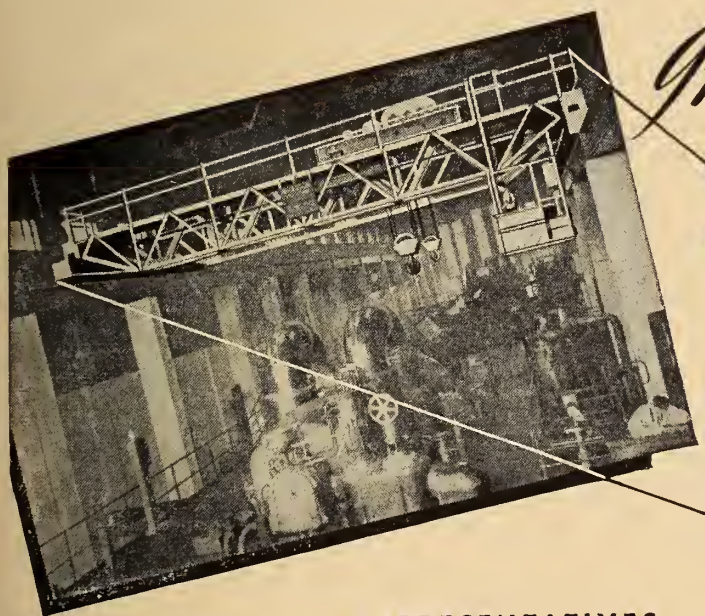
The Edmonton Branch was recently honoured by a three-day visit of the president of the Institute, Dr. J. B. Stirling and Mrs. Stirling. The president was accompanied by Dr. L. Austin Wright, general secretary, and Mr. and Mrs. E. B. Jubien of Montreal. Mr. Jubien is a past-councillor of the Montreal Branch.

One of the highlights of the visit was an air trip arranged by the Branch executive and provided through the courtesy of Air Commodore Kerr, officer commanding the Tactical Air Group at Edmonton. During the course of the trip, Dr. Stirling and Dr. Wright were given a view of the tremendous development taking place in the Edmonton area. The flight plan covered the Leduc oil field, Town of Leduc, the industrial development on the eastern outskirts of the city, the Sherritt-Gordon plant at Fort Saskatchewan, the Redwater oil field and numerous army and airforce developments on the northern outskirts of Edmonton. Excellent weather conditions obtained during the flight and the president expressed appreciation at being able to view at first-hand the major oil, gas, and industrial developments taking place.

The presidential party spent several hours on the University of Alberta campus, touring the educational facilities, having dinner with the executive of the Engineering Students' Society and attending an evening meeting with the members of the Society. Both Dr. Stirling and Dr. Wright addressed the students on this occasion.

A luncheon meeting with the Branch Executive was held at the Edmonton Club and was followed by a discussion of Institute affairs and policies. Another luncheon was given in the President's honour by the Association of Professional Engineers.

The meeting of the Branch itself with the president and the general secretary took the form of a banquet and dance. This was a gala affair attended by more than 200 members and their wives. At the banquet Dr. Stirling gave a very fine talk on aspects of the engineering profession. He particularly stressed the part engineers were playing in commun-



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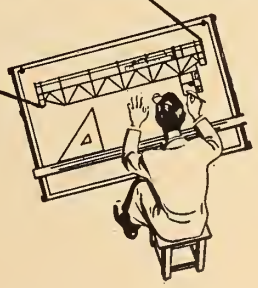

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ity and welfare organizations and expressed the hope that the participation of engineers in these organizations will continue to increase. During the evening Professor John A. Allan was presented with an honorary membership in the Institute for the major part that he has played in the profession during the past forty years. The entire evening, concluding with the dance, was considered a great success by those present.

The president's visit concluded with a council meeting in the morning and afternoon of Saturday, December 6.

The Edmonton Branch considered it a great honour to sponsor the Council meeting and the three-day visit of the presidential party and it can be truthfully said that the president and general secretary left a very favourable impression on all those whom they met during their visit to the "Oil Capital of Canada".

Lethbridge

R. D. Hall, jr.e.i.c.,
Secretary-Treasurer

Wm. J. Roy, s.e.i.c.,
Branch News Editor

President's Visit and Ladies Night

On November 20 the Lethbridge Branch held a dinner meeting at the Marquis Hotel in honour of the president, Dr. J. B. Stirling, with ninety-eight members and guests attending.

After refreshments and an enjoyable dinner, Chairman J. C. Neufeld introduced His Worship Mayor A. W. Shackleford who welcomed Dr. Stirling to the City and praised the work of engineers in Western Canada.

Mr. E. B. Jubien conveyed greetings to the Lethbridge Branch from the Montreal Branch of which he is a past-councillor.

Dr. Stirling was introduced by Mr. T. D. Stanley of the Calgary Power Compnay. In his interesting speech Dr. Stirling talked about the numerous meetings he had attended across Canada and in the United States since he became president. He stressed the need for continued public service as a means of raising the prestige of professional engineers. He suggested in his message to young graduates that they should not concern themselves too greatly with future security, but rather be content to work hard with the assurance of deserved advancement.

Mr. C. S. Clendening moved a warm vote of thanks to the speaker.

One of the highlights of the evening was the presentation by Dr. Stirling of an honorary life membership in the Institute to former City Manager J. T Watson, in appreciation of his long career of public service. Mr. Watson expressed his thanks and commented on the engineering progress in this district in the last fifty years.

Dinner music supplied by Mr. and Mrs. George Brown, community singing led by Mr. R. S. Lawrence, and a vocal selection and recitation by Mrs. Byron Palmer comprised the entertainment portion of the evening.

Moncton

V. C. Blackett, m.e.i.c.,
Secretary-Treasurer

R. A. Park, m.e.i.c.,
Branch News Editor

Tour of Canada Cement Plant No. 2, November 20

A group of fifty professional engineers, student engineers and a few laymen watched the manufacture of cement at Canada Cement Company's new $8,000,000 completely automatic plant at Havelock, N.B., on November 20. For the majority it was a thrilling first visit to a cement plant.

The group, composed chiefly of members of the Moncton Branch of the Institute, including about 35 students of the Mount Allison University Engineering Society, were guests of the Maritime Cement Company, Limited, through the kindness of Mr. A. W. Purdy, district sales manager. The conducted tour took the visitors through the large plant where they were shown the various stages of the manufacture of cement from the raw materials to the loading of the bagged product into box cars for shipment.

Limestone is quarried near the plant and brought to the primary crusher building by large trucks. Rock must be crushed to facilitate handling; this operation is accomplished by a jaw crusher and an impactor or hammer mill. Crushed rock is then carried on belts and

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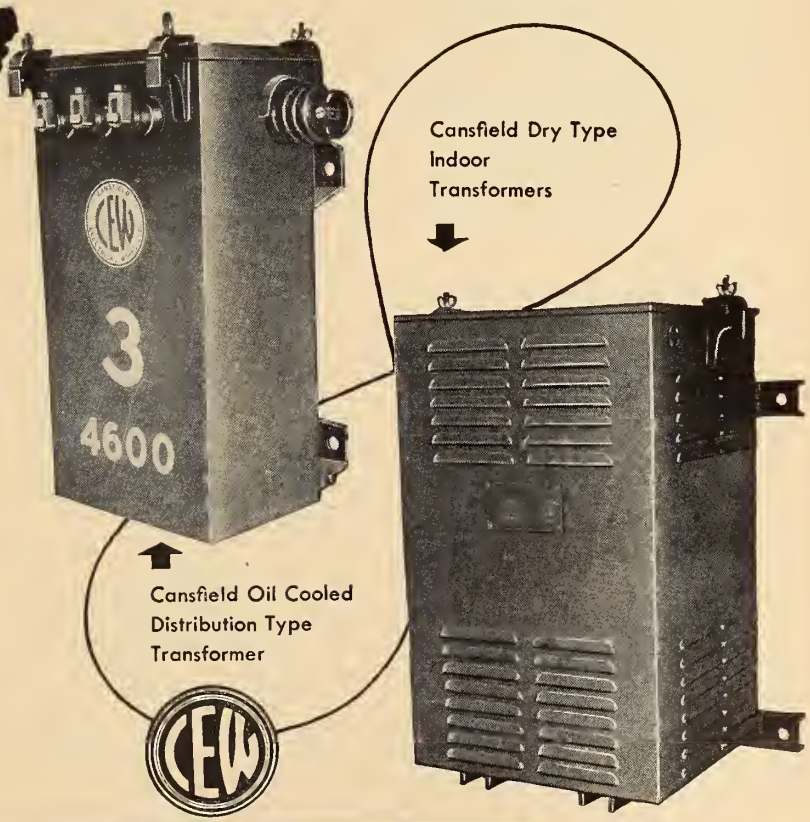

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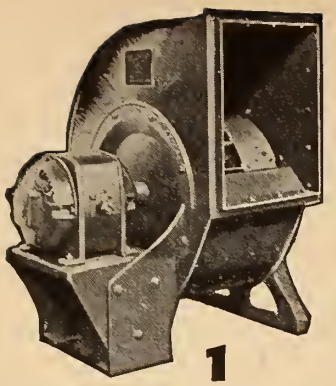
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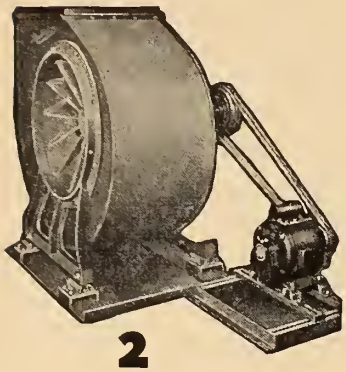
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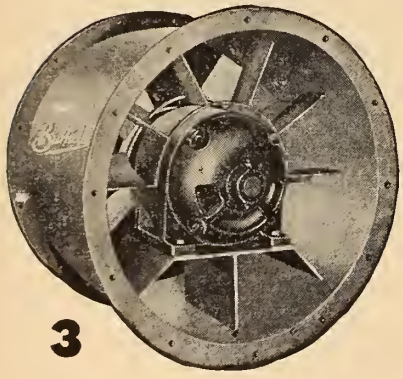
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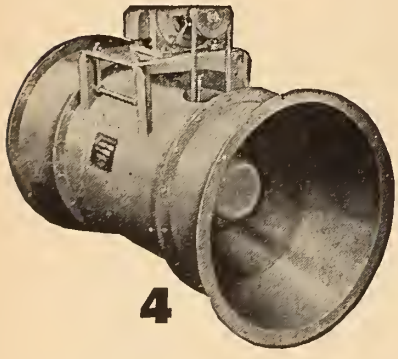
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stored ready for use in a large rock storage building which also shelters a shale stockpile. Shale here has been quarried at a location several miles distant and after having been trucked to the plant, it is crushed in the same manner as lime-rock. When limestone and shale are required, they are drawn from storage and conveyed by belt through weighing-feeders and then united in large tube mills where the mix is ground to a fineness of 90 per cent passing a 200 mesh-per-inch screen.

This process is designated as "dry" in contrast to the "wet" process in which raw materials are pulverized into a water dispersion called slurry. Havelock's mill is the only plant in Canada using the "dry" process.

By means of continuous laboratory supervision and control, a kiln feed raw mix of desired composition is obtained It is held in large silos ready for transfer to the kiln. By aeration of this raw mix it can be handled as a liquid; fluidization of dry raw materials permits of very intimate blending.

The chemical reactions involved in making cement take place at high temperatures in continuously operating kilns. The Havelock kiln is an all-welded steel plate cylinder, 380 feet long and 10 feet in diameter, lined with refractory brick, placed on a slope of one-half inch to each foot of length, and revolving at the rate of about one complete turn every minute. This kiln is heated by pulverized coal, as are most in Canada; some kilns, however, are fired by oil or by gas.

The raw mix is conveyed to feeders located above the kiln. These feeders deliver a constant amount of material which is immediately introduced into the feed end of the kiln. As a result of the slope and rotation of the kiln, the raw material advances into the kiln countercurrent to the hot gases coming from the flaming coal blast. At first, moisture only is driven off, but then further down the kiln where the temperature is about 1600° F., carbon dioxide is expelled. The section where this occurs is called the calcining zone. As the mass of material proceeds further, the heat increases until in the burning zone at a temperature of approximately 2500° F. the raw mix components react with each other to form new compounds. The resulting white hot material tends to fuse; because of its graular appearance after cooling, it is called clinker.

The clinker is discharged through grates into coolers and thence, after the addition of gypsum in the correct proportions, to either clinker storage or the finishing mill where it is ground and pulverized (80 per cent to 90 per cent through a 325 mesh-per-inch sieve). This greyish-white powder is Portland cement.

At the close of the tour, the visitors were welcomed by Superintendent H. W. Hamilton, of the Canada Cement Company, Limited, and entertained at a buffet supper.

R. T. Sansom, vice-chairman of the Moncton Branch, expressed the thanks of the engineers to the host for the privilege of making a tour of the plant and for the excellent reception, and Alfred Flemming expressed his thanks on behalf of the Mount Allison Engineering Society. Mr. Purdy replied on behalf of the Maritime Cement Company Limited.

Saint John

J. A. B. Brenan, M.E.I.C.,
Secretary-Treasurer

Harry McCleave, M.E.I.C.,
Branch News Editor

Col. L. F. Grant Is Speaker

The regular meeting of the Saint John Branch was held on November 25 at the Admiral Beatty Hotel. Speaker for the evening was Col. L. F. Grant, field secretary of the Engineering Institute.

Col. Grant opened his talk with an outline of some of his duties. Visiting areas in which there is no branch of the E.I.C. with the purpose of organizing one, and the many services provided by the E.I.C. Toronto Office keep his time well occupied. In connection with the employment service, he pointed out that many opportunities exist for young engineers with specialized training but that employers were hesitant about hiring older men.

Training Courses For Junior Engineers

The matter of post graduate training for engineers is one of the many problems now being studied by the Engineers Council for Professional Development, of which Col. Grant is president.

In Canada at the present time the engineer graduates and that is the end of his formal education. In the U.S. many companies give their engineers specialized training, and short courses are available on other subjects.

The feeling is, Col. Grant said, that the young engineers should have some training in the humanities, current affairs, accounting, public speaking and other such subjects which are not covered too well, if covered at all, in the college curriculum.

Col. Grant started a few years ago with a small class of Junior Engineers and by the second year classes were under way in 8 locations. It is hoped that this trend can be continued until courses are available at all branch locations.

In the United States, training courses for junior engineers are usually carried on only where there is a university that gives engineering courses. Students attend classes 3 times per week and are given assignments. These courses are designed to lead to a masters degree.

A question and answer period followed and Mr. F. P. Vaughan thanked Col. Grant for his excellent talk.

The Saint John Branch now has a committee studying the opportunities for courses in this city. A report on the progress of this committee is expected soon.

Visit To Cement Plant

On November 22 about 25 members of the Saint John Branch motored to Havelock for a trip through the Maritime Cement plant.

Members of the group were welcomed by Superintendent H. Hamilton, and were given a short talk on several outstanding features of the plant.

It was pointed out that this plant has had no lost time accidents since it has started operation, and if the party were cautioned against something it was for a very good reason. (The workers wanted their Christmas turkey.)

With this cheerful warning the tour started out through the plant beginning at the quarry, wending its way through a maze of buildings and ramps, and ending up at the bagging plant.

Much of the interest of the group centred on the kiln. This particular kiln is 385 ft. long, the longest of its kind in Canada and its 3000° warmth was appreciated in the cool weather.

After the luncheon, provided by the Maritime Cement Co., the thanks of the group was expressed by Mr. A. G. Watt.

Guides for the tour were Mr. R. Hughes, of the personnel department, Mr. A. W. Purdy, sales manager, Mr. J. Sevyln, chemist, and Mr. George Woodland, chief electrician.

Election Of Officers At Annual Meeting

The annual meeting at the Saint John Branch was held December 9 at the Admiral Beatty Hotel with John Reed as chairman.

Reports on the past year's business and the financial statement were read, and ballots counted to determine the slate of officers and members of the executive for the year 1953. As a result of the ballotting the following members were declared elected: A. G. Watt, chairman; A. R. Bonnell, vice-chairman; J. A. B. Brenan, secretary-treasurer; and C. G. Clark and T. C. Higginson, members of the executive.

Two members, J. A. Flood and F. L. Doty still have one year of a two-year term to serve as members of the executive.

Several amendments to the by-laws had been proposed and these suggested changes were sent out with the ballots. The changes were all approved by the majority of the members.

John Reed, the retiring chairman, presented the charter to Mr. Watt, the new chairman, and the meeting was adjourned.

Sudbury

G. W. Fleming, Jr.E.I.C.,
Secretary-Treasurer

H. M. Whittles, Jr.E.I.C.,
Branch News Editor

Dinner Meeting, December 4

The Sudbury Branch held a dinner meeting at the Sudbury Granite Club on Thursday, December 4.

The speaker, Mr. D. R. Robertson of the geological department of the International Nickel Company, was introduced to his audience by W. B. Ibbotson.

Mr. Robertson gave a most interesting and informative address on geology, under such topics as crystallography, oil geology, mineralogy, petrology, ore geology, paleontology, and stratigraphy. He described the various methods used by large companies in the search for ores, dealing with both ground and airborne equipment, and the part taken by prospectors and geologists in this work.

He also outlined the historical aspect of geology, such as the structure of the earth, geological age, and mountain building periods.

Mr. Robertson then described the relationship of minerals to specific types of rocks, and said that prospectors and geologists made a search for these rocks, rather than the minerals which they knew would be associated with them.

The geology of the Sudbury area was dealt with, and the vast number of rock types and ores found here were described.

Mr. Robertson's address was followed by an interesting series of pictures of Northern Canada, showing the wild life, and geology of the area. These slides were shown by Mr. H. F. Vuori, also of the International Nickel Company.

F. A. Orange expressed to the speaker the thanks of his audience for an address which was fully appreciated, and for which many members had been anxiously waiting.

Toronto

Harvey Kolesar, Jr.E.I.C.,
Secretary-Treasurer

Dugald Cameron, M.E.I.C.,
Branch News Editor

Ladies' Night, November 4

The Toronto Branch held the Annual Ladies' Night on the occasion of the president's visit at the Embassy Club in Toronto. Over 300 persons attended the meeting at the Embassy, and the president, J. B. Stirling, expressed his appreciation and that of Mrs. Stirling for an enthusastic reception, which he said was one of the best they had received.

The Branch chairman, W. H. Paterson, presided at the dinner and after introducing the head table guests, introduced the president.

Dr. Stirling gave the Branch a brief but complete outline of what he had done and where he had been since he took office. His remarks on the visits to various international meetings relative to the engineering profession met with a great deal of applause.

In the president's general remarks the group was given an inspiring talk on what may be termed the future of engineers in public service, and pointed out the accomplishments they had made in recent years in high public offices. He also noted the interest that has been and is now being taken by engineers in service clubs and in the various communities throughout the country.

Dr. Stirling concluded by addressing the students and sited a few examples relative to his experience over a good many years. He stressed the point that the student should have faith in the future and not be too anxious about what he would be doing six months later. As Dr. Stirling pointed out he had been many years with his firm, and though at times the next job was not in sight, it had come along.

Mr. John Hall, vice-president of the Branch, thanked the president and wished him and Mrs. Stirling good health and fortune on the long trip ahead.

After the dinner the evening was spent in dancing, and from all reports everyone had an excellent time.

J. S. Kendrick Addresses Meeting, November 20

Members of the Toronto Branch and their guests attended an instructive meeting on November 20 when Mr. J. S. Kendrick, assistant manager of Alcan's project at Kitimat, British Columbia, described some of the highlights of the development stages of the project.

Mr. Kendrick, in his easy style, gave his audience an appreciation of the vastness of the project and the difficult problems which had to be solved. The slides used to illustrate the talk showed interesting scenes of the area and pointed out the engineering aspects. Views were shown of the dam site before construction started, and at various stages of development. The reservoir will take 4½ years to fill; during which time no serious dislocation will be caused in the lower part of the watershed of the river.

Other slides showed tortuous roads leading up the mountain side, camp sites accessible only by helicopter, and numerous views of the main area, including the smelter site, which at the time the picture was taken was a bay with water to a depth of thirty feet.

Mr. Kendrick explained the methods used in diverting the river during construction of the dam, and discussed driving tunnels and building penstocks through the mountain. He showed several stages of construction of the underground power house which, when completed, will be the largest in the world. He indicated that cost was one major factor that influenced the decision to build the powerhouse underground, and that safety from aerial attack was not considered of great importance. Three of the sixteen planned units (4 jet impulse turbines to operate at a head of 2,600 feet) are being installed initially.

He finished his remarks by saying that the Kitimat development could not be considered independently of other aluminum developments and markets, and tied it in closely with Arvida by showing some slides of that area.

A lively question period followed the speech, during which Mr. Kendrick demonstrated his intimate knowledge of the immense project, and answered all questions to everyone's satisfaction.

Mr. Kendrick's talk was a valuable contribution to the Toronto branch activities and a worth while complement to the paper published in the September, 1952, issue of *The Engineering Journal*.

A debenture issue, successfully floated, does not solve your whole sewer problem. The important point is—how will your sewers "stand up"? Many municipalities have found pipe failure developing long before the debentures were paid off.

It's all a matter of chemistry. If sewer pipe cannot resist the strong corrosive action of acids and alkalis—in the sewage and in the soil—then you'll have a costly replacement job on your hands before long.

Sewage develops gases that have a powerful chemical action. VITRIFIED CLAY PIPE is acid and alkali proof, and provides sure and permanent resistance to such chemical action. It is "bonded by fire"! This assurance of permanency makes VITRIFIED CLAY PIPE the best and most economical buy.

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Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

Electrical Section

L. E. Marrin, Jr.E.I.C.,
News Editor

Eighth Annual Dinner Dance of the Electrical Section

The electrical section of Winnipeg Branch held its eighth annual dinner and dance, Friday, November 14, in the Blue Room of the Marlborough Hotel.

Members in attendance were especially happy to welcome to Winnipeg, Dr. and Mrs. J. B. Stirling of Montreal. This marked the first time a president of the Engineering Institute had attended an annual dinner dance of the Winnipeg Branch.

Other distinguished members and guests seated at the head table were: L. A. Bateman, past-chairman; R. H. Tivy, vice-chairman; E. M. Scott, chairman; Miss V. Bale; C. L. Fisher, chairman of the Winnipeg Branch and Mrs. Fisher; Dr. and Mrs. E. P. Featherstonhaugh; Dean A. E. Macdonald, dean of engineering and architecture of the University of Manitoba, and Mrs. Macdonald; Prof. V. Leathers, professor of French at United College, and Mrs. Leathers; E. B. Jubien, past councillor of the Montreal Branch, and Mrs. Jubien; J. W. Sanger, vice-president of the Institute, and Mrs. Sanger.

A highlight of the evening was a most entertaining address by Prof. V. Leathers in which he stressed the importance of hobbies for the relaxation of the busy professional.

The ballroom was decorated by a mural drawn by Peter Kuch depicting the activities of the electrical industry. Square dancing was a special intermission feature.

November Meeting

Mr. R. T. Harland, electrical engineer with the Winnipeg City Hydro Electric System, addressed a meeting of the electrical section of the Engineering Institute on November 6, at United College. Mr. E. M. Scott, branch chairman presided and the speaker was introduced by Mr. D. C. Bryden, M.E.I.C., chief engineer of the City Hydro.

The topic of Mr. Harland's address was "Carrier Current Control of Hot Water Heaters". This was a most appropriate subject as Manitoba, for many years blessed with an abundance of cheap hydro-electric power, is now faced with the very real problem of maintaining an adequate supply. Rapid industrial development together with increased utilization of electricity for domestic purposes and the implementation of an extensive program of farm electrification, have resulted in an phenomenal growth in the demand for power during the past ten years. Mr. Harland's paper, dealing with one of the devices which the City Hydro is using to meet this problem, was consequently received with the utmost enthusiasm.

Mr. Harland began his discussion by explaining that although it was foreseen that the installed capacity of the City Hydro's system would not be adequate to meet the anticipated increase in peak load requirements, it was impossible to commence any extensive program of construction due to the shortage of

Dr. J. B. Stirling, president of the Institute, and Mrs. Stirling (left) of Montreal are welcomed to Winnipeg and the annual dinner and dance of the Electrical Section by J. W. Sanger, vice-president, and Mrs. Sanger.

critical materials during the postwar period. The obvious alternative was to cut down peak loads to meet its capacity. After studying successful ventures in this field by several American cities, the Hydro commenced an investigation into the control of flat rate water heaters. Subsequent tests convinced the Company of the superiority of a system of control by 720 cycle carrier current. This frequency was high enough to be beyond the interference range of the harmonics of 60 cycles and at the same time low enough not to present a serious attenuation problem.

After setting up the required equipment in one of the Company's substations, a program of installing controllers in customers' premises was begun. To date 33,000 controllers have been put into operation, switching a load of 24,000 kilowatts.

The water heaters are switched off for a period of 2.4 hours, or 10 per cent of the day, 39 minutes over the noon hour peak and one hour and 45 minutes over the evening peak. Selecting the load curve for a typical winter's day, Mr. Harland illustrated by slides the usefulness of this cut-off in the daily loads of the Company. Without control of the evening load the peak reached 136.5 mega watts for a load factor of 62.9 per cent. With control the peak was reduced to 112.5 mega watts for a load factor of 75.3 per cent. Noon hour cut off is necessary as the noon peak was 117 mega watts without control, or greater than the evening peak with control.

The installation of 24,000 kilowatts of additional generating capacity at the time the control program was started, would have cost over three million dollars. The control system cost less than $800,000. This represents a saving of $150,000 a year in interest and depreciation charges alone, a saving which has been largely passed on to the Hydro's customers.

(*Continued on page 89*)

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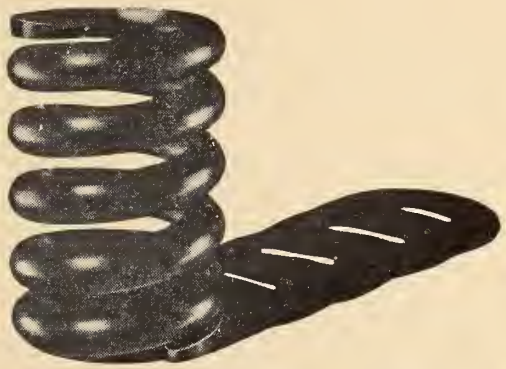

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

The Statesman's year-book 1952. S. H. Steinberg, ed. London, Macmillan, 1952. 1,586 pp., $9.00.

The Statesman's Year-Book is always a welcome addition to the book world, and this one is particularly so, in that it includes the nineteen fifty-one United Kingdom census figures, and also, in the addenda, the returns from the nineteen fifty-one/fifty-two general election in India.

This revision of the nineteen fifty-one edition does not merely present slight changes in paragraphs and dates. The type has been reset and information brought up to date all the way through. This is particularly noticeable in the sections devoted to the United Nations, United Kingdom, India and Africa.

With the table of contents obviously reset, we would very much like to have seen the correction made under America, which still gives the casual consultant the impression that Canada has twelve provinces.

And, we do wonder about the index. It is four pages smaller than nineteen fifty-one, and has four less entries per page, and both additions, and omissions, are evident. Most of these seem to be place names, although a casual glance revealed, for instance, the omission of an entry for synthetic rubber, in nineteen fifty-two, which entry is to be found in the previous volume.

In practically all reference books, the index is of prime importance, and rather than decreasing, one would normally expect it to increase in size from one year to another.

However, these criticisms of the index are far outweighed by the timeliness and usefulness of the contents of the volume proper, which certainly surpasses that of nineteen fifty-one for current reference use, and will be an invaluable addition to both the library and the office reference shelf.

E.K.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

American, British, Canadian conference on unification of engineering standards: screw threads, pipe threads, cylindrical fits, drafting practice, gas cylinder threads. New York, American society of mechanical engineers, London, British standards institution, 1952. 63 pp., $1.00.

Many people in the engineering industries are familiar with the background to the A-B-C unification program, which arose out of disastrous and costly wartime experiences due to the limited interchangeability between the Services equipment of the three countries. First step to overcome this difficulty was the 1945 Ottawa conference from which arose the "Declaration of accord" on screw-thread sizes of ¼ inch diameter and upwards. The present publication is a report on a second conference which was held in New York in June 1952. It gives the complete program and discussions and agreements on attachment screws, acme threads, buttress threads, instrument threads, gaging practice, stub acme threads, pipe threads for the petroleum industry and electric conduits, valves, etc. Tables of tolerances are included.

Callender-Hamilton bridge handbook: highway bridges type "B". G. D. White-Parsons. London, British insulated callenders construction company, 1952. 151 pp., illus., 20/-. (The company's publication No. 11).

The Callender-Hamilton type "B" bridge has been developed to meet the requirements for a highway bridge of variable span up to 200 ft. of a permanent or semi-permanent type capable of taking the heaviest road loads. It is a bridge of the Warren girder type with variable section trusses in multiples of 10 ft. in length from a set of standard parts. The outstanding feature of the design is that the individual members of the trusses are composite in structure. This book covers the subject in details and shows its advantages. Necessary diagrams, photographs and tables are included.

Gas discharge lamps: principles, characteristics, applications. J. Funke and P. J. Oranje. Eindhoven, Netherlands, Philips Gloeilampenfabrieken, Houston, Texas, Elsevier, 1951. 270 pp., illus., $4.25. (U.S.)

Since 1932, when the first public highway was lighted by means of electrical discharge lamps, the development of this type of lamp has progressed steadily in the laboratories and factories of the leading manufacturers. The object of this book is to present a survey of existing types of discharge lamps as marketed by N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands, together with their relative possibilities, advantages and disadvantages, characteristics and principles. It is only here and there in this work that something more than an elementary knowledge of mathematics and physics is required of the reader. The text includes references to developments in countries other than Holland, but as the book deals primarily with the products of the Philips Company the references are practically without exception confined to the work of members of the Philips organization. The present work is adequately illustrated and indexed and contains a bibliography.

Material handling in works stores. L. J. Hoefkens. London, Iliffe, c1952. 106 pp., illus., $2.65.

Dealing particularly with the fork lift truck and pallett system of materials handling, modern stores systems and storage and stores control methods, are here discussed and all that they offer in economies of time, cost and labour.

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Non-members may consult the library, but may not borrow material.

considered and material is followed through from its raw, to its finished state, and numerous, although very poorly reproduced, photographs, add to the verbal descriptions.

Useful and unexpected inclusions are discussions of labour incentives, the economical disposal of swarf and scrap, and in the opinion of the author, the most up-to-date and effective method of stock-taking. The book is not indexed. It is published by Messrs. Iliffe, for Mechanical Handling.

Seventh annual time study and methods conference, proceedings. Society for advancement of management and American society of mechanical engineers, management division. New York, Society for advancement of management, c1952. 192 pp., $5.00. (U.S.)

This publication contains sixteen papers on the application of time study and methods to cost control, tools, equipment and layout, inspection, office and clerical work, materials handling, scheduling and inventory control, maintenance, pricing and unit cost, and sales and distribution. Other papers explain the usefulness of these methods in meeting responsibilities to stockholders and customers. The reader will also find some observations on the data from the survey of the rating of time studies, a paper on current economic outlook, a research report on interference delays in multiple machine assignments, an MTM analysis of performance rating systems and a paper on ratio delay developments.

A standard list of subject headings in industrial relations. Princeton university, Committee of university industrial relations librarians. The university, Industrial relations section, c1952. 95 pp., $2.00.

This list of subject headings is intended for use in cataloguing industrial relations materials. In selecting headings for inclusion, the members of the committee have been guided by what seems to be the preferred current terminology. In some few cases terms no longer in current use, but important for historical reasons, have been included. One of the special features of this list is the inclusion of explanatory notes for each main heading. In addition to sub-divisions listed under particular headings, a separate list of suggested subdivisions is given. A list of industries and occupations is also included for use as subject headings or subdivisions.

Structural adhesives: The theory and practice of gluing with synthetic resins. London, Lange, Maxwell c1951. 203 pp., illus., 30/–.

From September twenty-third to twenty-ninth, nineteen hundred and fifty, a summer school was held at Cambridge, under the auspices of Aero Research Limited, entitled "The technology of synthetic resin adhesives". Structural Adhesives is these lectures in published form.

Opening with a discussion of basic ideas in adhesion and their practical significance, the subjects of the lectures, each one given by a specialist in the field, then broaden out to the various types of materials to be glued, and the types of glueing and setting, i.e. veneering, edge-splicing, plywood, strip heating, etc., all covering the woodworking industries.

The second section, or course, treats adhesives in the engineering electrical manufacturing and allied industries, and covers design for redux, bonding metals processes, ethoxyline resins, adhesives in the electrical industry, and the bonding of friction fabrics.

The book has a good detailed index, and illustrations include photographs, charts and diagrams.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Modern plastics encyclopedia and engineer's handbook 1952. New York, Plastics Catalogue Corporation, 1952. 848 pp., illus., $2.00. (U.S.)

As in the previous edition, this useful reference work presents in detail the recent developments in plastics engineering and methods, machinery and equipment, and plastics materials. The materials are now arranged in three sections: resins and molding compounds; chemicals for plastics; fillers and reinforcements. The directory section contains buyers' guides for materials, equipment, etc., and an extensive list of trade names. The technical data section now includes a fibres' properties chart, the plasticizers chart has been expanded, and the large folded plastics' properties chart is included as usual.

Reviews of petroleum technology, Volume 12, 1950. Edited by George Sell. London, Institute of Petroleum, 1952. 513 pp., £2.10.0.

Advancements in the field as written up during the year noted are discussed critically by British specialists under twenty-two major headings covering a wide range of topics: geology, drilling, production, refining, petroleum gases, Diesel fuels, lubricants, special products, internal-combustion engines, engine testing of fuels and lubricants, and petroleum legislation. A considerable bibliography is cited in addition to the literature references accompanying each chapter.

Steel defects and their detection. Henry Thompson. Toronto, Pitman, 1952. 85 pp., illus., $3.00.

This concise reference work gives a description of the characteristic common defects associated with steel ingots and with the rolling processes. Both macroscopic and microscopic tests are described and the microscopic constituents of steel are noted and illustrated. Special methods are covered in the last chapter: magnetic, fluorescent, electronic, and supersonic flaw detection; spark testing, magnetic sorting, etc.

STANDARDS REVIEWED

British Standards, British standards institution 24/28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building Ottawa, Canada.

B.S. 731 part 1; 1952 — Flexible steel conduit and adaptors for the protection of electric cable. 2/6.

This standard provides for three types of flexible steel conduit suitable for insulated cables — unpacked, asbestos packed and rubber packed, and for two types of adaptors — clamp type and solid type. In addition to standardizing dimensions, it specifies mechanical requirements and tests for the finished conduit, and prescribes suitable qualities of materials for use in the manufacture of flexible steel conduit and adaptors for cable protection.

B.S. 1826: 1952 — Reference tables for platinum/rhodium *v* platinum thermocouples. 7/6.

B.S. 1827: 1952 — Reference tables for nickel/aluminum *v* nickel/chromium thermocouples. 6/–.

These reference tables are for use in converting thermocouple voltages into the equivalent measured temperatures and in defining the relation between impressed e.m.f. and scale reading for pyrometers which indicate temperature directly. The tables in the first standard are based on those formulated by the National physical laboratory, while in the second they are based on those formulated by the National bureau of standards of America.

B.S. 1886: 1952 — Terms and definitions for single-point cutting tools. 6/–.

This is a very detailed set of definitions of the numerous terms used in connection with single-point cutting tools for lathes, boring-mills, planing, shaping and similar machines. After presenting definitions of various types of single-point tools, this publication proceeds to deal with rakes, working angles, clearance angles, tool elements and general terms. Sketches and diagrams serve to assist and clarify the textual definitions.

B.S. 1889: 1952 — Dimensions of foundry moulding boxes. 2/6.

The standard specifies dimensions of 2-pin square, rectangular or round box parts, designed for loose pins, of sizes ranging from 12 in. x 12 in. x 3 in. to 72 in. x 72 in. x 24 in., with pin diameters ranging from ¾ to 1¼ in. and distances between pin centres ranging from 15 in. to 77 in. It specifies also dimensions of lugs and bushes, which may be single or double.

B.S. 143: 1952 — Malleable cast iron and cast copper alloy pipe fittings for steam, air, water, gas and oil (screwed B.S.P. taper thread or API line pipe thread) 7/6.

B.S. 1256: 1952 — Malleable cast iron (Whiteheart process) and cast copper alloy pipe fittings for steam, air, water, gas and oil (screwed B.S.P. taper male thread and parallel female thread) 7/6.

These standards specify the standard dimensions of plain and reinforced malleable cast iron and cast copper alloy pipe fittings suitable for working pressures up to 200 lb./sq. in. in the case of water, and up to 150 lb./sq. in. in the case of steam, air, gas and oil. They also provide for the customary types of equal and reducing fittings for use with nominal pipe sizes within a range of ⅛ to 6 in. Tests for porosity and ductility are specified.

Canadian standards, Canadian standards association, National research building, Ottawa Canada.

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CSA B34-1952 — CSA established lists of unfinished machine, carriage and plough bolts and nuts, 2nd ed. $1.75.

These lists apply to all unfinished machine, carriage, plow, countersunk, elevator, step, lag bolts and regular square and hexagon nuts. They are for the guidance of designing engineers, draughtsmen, purchasing agents and the trade generally, and give a range which should be sufficient for all practical purposes. The Unified screw thread standard shall apply throughout except for lag bolts.

CSA C22.2, No. 26-1952 — Construction and test of wireways, auxiliary gutters and associated fittings 2nd ed. $0.75.

This specification applies, for potentials up to and including 600 volts between conductors and ground, to metal enclosures of the following types: wireways for insulated wires and cables, auxiliary gutters (for insulated wires and cables) for use at switchboards, meter centres, etc., and associated fittings for completing wireway systems. These enclosures are intended for use in non-hazardous locations and where they are not likely to be subjected to severe mechanical damage.

CSA C22.2 No. 27-1952 — Construction and test of busways and splitter boxes 2nd ed. **Section A — Busways and associated fittings. Section B — Splitter boxes.** $1.00.

The first section of this specification applies to busways and associated fittings for potentials up to and including 600 volts between conductors, and between conductors and ground, and in capacities of 6,000 amperes and less. The second section applies to splitter-boxes for potentials not exceeding 600 volts between conductors, and between conductors and ground, and in capacities of 1,200 amperes and less. A splitter-box having materials or forms of construction differing from those described may be tested according to the intent of the requirements.

CSA Z114-1952 — Safety code for the woodworking industry. $1.00.

This code is intended as a guide for the safe installation, operation, and maintenance of woodworking machinery, including cooperage operations and the making of veneer. It deals primarily with "point of operation" hazards on woodworking machinery but shall not apply to sawmill and woods operations.

BOOKS RECEIVED

The ABC of gliding. Fox Geen. London, George Allen & Unwin, Toronto, Thomas Nelson, c1952. 103 pp., illus., $3.00.

Adhesives for wood. R. A. G. Knight. New York, Chemical publishing co., 1952. 242 pp., illus., $5.00 (U.S.)

Anger's digest of the mercantile law of Canada, 16th ed. F. R. Hume compiler. Toronto, Cartwright, c1952. 530 pp., $7.50.

Canadian master tax guide, 8th ed. Toronto Canadian CCH, limited, 1952. 311 pp., $3.00.

Charbons activés (adsorption des gaz et des vapeurs). C. Courty. Paris, Gauthier-Villars, 1952. 534 pp., illus., $13.25.

The Colombo plan: the first annual report of the consultative committee on economic development in South and South-East Asia. London, HMSO, 1952. 75 pp., 2/6.

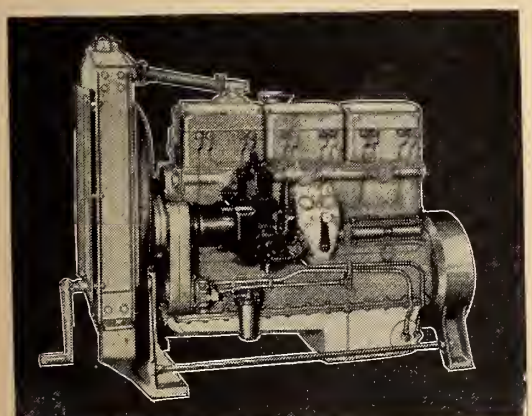
Conciliation in action: principles and techniques. Edward Peters. New London, Conn., National foremen's institute, c1952. 266 pp., $4.50, (U.S.)

Diesel engine catalog, Vol. 17, 1952. Los Angeles, Diesel engines inc., 1952. 409 pp., illus., $10.00 (U.S.)

Directory and handbook of the scientific instrument manufacturers association, 1952. London, the association, 1952. 251 pp., illus.

Education in town planning: an international survey. The Hague, International federation for housing and town planning, 1952. 139 pp., Fl. 5.00.

Elasticity in engineering. E. E. Sechler. New York, Wiley, c1952. 419 pp., illus., $10.20.



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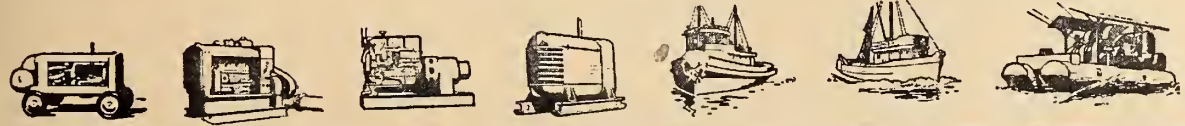

Electric fuses: a critical review of published information. H. Lapple. Toronto, Butterworth, 1952. 173 pp., $5.00.

Electronic valves, Book 3A: Data and circuits of radio receiver and amplifier valves. N. S. Markus and J. Otte, comp. and ed. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1952. 487 pp., illus., $6.25 (U.S.).

Essentials of microwaves. R. B. Muchmore. New York, Wiley, c1952. 236 pp., illus., $5.40.

Fatigue and fracture of metals. W. M. Murray ed. New York, Wiley, c1952. 313 pp., illus., $7.20.

Flux linkages and electromagnetic induction. L. W. Bewley. Toronto, Macmillan, c1952. 100 pp., illus., $4.00.

Fundamentals of engineering electronics, 2nd ed. W. G. Dow. New York, Wiley, c1952. 627 pp., illus., $8.50 (U.S.)

A geology for engineers 3rd ed. F. G. H. Blyth. Toronto, Longmans Green, c1952 336 pp., illus., $4.50.

German immigration into Canada. W. G. Friedmann. Toronto, Canadian institute of international affairs, c1952. 63 pp., $1.25. (Contemporary affairs series No. 23.)

Handbook of chemistry, 8th ed. N. A. Lange ed. Sandusky, Ohio, Handbook publishers, inc., 1952. 1,998 pp., $7.00 (U.S.)

Hydraulic research in the United States. H. K. Middleton and S. W. Marchett. Washington, Department of commerce, 1952. 200 pp., $1.20. (National bureau of standards miscellaneous publication No. 205).

An international bibliography on atomic energy Vol. 2: Scientific aspects, Supplement No. 1. New York, United Nations, Toronto, Ryerson, 1952. 233 pp., $3.50.

Kingzett's chemical encyclopedia, 8th ed. R. K. Strong ed. Toronto, Macmillan, 1952. 1,186 pp., illus., $13.25.

Link-belt general catalog. Toronto, Link-belt limited, c1952. 1,295 pp., illus.

Metal industry handbook and directory, 1952. London, Louis Cassier, 1952. 448 pp., illus., £2.12.0.

North-east coast institution of engineers and shipbuilders, Transactions, Vol. 68. Newcastle upon Tyne, the institution, 1952. 330, 182 pp., illus.

Ontario tax acts consolidated, 4th ed., 1952. Toronto, CCH Canadian limited, 1952. 289 pp., $2.50.

Plastics in building. J. B. Singer, London, Architectural press, Toronto, British book service, c1952. 192 pp., illus., $3.75.

Quebec tax acts consolidated 1952, 4th ed. Toronto, CCH Canadian limited, 1952. 169 pp., $2.50.

Road test One-MD: effect of controlled truck axle loadings on concrete pavement, final report. Washington, United states highway research board, 1952. 142 pp., illus., $2.25.

Science and hypothesis. Henri Poincaré. New York, Dover, c1952. 244 pp., paper ed. $1.25, cloth ed. $2.50 (U.S.)

Science and method. Henri Poincaré. New York, Dover, c1952. 288 pp., paper ed. $1.25, cloth ed. $2.50 (U.S.)

Sound insulation and room acoustics. P. V. Bruel. London, Chapman, Toronto British book service, 1951. 275 pp., illus., $7.00.

Television. F. Kerkhof and W. Werner. Eindhoven, Holland, Philips technical library, 1952. 434 pp., illus., $7.75 (U.S.)

Theory of electicity and plasticity. H. M. Westergaard. Cambridge, Mass., Harvard university press, 1952. 176 pp., illus., $5.00 (U.S.). (Harvard monographs in applied science No. 3.)

Timber drying and the behavior of seasoned timber in use, 3rd ed. R. G. Bateson. London, Crosby Lockwood, c1952. 143 pp., illus., 15/-.

United Nations scientific conference on the conservation and utilization of resources, Vol. 2, Mineral resources. New York, United Nations, Department of economic affairs, Toronto, Ryerson, 1951. 303 pp., illus., $3.00.

United Nations scientific conference on the conservation and utilization of resources, Vol. 3, Fuel and energy resources. New York, United Nations, Department of economic affairs, Toronto, Ryerson, 1951. 303 pp., illus., $3.00.

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TECHNICAL BULLETINS RECEIVED

American society for testing materials. Special technical publications:

No. 122 — Symposium on surface and subsurface reconnaissance.

No. 123 — Symposium on acoustical materials. No. 126 — Symposium on consolidation testing of soils.

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ASTM B 259-52T — Copper and copper-alloy welding rods.

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37-GP-9 — Asphalt primer; asphalt roofing.

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25-GP-1b — Methods of sampling and testing waxes and polishes.

37-GP-15 — Recommended methods for application of asphalt primer for asphalt roofing.

Canada. National research council. Radio and electrical engineering division. Publications:

ERB-289 — A high-speed time base for PPI radar display, by R. I. Mott.

Clifford Manufacturing Company. Papers:

No. 52-20-2 — Aircraft temperature control systems, by Secor D. Browne.

Edison electric institute. Publications:

No. 52-5 — Turbines, condensers and auxiliaries, feed-water heaters, evaporators, and deaerators, 1950. No. MSJ-4 — AEIC-EEI-NEMA standards for indicating demand registers (Cumulative and pointer forms).

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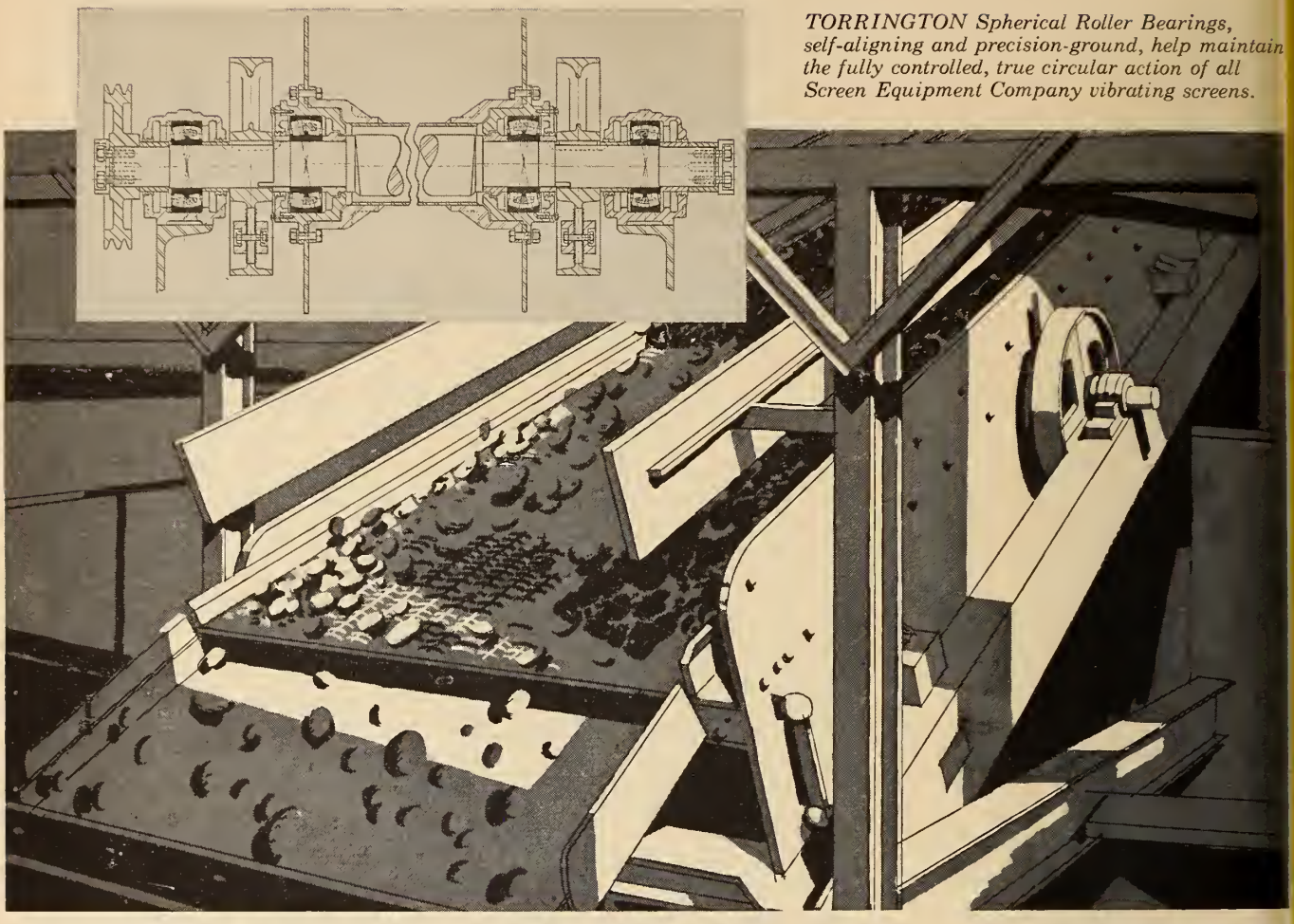
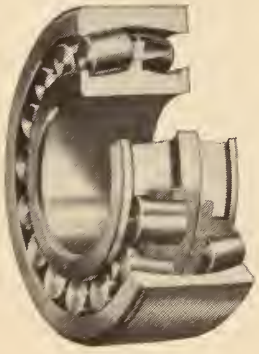


TORRINGTON Spherical Roller Bearings, self-aligning and precision-ground, help maintain the fully controlled, true circular action of all Screen Equipment Company vibrating screens.

Screening higher tonnages per day and per dollar!



Either way you look at it, per day or per dollar, TORRINGTON Spherical Roller Bearings help to increase tonnages from vibrating screens.

Self-aligning TORRINGTON Spherical Roller Bearings compensate for shaft deflection and frame distortion. They maintain sharp, accurate throw and a smooth flow of power under all operating conditions. Loads move along rapidly, carry-over is eliminated—and daily tonnages climb.

Precision-ground from the finest of bearing steels, TORRINGTON Spherical Roller Bearings resist the wear and tear of eccentric action. They cut maintenance to a minimum, lengthen service life, help you get, over the years, maximum total tonnage per equipment-dollar invested.

No wonder so many of the best vibrating screens—like the best crushers, pulverizers and other aggregate processing machinery—are equipped with TORRINGTON Spherical Roller Bearings.

Next time, specify TORRINGTON!

•

THE TORRINGTON COMPANY, LIMITED
925 MILLWOOD RD., TORONTO 17, ONT., CANADA

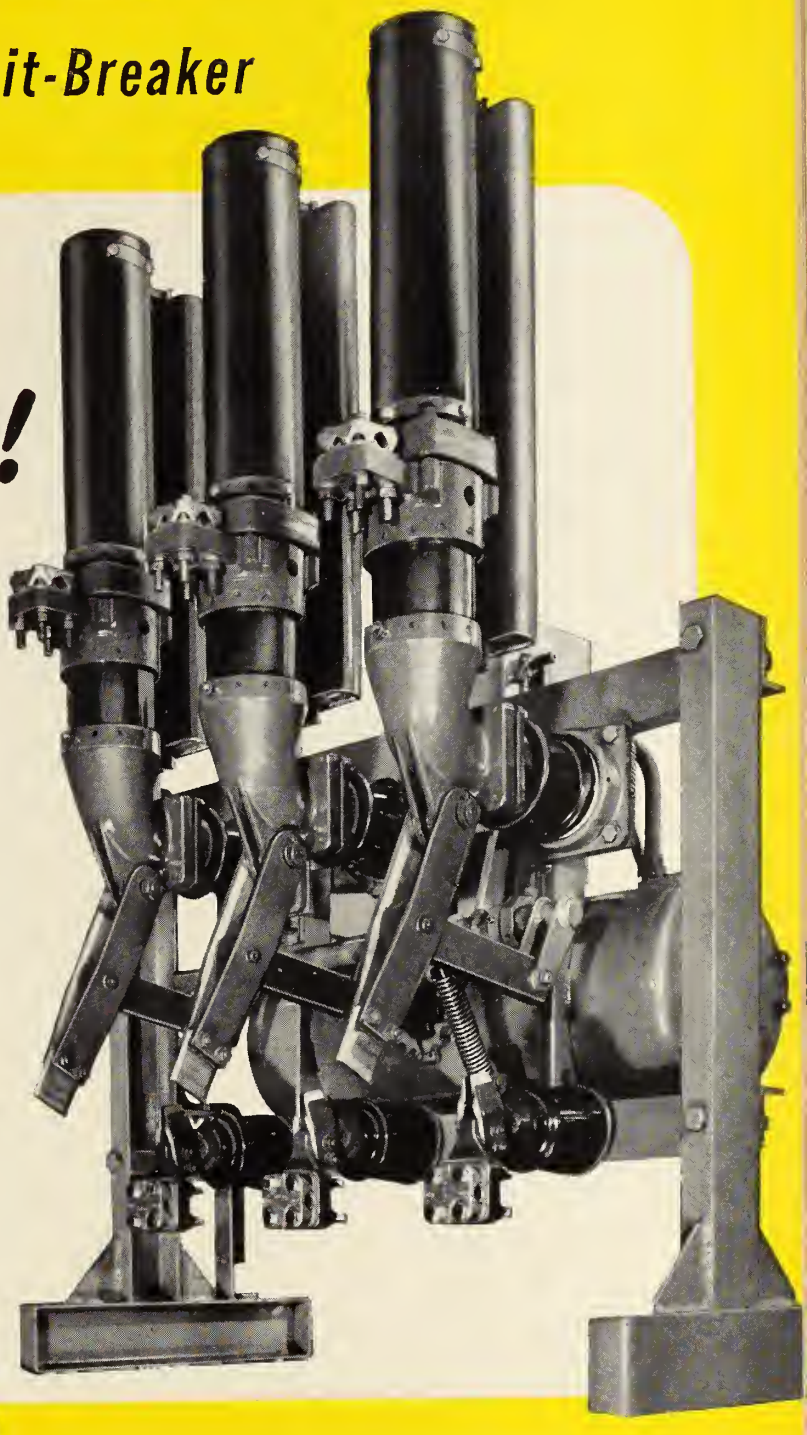
TORRINGTON SPHERICAL ROLLER **BEARINGS**

Spherical Roller • Tapered Roller • Straight Roller • Needle • Ball • Needle Rollers

BROWN BOVERI

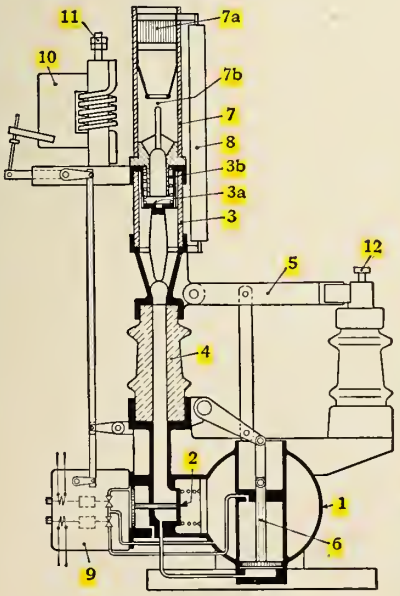
Air-blast

High-Speed Indoor Circuit-Breaker



built to be 12 ways better!

1. Compressed air receiver
2. Main valve
3. Arc extinguishing chamber
   - 3a. Extinguishing contact spring
   - 3b. Compression spring
4. Hollow insulator
5. Isolating contact
6. Isolator operating machanism
7. Exhaust cooler
   - 7a. Damping baffles
   - 7b. Spark for switching resistor 8
8. Damping resistor
9. Control unit
10. Built-on relay
11. Line terminal
12. Load terminal



Here's how it's Built

and...

...here's how it's BETTER!

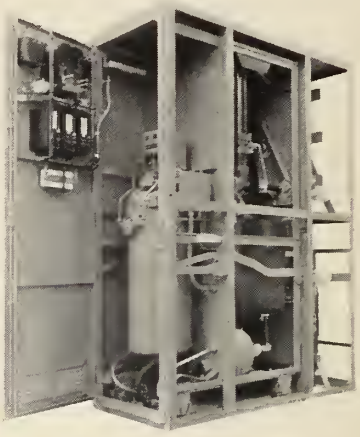
1. Explosion, sooting, and fire hazard free
2. Clean in operation
3. Has short switching times
4. Operates with maximum mechanical safety due to greater number of mechanical switching operations which can be executed.
5. Easy and quick to overhaul
6. Gives trouble-free operation under low and high temperature conditions
7. Doesn't cause dangerous over-voltages — maximum electrical reliability obtained
8. Individual parts do not oscillate or rebound. Main valve and isolating contacts are pneumatically damped.
9. Employs spring-loaded power storage devices for "positive" transmission of all short control orders
10. Equally suitable for frequent or infrequent switching
11. When equipped with additional air receiver, Brown Boveri's Air-blast High-speed Circuit Breaker, Type DB, is the most suitable type for high-speed reclosing. High-speed reclosing, as an effective means of dealing with faults, is of special importance for the protection of medium-voltage networks — eliminating as much as three-quarters of all faults. The entire equipment for this feature can be located in a relay box

Type DB circuit-breakers can be supplied in:—

Voltage Ratings — 10, 20, 30, 45, and 60 kV
Current Ratings — 1000, 1500, 2500, and 4000 amps
Interrupting Capacity — 200, 400, 600, 1000, 1500, and 2000 MVA

You are invited to discuss your circuit breaker requirements with Brown Boveri specialists. Type DB is made in Canada and available for immediate delivery.

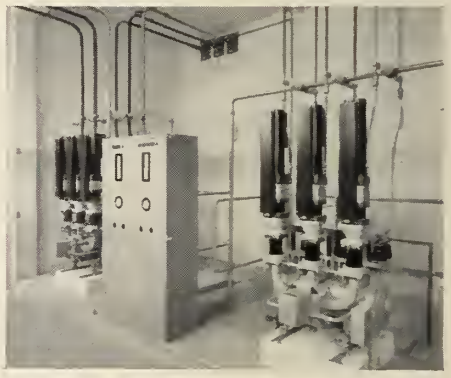
Adaptable to conditions on site: floor or wall mounting, with mounting plate or truck, or enclosed cubicle. Illustrated are two typical installations:—



STEEL CUBICLE:

This draw-out type steel-enclosed panel for Type DB is particularly suited to new installations. A real space saver, this unit can be installed rapidly and with low cost.

12

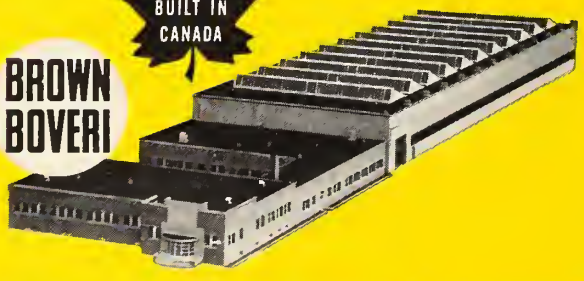


FLOOR MOUNTING:

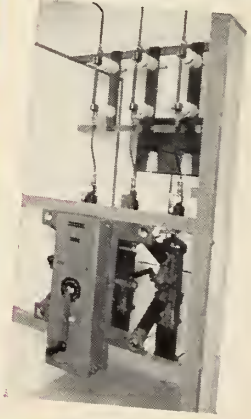
Suitable in the event of modernization as was the case in the above power station. Built before the first world war its oil circuit breakers were replaced recently by the modern air-blast circuit breakers, Type DB

NOW BUILT IN CANADA

BROWN BOVERI



Convector Circuit-breaker • TYPE S



A low-oil-content high-speed circuit breaker of exceptional simplicity and reliability. Particularly suitable for small distribution stations in local or industrial systems, where only a small number of circuit-breakers are required and the cost of the air-blast type is too high, because of the need for a compressed-air plant.

Rated Voltage: 3, 6, 10, 20, kV.
Rated Current: 600 amps.
Interrupting Capacity: 75, 150, 250, 400 MVA

BROWN BOVERI (CANADA) LIMITED

Head Office: 1111 Beaver Hall Hill, Montreal—*Plant:* St. Johns, Que.
ONTARIO BRANCH—249 VICTORIA STREET, TORONTO
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GORDON RUSSELL Ltd., Vancouver
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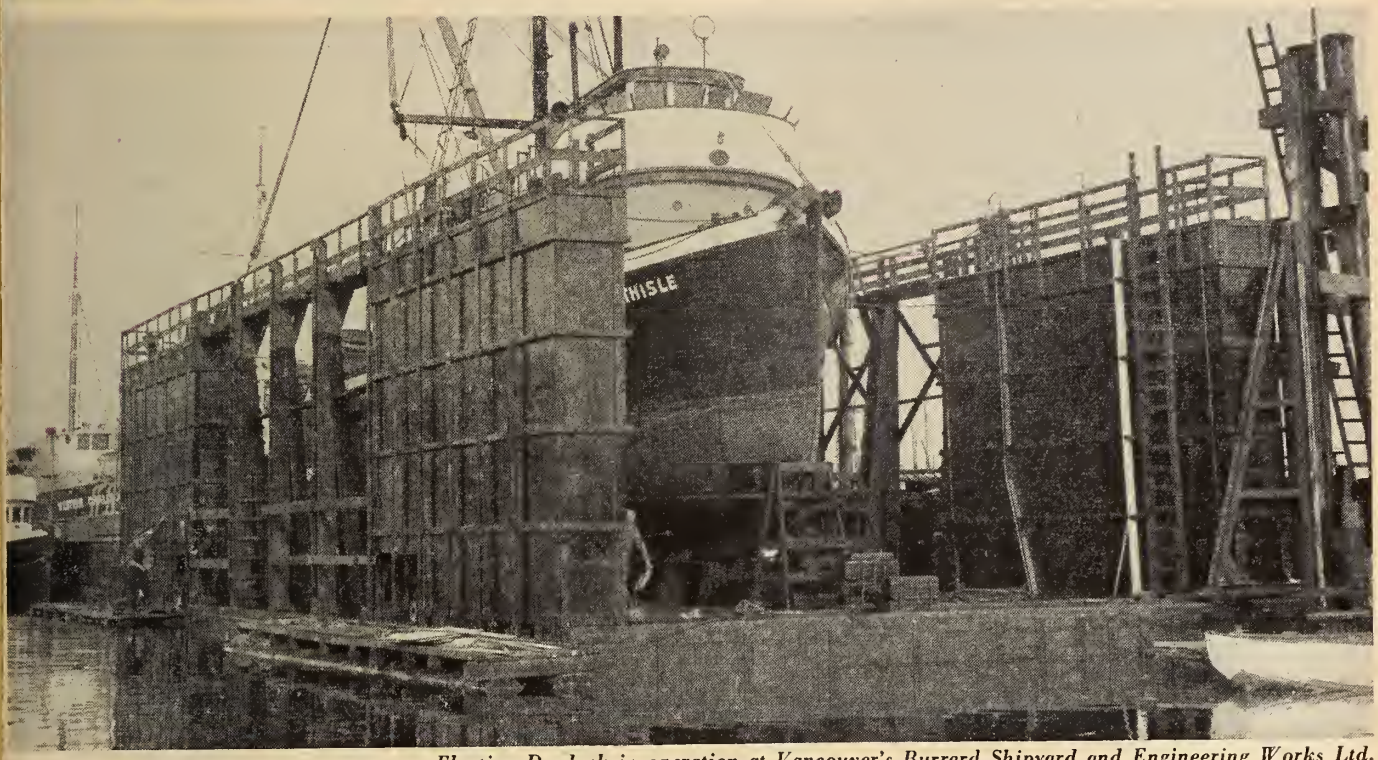
CB 1-3

Look What A West Coast Shipyard Is Doing With...

SYLVAPLY WATERPROOF -GLUE PLYWOOD



Floating Drydock in operation at Vancouver's Burrard Shipyard and Engineering Works Ltd.

performance under pressure!

Old dockyard hands gasped at the idea of *plywood* ballast tanks . . . but Vancouver's pace-setting Burrard Shipyards had already investigated other salt and fresh water installations where Sylvaply had demonstrated superiority over traditional construction materials.

The giant buoyancy tanks which make up both sidewalls of the drydock in the photo are built with ¾-inch Sylvaply. The crossply construction of Douglas Fir waterproof-glue plywood provides the necessary strength to withstand tremendous pressures.

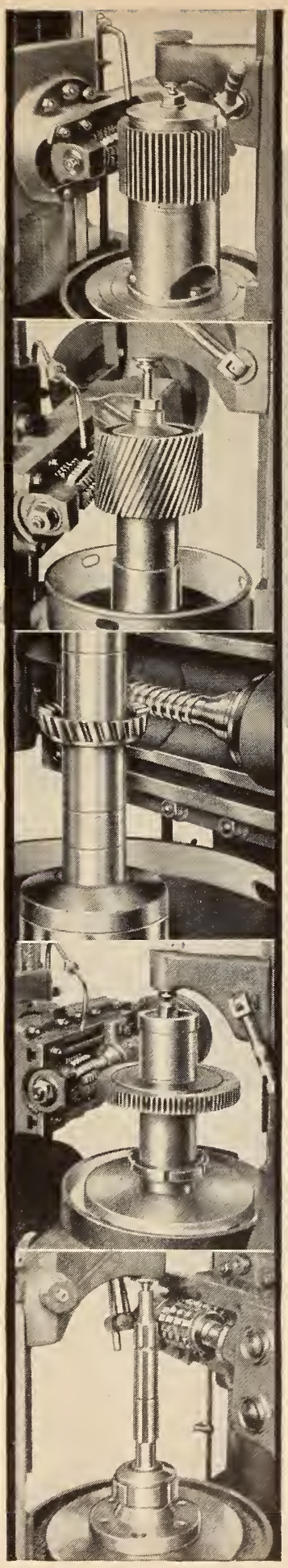
Wood planking previously used for these tanks required many hours of costly labor to caulk the joins between each board. Sylvaply's big, rugged 4 x 10 foot panels reduced joins to a minimum. Ideally dimensioned for pressure treating with creosote, complete penetration is possible with plywood. Cuttings taken after treating demonstrated that the Sylvaply panels could be cut, sawn and bored without exposing any area not completely creosote protected.

Today, after a rigorous testing period which included repeated submersion and exposure to sun, Burrard reports "complete success, with no sign of water seepage anywhere." The Shipyard is also happy about the considerably lower construction cost with Sylvaply.

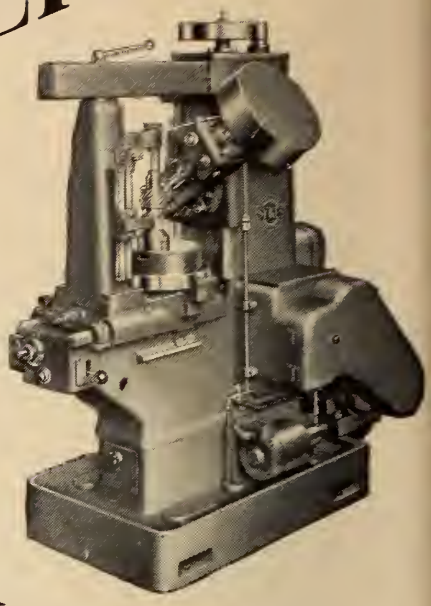
Dollar-wise men of Canadian industry have solved construction and fabrication problems with Sylvaply. For information which may help you solve your particular problem correspond with Technical Section, MacMillan & Bloedel Ltd., P.O. Box 355, Vancouver 1, B. C.

Specify **SYLVAPLY** *Canada's Busiest Building Material.*

MacMILLAN & BLOEDEL LTD., SERVING THE WORLD WITH FOREST PRODUCTS SINCE 1911



VERSATILITY IN GEAR PRODUCTION



SYKES UNIVERSAL HOBBERS

Readily accessible change gears, and Vernier scales on hob carriage and work saddle, facilitate setting and speed up changeover from one gear type to another, reducing 'down-time' to a minimum. These are precision machines — Spurs and helicals, splines and sprockets, worms and worm-wheels, can all be generated with the greatest accuracy — yet with automatic limit switches and rapid power traverse for speedy operation, high production rates are easy to maintain.

3 MODELS

HV. 14 up to 14 ins. dia.
HV. 24 up to 24 ins. dia.
HV. 40 up to 40 ins. dia.

Full technical data on request.

SYKES

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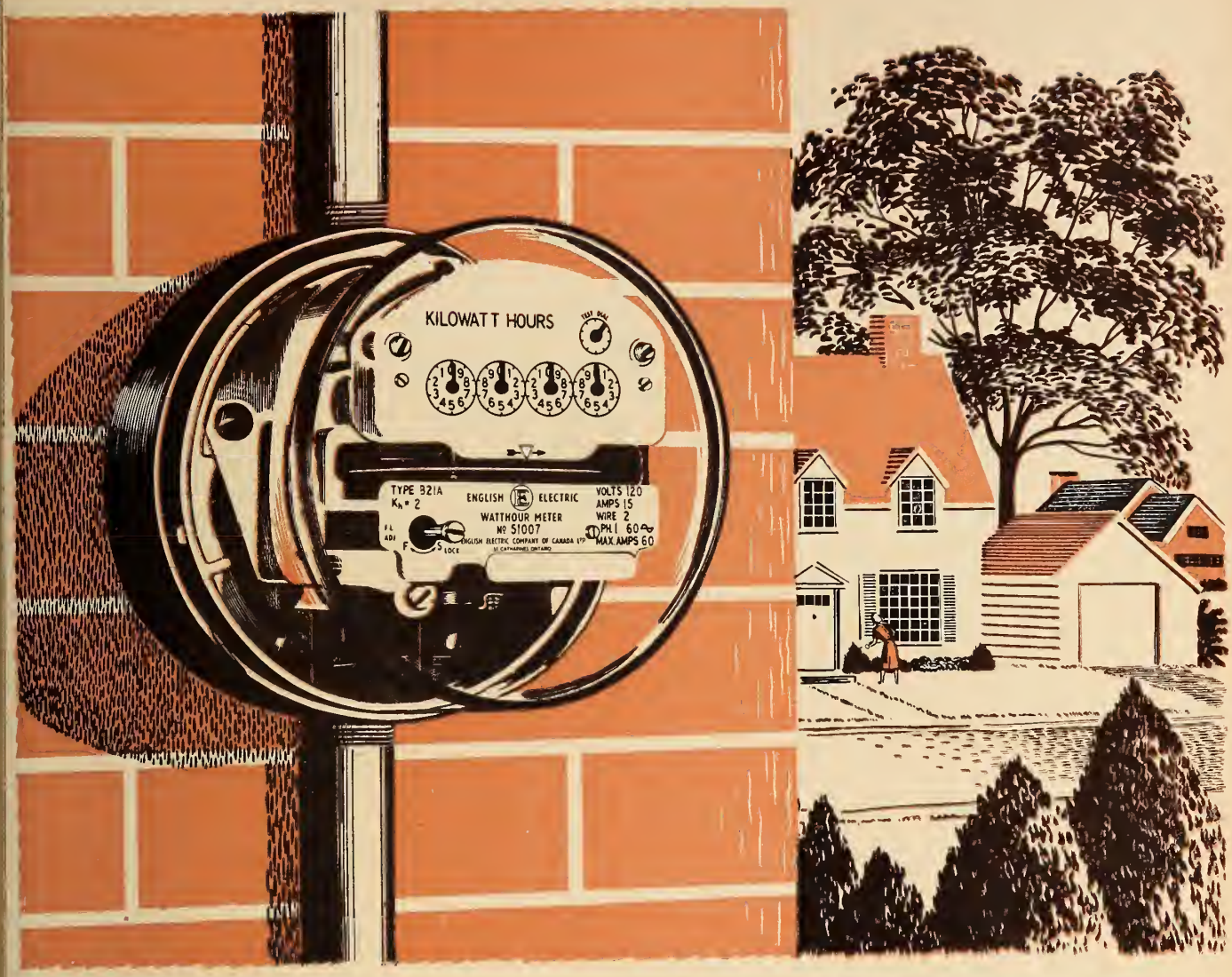

A new Watthour Meter for Canada

The answer to your problem of rising operating costs is in this type B.21 meter. Nearly twenty years of experience and research into factors affecting meter performance all over the world have been crystalized to produce this meter to fit Canada's operating conditions. Based on well established principles, the design incorporates features that revolutionize existing conceptions of bearing life. The wide range accuracy and reduced bearing wear are results of an entirely new form of magnet system, allowing the meter to have a low operating speed with reduced side thrust at high loads, and an almost complete absence of pivot oscillation at all loads.

See publication AX 138

'ENGLISH ELECTRIC'

PA5212

English Electric Company of Canada Limited . Head Office and Factory: St. Catharines, Ontario
Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

FOR THE ATTENTION OF WIRE ROPE USERS

Give your Ropes a chance

SLING SAFELY...

FOLLOW THIS CHART...ACHIEVE LONG LIFE FOR YOUR WIRE ROPES AND SAFETY FOR YOUR MEN

- The load capacity of two-legged slings decreases as the angle between the legs increases.
- When both legs are vertical their capacity is twice that of each individual leg, but when the legs have been separated to an angle of 120° the capacity of the two legs is reduced by half, i.e., equivalent to the lifting capacity of one leg.
- The loads given in the following table are the maximum recommended to be lifted with two-legged slings.
- All figures given are based on a safe working factor of six.

DON'T—SNATCH THE LOAD OFF THE GROUND.

DON'T—ALLOW THE SLING LEGS TO BE BENT AROUND SHARP CORNERS OR SMALL RADII WITHOUT PACKING.

DON'T—USE A HOOK OR SHACKLE TO PROVIDE A BIGHT.

DON'T—DRAG THE SLING ALONG THE FLOOR OR THE GROUND.

DON'T—PULL THE SLING FROM UNDER A LOAD WHICH HAS BEEN LOWERED AND IS RESTING ON IT.

DON'T—LIFT UNBALANCED LOADS.

Tonnage in long tons (2,240 lbs.)

PERMISSIBLE WORKING LOADS FOR TWO-LEGGED SLINGS

Breaking Strain of Rope.			Permissible Working Load Of One Leg.			INCLUDED ANGLE BETWEEN LEGS													
						0°			30°			60°			90°			120°		
Tons	lb.	Kilos	Tons	lb.	Kilos.	T.C.	lb.	Kilos	T.C.	lb.	Kilos	T.C.	lb.	Kilos	T.C.	lb.	Kilos	T.C.	lb.	Kilos
1½	3360	1524	¼	560	254	— 10	1120	508	9½	1064	483	— 8½	952	432	— 7	784	356	— 5	560	254
3	6720	3048	½	1120	508	1 0	2240	1016	— 19½	2156	978	— 17½	1932	876	— 14	1568	711	—10	1120	508
4½	10080	4572	¾	1680	762	1 10	3360	1524	1 9	3248	1473	1 6	2912	1321	1 1¼	2380	1080	—15	1680	762
8																				
6	13440	6096	1	2240	1016	2 0	4480	2032	1 18½	4312	1956	1 14½	3864	1753	1 8¾	3154	1435	1 0	2240	1016
9	20160	9144	1½	3360	1524	3 0	6720	3048	2 18	6496	2946	2 12	5824	2642	2 2½	4760	2159	1 10	3360	1524
12	26880	12192	2	4480	2032	4 0	8960	4064	3 17¼	8652	3924	3 9¼	7756	3516	2 16½	6328	2870	2 0	4480	2032
15	33600	15240	2½	5600	2540	5 0	11200	5080	4 16½	10808	4902	4 6½	9688	4394	3 10½	7896	3581	2 10	5600	2540
18	40320	18288	3	6720	3048	6 0	13440	6096	5 16	12992	5893	5 4	11648	5283	4 4½	9492	4305	3 0	6720	3048
24	53760	24384	4	8960	4064	8 0	17920	8128	7 14½	17304	7849	6 18½	15512	7036	5 13	12656	5740	4 0	8960	4064
30	67200	30480	5	11200	5080	10 0	22400	10160	9 13	21616	9804	8 13	19376	8788	7 1	15792	7163	5 0	11200	5080
36	80640	35576	6	13440	6096	12 0	26880	12192	11 11¾	25956	11773	10 7¾	23268	10554	8 10	19040	8636	6 0	13440	6096
45	100800	45720	7½	16800	7620	15 0	33600	15240	14 9¾	32452	14720	13 0	29120	13208	10 12	23744	10770	7 10	16800	7620
Factor						1·000			0·966			0·866			0·707			0·500		
Approximate Percentage Reduction						0%			3½%			13½%			29½%			50%		

★ NOTE It is recommended that wherever possible, the angle between the Legs of a two-legged sling should not exceed 90 degrees.

MARTIN BLACK *Wire Ropes*

MARTIN BLACK & CO. (WIRE ROPES) LTD. • SPEEDWELL WORKS, COATBRIDGE, SCOTLAND

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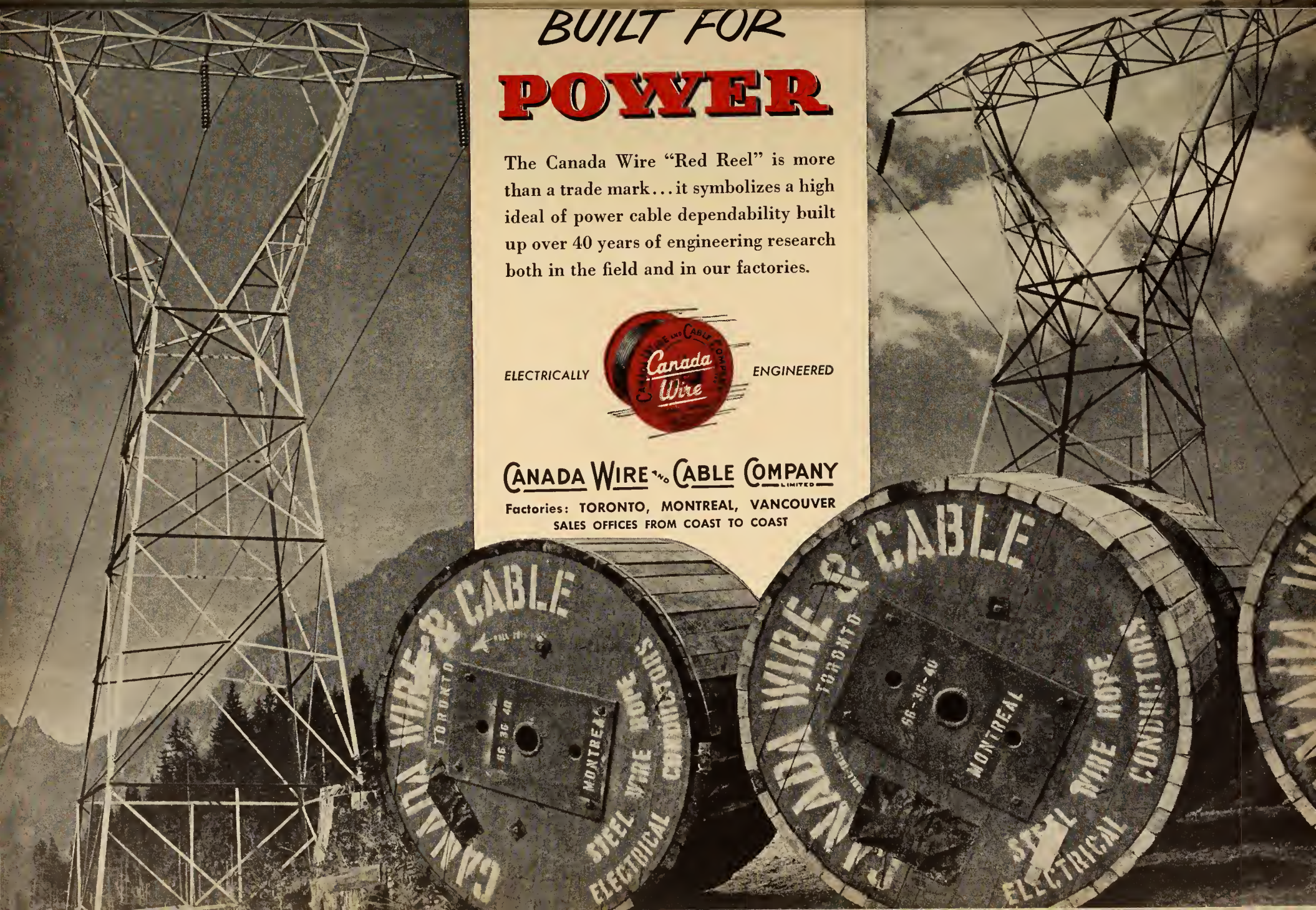
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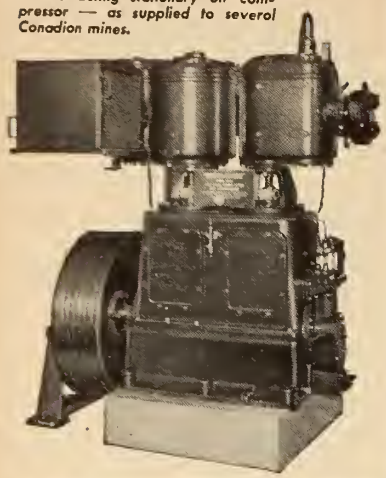
Broomwade Type TS1-B 2-stage double acting stationary oir compressor — as supplied to several Canadian mines.



looking for air compressors *and* pneumatic tools

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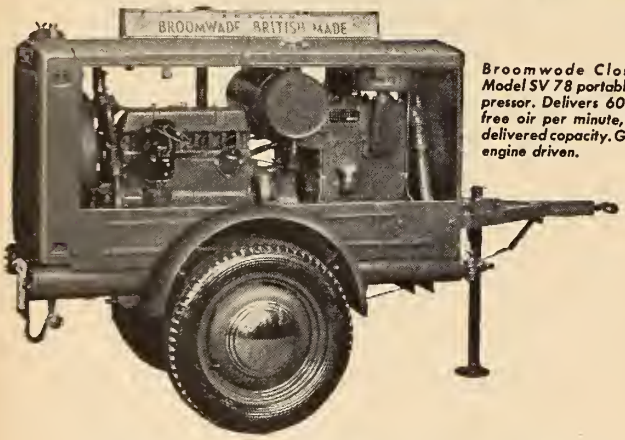
"BROOMWADE"

Immediately Available . . . Servicing all Across Canada



Broomwade Class 60, Model SV 78 portable compressor. Delivers 60 cu. ft. free oir per minute, actual delivered capacity. Gasoline engine driven.

For air compression equipment that gives you increased efficiency, low fuel consumption — and reliability, you can't beat Broomwade. They have an outstanding record of high performance under *all* working conditions!

Broomwade air compressors and pneumatic tools are built in a wide range of types, sizes and capacities. They are the result of long and specialized experience in this field — and contain the most up-to-date improvements in air compression equipment.

Write today and get complete details on the famous line of Broomwade Air Compressors and Pneumatic Tools.

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STELCO — ZINC TIGHT — GALVANIZED WIRE — THE STEEL CO. OF CANADA LTD.

a wire

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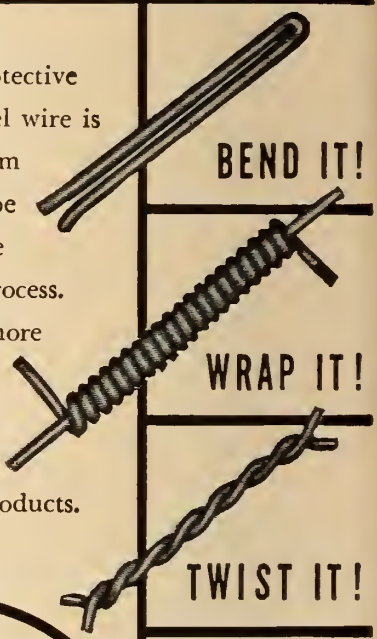
THE TOUGHEST TESTS!

The best metallic protective coating today for steel wire is zinc. The most uniform zinc coating that can be applied is done by the electro-galvanizing process. No manufacturer is more experienced in this modern process than STELCO—the leader in the field of wire products.



ELECTROLYTIC ZINC COATING WILL NOT FLAKE, CRACK NOR PEEL

- Smooth finish
- Absolutely uniform coat
- Unadulterated coating 99.99 pure zinc
- More ductile coating

The STEEL COMPANY OF CANADA LIMITED

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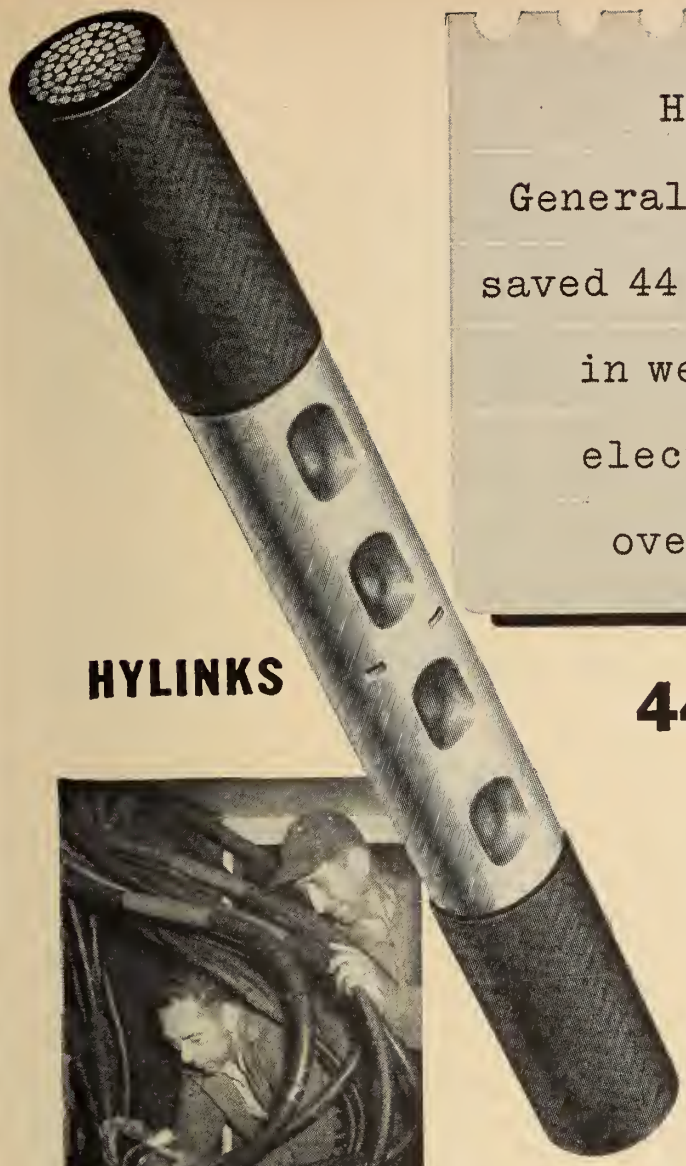
How
General Aniline
saved 44 man-hours
in weekend
electrical
overhaul



HYLINKS

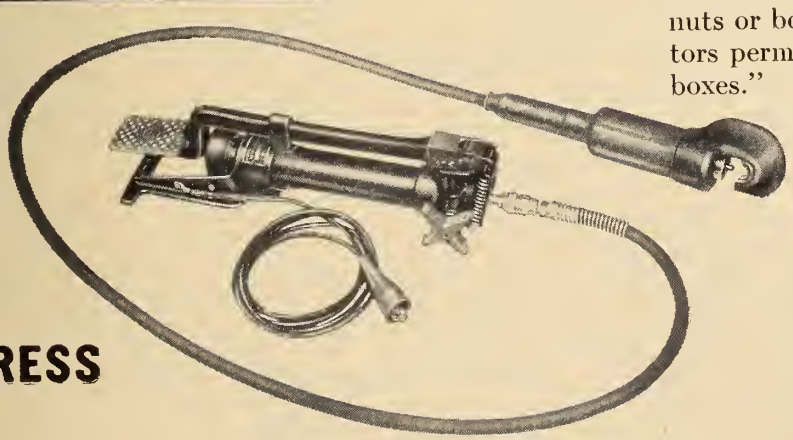
44 man-hours saved!

Annual factory shut-down for electrical overhaul and maintenance is a growing trend because it permits major work to be done more quickly, safely, cheaply, with minimum interruption of production.

During the last such overhaul at the General Aniline Works in Graselli, N.J.—Labor Day weekend—*one* of the *big* discoveries was the time saved by using Burndy Hydent connectors on their large power feeders!

"More than 44 man-hours were saved on installations. The smooth surface of the connector permitted faster taping of the connection, since there were no protruding nuts or bolts to be covered. These connectors permitted the use of smaller junction boxes."

(Factory, pg. 104, December '51)



HYPRESS

Whether you're doing annual overhauls or year-round maintenance, Burndy Connectors and installation tools—in every size, type, and service—help electrical engineers and crews do an *important* job *better!*

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suit of armour!

(for $10,000)

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B.U.P. Exhibitor Report

SHOW AND GROW at the 1953 Trade Fair. Among the 1272 Exhibitors from 29 countries in 1952, there was greater satisfaction with business results than in any previous year.

Reservations are far ahead of last year. Book your space NOW. Be in the best possible position to meet "a world" of buyers—from Canada, the United States and overseas countries—easily, economically, profitably! *Show and Grow!*

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Sixth

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TORONTO, JUNE, 1-12 1953

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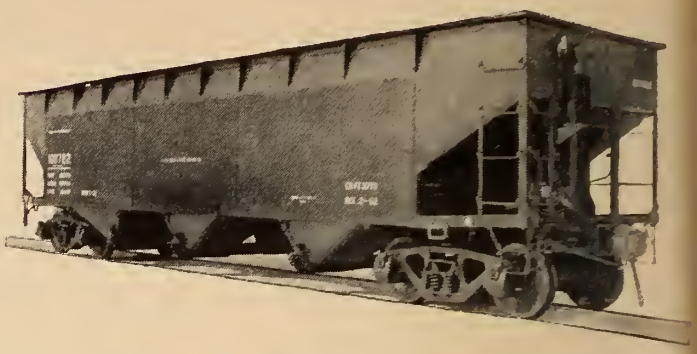

Rolling out!

A very high percentage of the railway rolling stock, produced in Canada, rolls out from National Steel car, made to the most exacting standards. This output is only made possible by a combination of experienced management, skilled workmen, and an efficient and modern plant.

National Steel Car always welcomes the opportunity of placing definite recommendations, estimates and specifications before those interested in modern steel rolling stock and allied products.

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LINK-BELT research and engineering . . . Working for Canadian Industry

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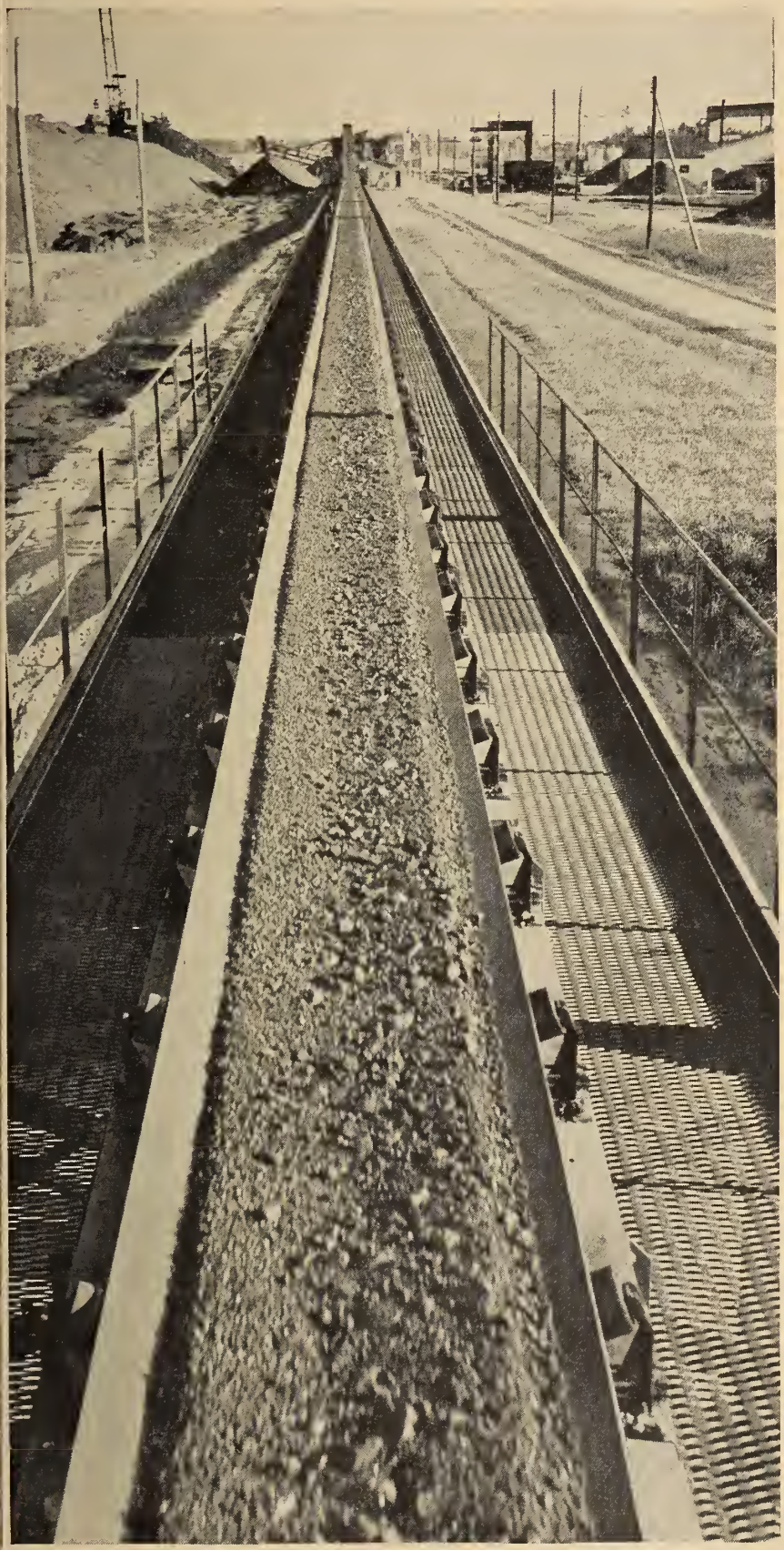

Millions of tons of bulk materials now ride on belt conveyors engineered and built by LINK-BELT

For bulk materials handling, belt conveyors provide remarkable initial economies. And in many cases operation and maintenance cost far less than any other method of transportation.

Belt conveyors handle huge tonnages, because the material runs at high speed in a continuous stream—24 hours a day, if desired.

Initial cost is low, because there is no need to carve out hills or fill in low spots —no need for heavy bridges over obstructions. Belt conveyors are light in weight and operate in narrow or low passages . . . up or down steep grades. They are inherently long-lived, requiring little maintenance.

Link-Belt is a nation-wide organization with broad experience in the engineering, manufacture and installation of materials handling and power transmission machinery. Link-Belt is prepared to take care of every detail from planning through erection.

◀ *Link-Belt Belt Conveyors handle titanium ore and coal from boats or railroad cars to storage or to smelting plant at Quebec Iron & Titanium Corporation's smelting plant at Sorel, Que.*

12,748-A

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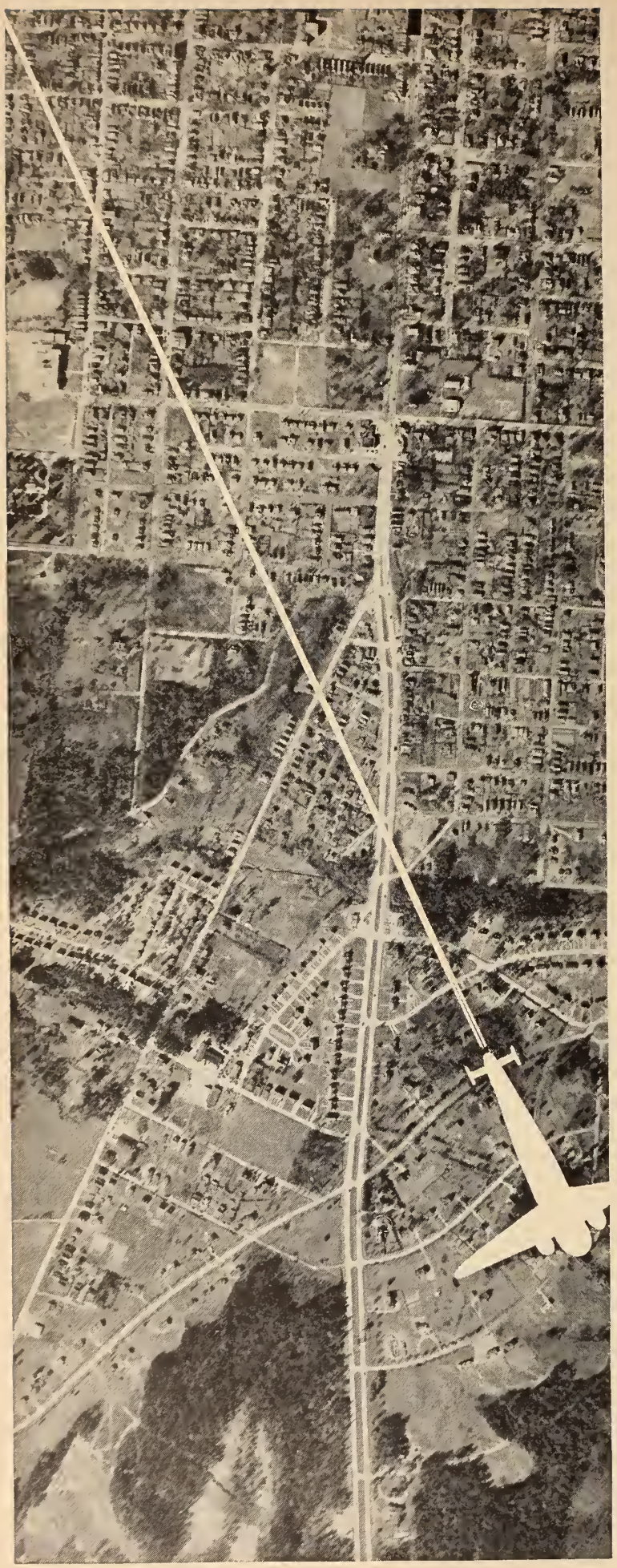
LINK-BELT, as an integral part of Canadian industry since 1914, has worked to step up production



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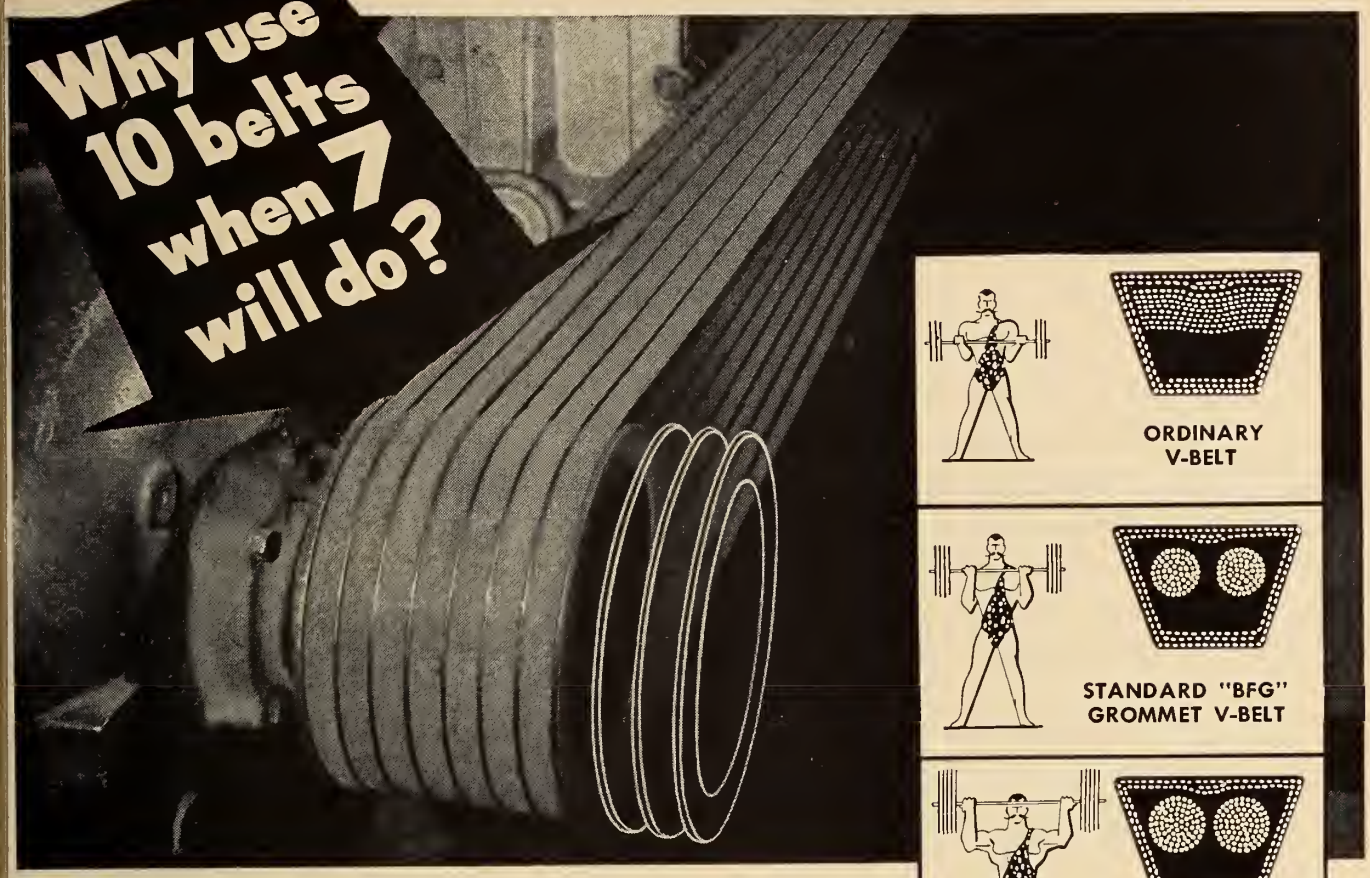
fewer belts...fewer sheave grooves



Another B. F. Goodrich First!

Up until now special belts were required for different applications, one type for highest possible horsepower rating, another for oil-resisting qualities, and yet another for static dissipation. Now all of these important features have been combined in *ONE BELT*—The new B.F.G. High Capacity V-Belt.

B.F.G. High Capacity V-Belts require 30% fewer belts and sheave grooves greatly reducing the over-all weight of the drive. *Only with exclusive B.F.G. grommet construction is it possible to increase the number of cords reinforcing a V-belt to obtain a higher horsepower rating.*

New B.F.G. High Capacity V-Belts are Recommended for Use where a large amount of horsepower must be transmitted within a limited amount of space, or where the total weight of the power unit is a serious factor. They are ideal for use on existing overload drives, and drives where sheaves with fewer grooves are required.

★ *Specify* **BFG HIGH CAPACITY V-BELTS FOR SPECIAL SERVICE**

- *Heat resisting compounds*
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- *Oil-proof covers*
- *Static dissipating type*
- *30% fewer belts and sheave grooves required*

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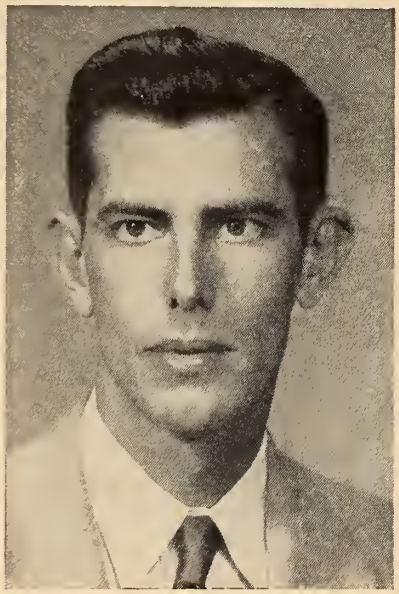
Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

R. H. Foy.—Richard Henry Foy has been appointed to the engineering management staff of the Electronics division of Canadian Westinghouse Company Limited.

●



R. H. Foy

Swedish Visitor. — Nils V. Lindqvist, secretary of Sweden's state committee for building research, arrived in Canada in November to study building in Canada. He will be attached to the staff of the division of building research, National Research Council, for a year. He expects to travel widely in Canada in the course of his work.

●

John D. Palmer. — Reliance Electric & Engineering (Canada) Limited, Welland, Ontario, has announced the appointment of John D. Palmer as advertising manager.

●

Roy G. Peers.—Roy G. Peers has been named to the board of directors of Canadian Arsenals Limited.

Mr. Peers is vice-president of Canadian Commercial Corporation and is in charge of their operations in the United States.

●

Canadian Agency.—Brodrene Dahl Corporation of Canada Ltd., 29 Melinda Street, Toronto, Ont., was established during 1952 to operate as manufacturers' agents for Scandinavian and other industries.

The Dahl group of companies, concerned with building, heating and industrial supplies, is represented in Canada, Denmark, France, Great Britain, Norway, Sweden, and the United States, with central management in Denmark.

●

Canadian Agent Appointed. — Gunnar Bostlund, 85 Balliol St., Toronto 12, is Canadian agent for the products of the Danish firm, Dansk Industri Syndikat Ltd.

●

North American Cyanamid.—Walter B. McBurney has been appointed technical director of North American Cyanamid Limited and Thomas P. Turchan has succeeded him as plant manager of the Niagara plant.

●

Eric G. Bergenstein. — Eric G. Bergenstein has been appointed senior transformer engineer of Reliance Electric & Engineering (Canada) Limited, Welland, Ont.

●

A. L. Irwin. — A. L. Irwin has been appointed to the newly created position of manager of the purchasing division of The Consolidated Mining and Smelting Company of Canada Limited. Mr. Irwin's new post embraces the responsibilities of purchasing agent, the position he has held up to this time.

●

Liquid Air Appointments. — Canadian Liquid Air Company Limited announced the following new appointments in its western Branches:

J. A. Partridge, formerly manager of the gas sales division at Head Office, Montreal, has been placed in charge of the Winnipeg branch office. Mr. Partridge succeeds Don J. Telfer who has been transferred further west, to Calgary, to become manager of the Alberta branch.

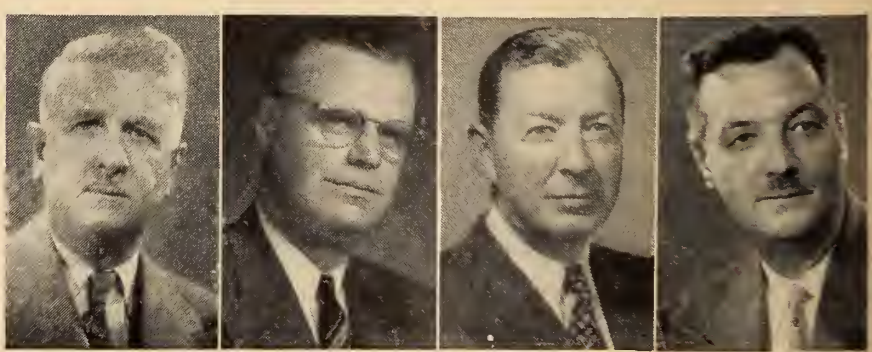
●

G. W. Hunter.—The Rt. Hon. C. D. Howe, Hon. M.E.I.C., has announced the appointment of Gordon W. Hunter, as Financial Adviser to the Department of Defence Production. Mr. Hunter succeeds O. A. Matthews whose appointment to the Board of Transport Commissioners became effective on January 1, 1953.

●

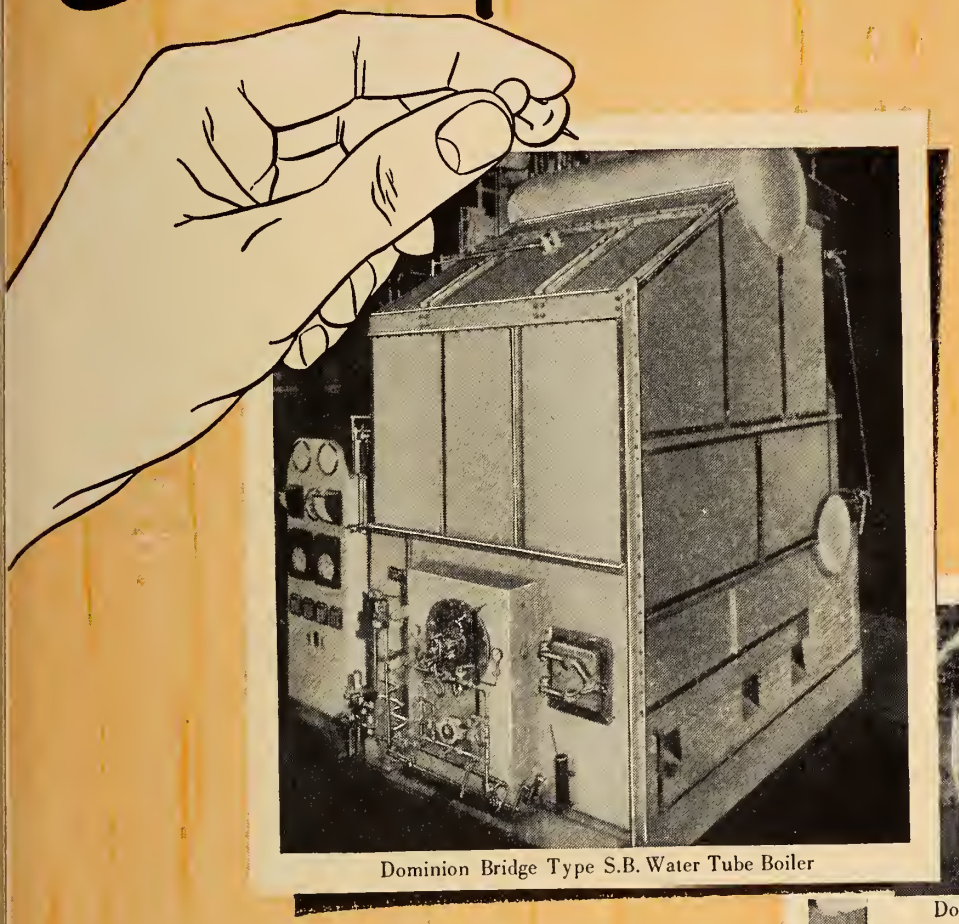
N. Slater Changes.—The following appointments have been made by N. Slater Co. Ltd., Hamilton, Ontario. C. W. Cassels has been elected president and general manager, W. G. Milne, M.E.I.C., has been appointed vice-president and managing director. R. W. Cooper, has been appointed executive vice-president. S. C. Watson, vice-president, sales manager pole line hardware division and Edward Garside, secretary-treasurer of the Company.

●



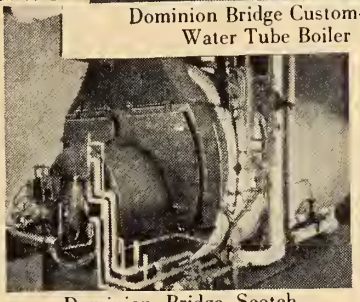
C. W. Cassels — R. W. Cooper — S. C. Watson — Edward Garside

Something NEW has been added

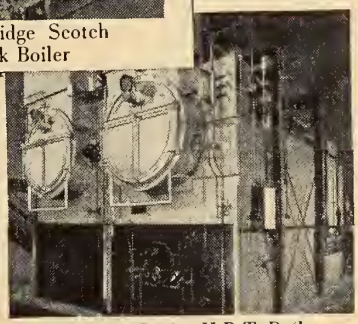


Dominion Bridge Type S.B. Water Tube Boiler

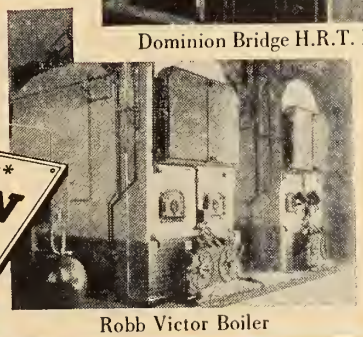
Dominion Bridge Custom-built Water Tube Boiler



Dominion Bridge Scotch Dry Back Boiler



Dominion Bridge H.R.T. Boiler



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The new type S B Water tube boiler is modelled on our larger custom-built steam generators and specially designed for the small to medium capacity field.

It has the same desirable features of high efficiency, reliability and fuel convertibility of the larger Dominion Bridge water tube boilers and is available in several sizes for outputs of 9,000 to 25,000 pph.

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*Other Divisions: STRUCTURAL, WAREHOUSE MECHANICAL, PLATEWORK

J. A. Porteous

C. M. Metcalfe

F. H. Brennian

Dominion Rubber Appointments. — The Dominion Rubber Company Limited has announced the appointment of J. A. Porteous as assistant to the general manager, mechanical goods division.

C. M. Metcalfe has been appointed manager of all hose sales and F. H. Brennian has been named manager of moulded goods and special product sales.

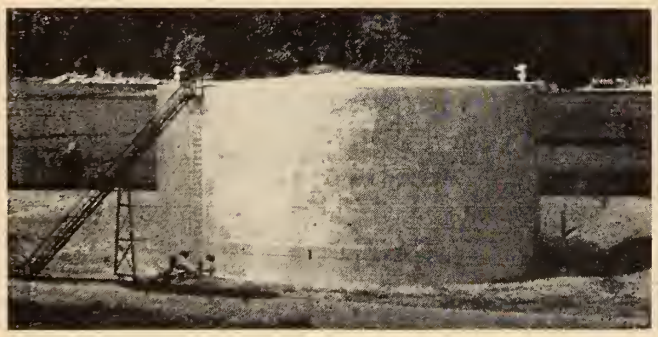
D. J. Mackenzie has been named sales manager, mechanical goods division, Toronto. He replaces G. A. Lamond, who has been transferred to Montreal and is now general manager of the Company's export division.

●

Perry T. Egbert. — On December 16th, the board of directors of Montreal Locomotive Works Limited elected Perry T. Egbert president of the Company.

Duncan W. Fraser, retiring president, will continue to serve as chairman of the board and William G. Miller, will remain as executive vice-president. ●

HORTON FLAT-BOTTOM TANKS



The above view shows a 35,000-bbl. tank installed at the McColl-Frontenac Oil Company, Limited, terminal at Barnet, B.C. One 15,000-bbl. and two 20,000-bbl. tanks were also installed at this terminal. Gasoline is received by ocean tanker and stored in the above-mentioned tanks until it is shipped by tank car to the interior of British Columbia, by tank truck to the Vancouver area and by barge to Vancouver Island.

If you are considering increasing your present or future storage facilities, write our nearest office for full details or tenders on welded steel tanks that are — built for the job.

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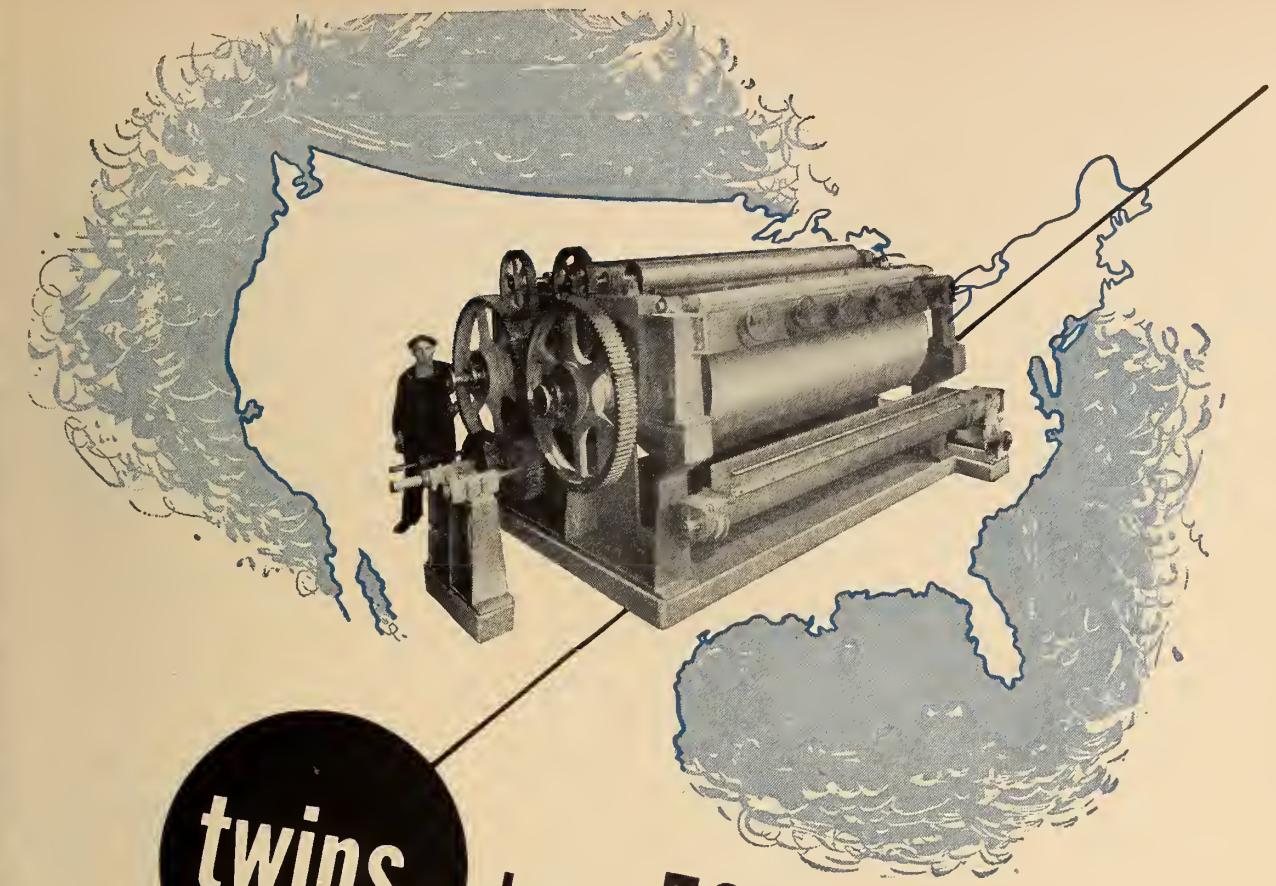

twins- born 500 miles apart!

The original atmospheric roller was fabricated in Chicago, Ill. The other one was made exactly to specifications in Toronto, Canada . . . This is only one of many instances where the "custom fabrication" service provided by Dominion Wheel & Foundries Limited can save heavy freightage, import duties and insurance charges on a specialized piece of equipment needed in Canada . . . We invite inquiries for such work. Many years of experience in translating original specifications to local requirements are invaluable. In some instances we are able to provide special Domite alloys (such as Noduloy) to produce an even better structure than the original.

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THE FOUR DIVISIONS of United Steel are engaged in the design and manufacture of essential components and complete installations . . . Transmission Equipment — Sanitation Equipment — Materials Handling Equipment — Coal and Ore Handling Equipment, and many other types of mechanical equipment for industry.

548

English Electric Changes.—A. Uretsky, has been appointed chief engineer of the English Electric Company of Canada Limited, St. Catharines. The appointment was made by M. B. Mallett, general manager, who has relinquished the post of chief engineer.

•

James M. Packham, general executive assistant, Canadian Vickers Limited, whose services are on loan from Canadian Vickers to the Canadian Government, department of defence production, as general executive assistant to the director, shipbuilding division.

•

R. H. Waddington.—R. H. Waddington has been appointed an assistant to the vice-president of the International Nickel Company of Canada. Before this appointment, Mr. Waddington was general superintendent of refineries at Copper Cliff and Port Colborne.

•

R. O. Cleworth.—Canadian Westinghouse Company Limited has announced the formation of a new agency and resale department. R. O. Cleworth, formerly manager of the Company's Niagara district sales office in Hamilton, will manage the new department.

•

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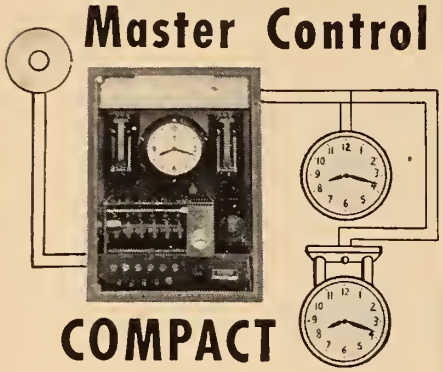

COMPACT

Clock Systems, Time Recorders ond Time Stomps will olwoys be on time, when you instoll the NEW Stromberg Synchronous Master Control. This new compact unit, much smoller but with oll the features of previous models, automotically sends out an electricol impulse —every minute—to oll clocks! In addition, it checks their uniformity every hour . . . moking sure oll the clocks in the system are synchronized.

The Stromberg Synchronous Moster Control is precision mode, sturdily constructed, for long weor—seoled in dustproof, tamper proof cose. It requires no regulating. And on outomatically wound spring keeps it running—perfectly, even during current foilures.

When it comes to providing perfect occuracy over any system of clocks, you can't beat the Stromberg Synchronous Master Control. Find out for yourself! Write us for complete details. S-5304R

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New Equipment and Developments

New Reliance Motor. — Reliance Electric & Engineering (Canada) Limited, Welland, Ontario, has announced what may be termed a totally-enclosed, dual-cooled motor, equipped with a heat exchanger as an integral part of its own frame. A 1½-hp., 3-phase, 60 cycle motor, built into the heat exchanger, runs at 3600 rpm. to drive internal and external fans independently of the main motor itself.

The heat sections are cast aluminum with both internal and external fins for maximum heat dissipation. Air velocity through the internal sections of the exchanger is 2900 fpm. In the external path between the cover and the exchanger bank the air is pumped at 3300 fpm.

The new design also simplifies maintenance.

In a news item covering this development it is stated "because cooling efficiency has been increased, use of smaller motors for a given horsepower is possible. This, in turn, enables Reliance to build totally enclosed motors up to 150 hp.—double the limit previously imposed. The new dual-cooled design also enables Reliance to build motors in all these sizes for use in hazardous atmosphere, such as coal mining, and for difficult industrial applications.

The new units are available in sizes up to 150 hp. with Underwriters and Bureau of Mines approval.

●

Meter Approved.—The Canadian Westinghouse Company Limited has announced that its new 25 amp. watthour meter with standard register has government approval for a maximum rating of 100 amps. This approval allows a saving of $6.00 per meter installed over the meter formerly available for lightly loaded 100 ampere services.

●

Westinghouse in the West. — Canadian Westinghouse Company has announced that it plans to manufacture distribution transformers in western Canada.

For the present, Company premises in Calgary will be used for this purpose.

To serve the needs of progressive western public utilities, who are encouraging increased use of electricity in homes and on farms, Westinghouse has taken this latest step in decentralization of manufacturing facilities.

●

British Industries Fair. — The British Industries Fair promises to be the largest in the history of this internationally-known industrial exposition.

In London there will be two fair centres—mainly chemicals, fancy goods, food, plastics, pottery, light machinery, scientific and sports goods and textiles. In London, also, will be a huge Commonwealth display, organized officially by all the Commonwealth governments. The largest since the war, its 23 exhibitors will occupy 9,000 sq. ft. of floor space.

At Earls Court, London, largest unobstructed indoor arena in the world, there will be a huge textile display, the Commonwealth section, and eight other main trade sections.

At Olympia, London, more than a thousand exhibitors of lighter industrial products will be presented.

At Birmingham, the heavy engineering section will be located.

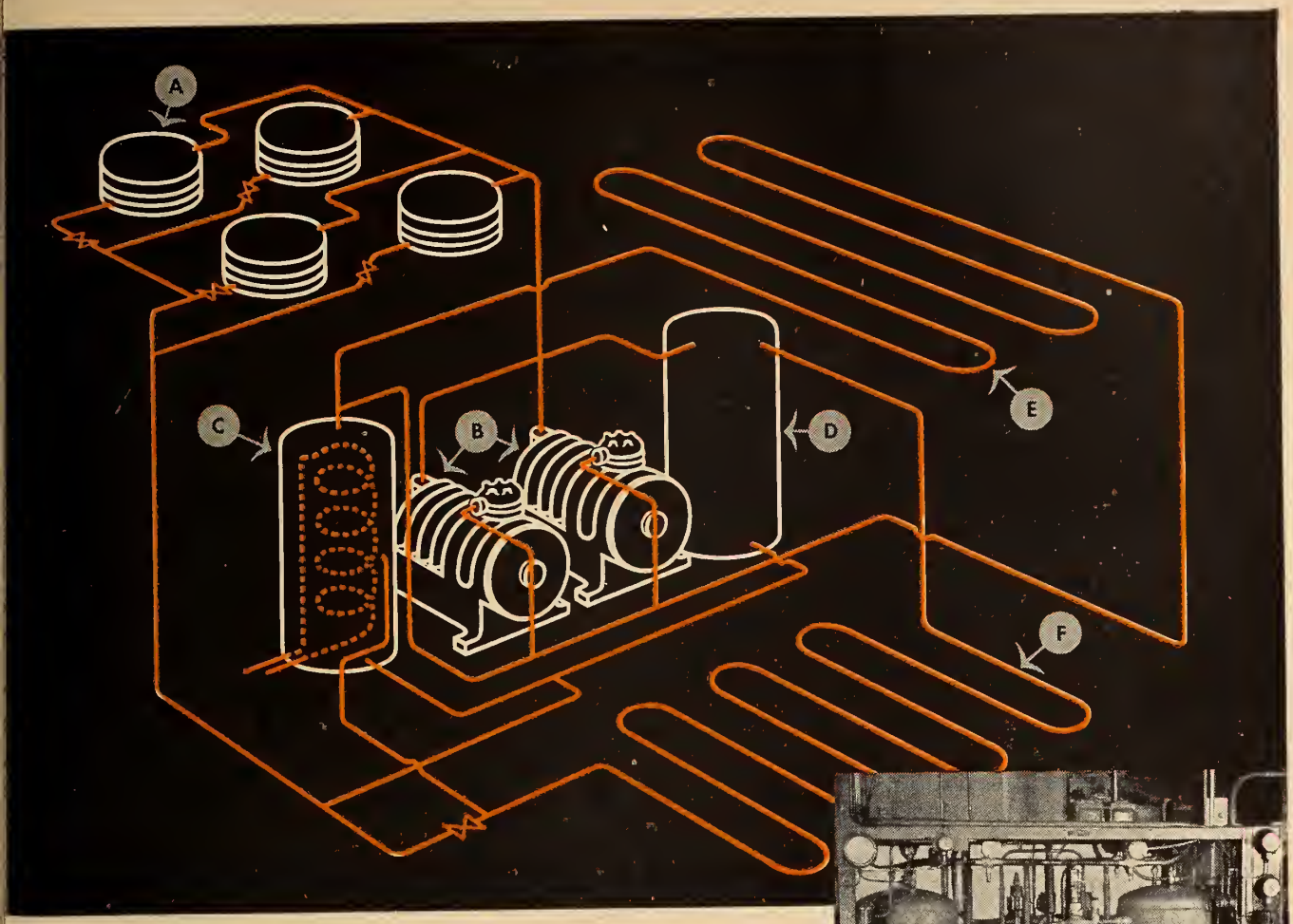
Castle Bromwich, Birmingham, will house 1,300 exhibitors of hardware, building and heavy electrical goods and engineering, quarry, transport and farm equipment. Also at Birmingham will be displayed a new type of electrical generating plant made to retail at less than $900.00 (in Britain) and a new 250-watt battery charging unit.

In the engineering section at Birmingham new developments will include an electric spot welder which shoots spot welds like a sub-machine gun . . . a loom designed for weaving

(*Continued on page 88*)

English Electric Meeting.—Recently Sir George H. Nelson, chairman and managing director of The English Electric Company Limited, met the district managers and other members of the staff of the English Electric Company of Canada Limited.

Shown in the picture above and seated from left to right: I. S. Patterson, St. Catharines; Sir George N. Nelson; M. B. Mallett, general manager of the English Electric Company of Canada Limited; H. B. Style, president of the English Electric Company of Canada Limited; D. O. D. Ramsdale, St. Catharines; and W. G. Gibson, Montreal. Standing are: (l. to r.) R. J. A. Behan, St. Catharines; H. W. Tucker, Ottawa; E. P. Watt, Ottawa; Frank Bennett, Halifax; D. A. Gray, St. Catharines; G. L. MacDonald, Winnipeg; F. Watson, St. Catharines; C. F. Domoney, Calgary; D. C. Brooking, Montreal; E. Wolstencroft, Vancouver; and P. J. Farmer, Toronto.

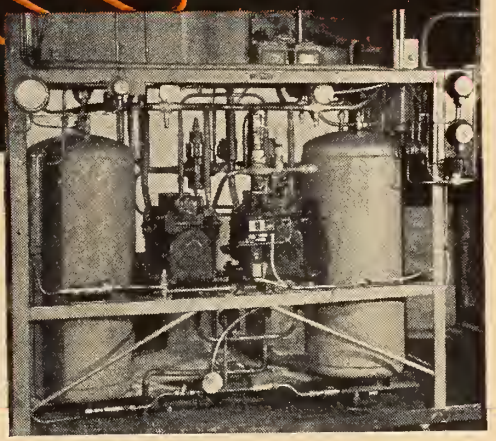


ANACONDA Copper Tubes contribute to the success story of a "HEAT PUMP"

HOW IT WORKS—*Heat pump system in sausage plant removes heat from sausage with forced-air refrigerating convectors (a). Compressors (b) use Freon-12 refrigerant. 80-gallon heat exchanger tank (c) warms domestic water running through 300 feet of copper tubing. Surge tank (d) takes care of vapor or liquid refrigerant. 500 feet of copper tubing in office floors (e) provides radiant heat, and 1800 feet in basement floor (f) dissipates heat in summer, stores it for radiant heating on nights, weekends.*

■ When both heating and cooling sides of a refrigeration system are put to work, it's a true heat pump *with important operating economies.* In this example Anaconda Copper Tube plays a big part because of its heat-transfer properties, corrosion resistance and consistent uniformity.

Primarily this system was designed to cool cooked sausage. But the "heat" side now does *three* jobs: (1) heats offices, (2) provides washroom hot water, (3) stores heat underground, for use when meat is not being processed. Expansion plans for the system may make further use of the heat. Write for full description of the installation, to Anaconda American Brass Limited, Head Office and Plant: New Toronto, Ontario, Montreal Office: 939 Dominion Square Building.



HEAT PUMP HEART—All mechanical equipment is assembled as a packaged unit. Two 3-hp. compressors, plus automatic controls, are located between heat exchanger (left) and surge tank (right).

HEAT USED—Shown here is part of the 500 feet of copper coil embedded in concrete slabs in the floor of adjacent plant offices and other areas. This tubing circulates the refrigerant gas to furnish radiant heat.

modern piping calls for ANACONDA copper tubes

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 84*)

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Journal readers who are contemplating visiting Britain this year are advised to make their reservations early in view of the forthcoming Coronation. British Trade Commissioners in Canada can be of great assistance in arranging visits to the Fair.

●

Nylon Truck Tires. — All-Nylon truck tires are now available to the automotive transport industry across Canada, according to an announcement made by H. G. Harper, Vice-President in Charge of Sales, The Goodyear Tire & Rubber Company of Canada, Ltd.

Commenting on these products Mr. Harper said "introduction of the All-Nylon truck tire, with its super-strong carcass, means that operators will be able to 'pare' tire costs to the bone." For complete information on these tires consult any Goodyear distributor.

●

Huge Underground Blast.—The biggest single blast in the underground mining program of The International Nickel Company of Canada, Limited, has reduced to handling proportions two giant blocks containing 400,000 tons of nickel-copper ore. The blast, at Inco's vast Frood-Stobie Mine near Copper Cliff, required 64 tons of explosives and the drilling of 2,000 blastholes totalling more than 31 miles in length. The broken ore would fill a train of freight cars 14 miles long. So well designed was the blast that only a muffled explosion was heard, less noticeable even

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than an ordinary blast on the benches, or steps, forming the open sides of the pit. No one in the area realized that so large an explosion had been made except those employed on the job.

The blast, climaxing months of careful planning, was the second of its kind at Frood-Stobie this year. Earlier, a 225,000-ton pillar was blasted to pieces for removal to the surface for treatment.

●

B. F. Sturtevant Expansion.—The B. F. Sturtevant Co. of Canada Ltd., will celebrate its fortieth year in Canada with the completion of a $260,000 addition to its head office and plant at Galt, Ontario. Greatly increased sales during the past years, and an anticipated volume of new business in the future, are responsible for the large expansion program now in progress.

Sturtevant, a subsidiary of the Canadian Westinghouse Co. Ltd., manufactures air handling, air cleaning and air conditioning systems.

●

Nickel Patent Upheld. — The British Patents Appeal Tribunal, in a judgment of wide industrial interest, has upheld the decision of the British Patent Office to grant to the Mond Nickel Company Limited, an affiliate of the International Nickel Company, Inc., a patent covering the production of Ductile Iron.

●

BRANCH NEWS

(*Continued from page 57*)

Using slides and a demonstration model, Mr. Harland explained in detail the operation of the carrier current control system. Although a number of difficulties were met and overcome in the early stages of the program, a fault record of less than one-twentieth of one per cent per month testifies to its present reliability.

A lively discussion followed Mr. Harland's address. He was complimented for its excellence by Mr. J. J. Halme, apparatus manager for the Canadian General Electric Company, who spoke on behalf of the large number of members in attendance.

President Discusses Shortage of Engineers

During a press interview in Winnipeg on November 6, Dr. J. B. Stirling of Montreal, president of the Engineering Institute, stated that Canada's unprecedented industrial growth in recent years has brought about a serious shortage of electrical, mechanical, and civil engineers.

This shortage of engineers, he pointed out, is due partly to lack of accommodation in some universities and to the lack of students going into the course. There is also a "tremendous casualty list" in the engineering courses, he said. About 40 per cent of the undergraduate students never make the grade.

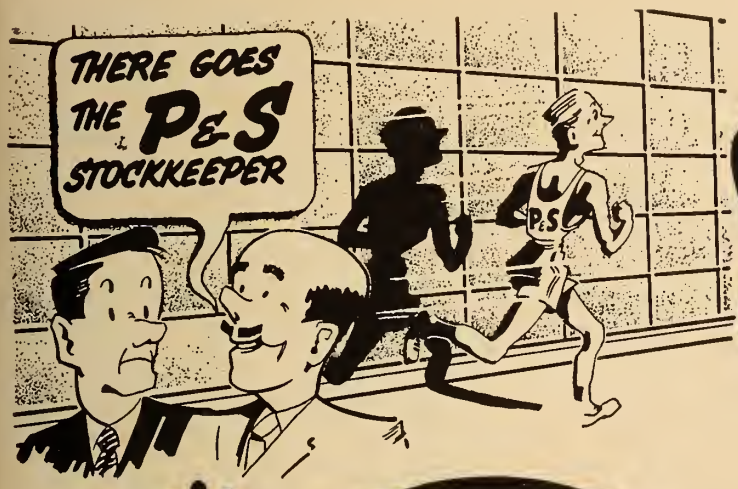
"So many young students go into engineering who are not fitted for it, and so many who would be fitted for it, don't go into it," he said.

In an effort to meet this problem, he continued, the universities and the Engineering Institute are uniting on a vocational guidance project in high schools. Under the auspices of the Canadian Committee for Student Counselling, the Chemical Institute of Canada, and the Canadian Institute of Mining and Metallurgy are joining forces with the Engineering Institute on this project, Dr. Stirling said.

He believed that the Winnipeg branches of these groups would be working with Manitoba schools within a short time.

Contrary to popular belief, "very few engineers are leaving Canada for the United States," he pointed out. As many engineers are coming into this country as those who do go south he added. The American engineers are being brought here by the huge investment of American capital in Canada.

Dr. Stirling stopped in Winnipeg on his annual visit to Institute branches across the country.



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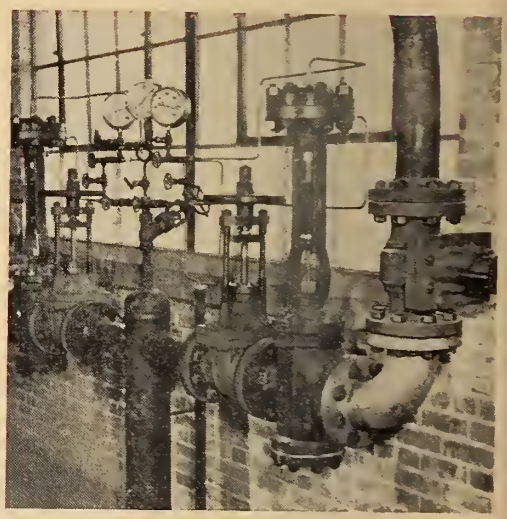

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A paper presented before
the Centennial of Engineering, Chicago, Ill.,
on September 5, 1952.

The Initiative in Airliner Design

by
Elizabeth M. G. MacGill, M.E.I.C.
Consulting Engineer,
Toronto, Ont.

Introduction of turbine-powered airliners into scheduled service is the challenge facing commercial aviation today. The twenty-year period of American reciprocating-engine airliner supremacy is recalled, and a parallel drawn between it and the design and production of turbine-powered airliners today in the United Kingdom. British designers have a 3-to-5-year start, and a good chance of capturing market leadership.

The Canadian aviation defence program is cleared of responsibility for the lag in commercial design in Canada, which is attributed to loss of will and resource, ascribed to the influence of 13 years of concentration on military projects. Further deterioration is anticipated because military and civilian research aims, once roughly identical, now diverge.

Gas Turbine Signals a Change

The commercial exploitation of the aircraft gas turbine engine, and the introduction of turbine-powered airliners into scheduled service on the world's air routes is the challenge facing commercial aviation today. The immediate problems are not aeronautical, for the familiar reciprocating-engine airliner configuration can be continued without serious compressibility effects up to speeds of approximately 600 m.p.h. Considerations of passenger comfort will probably preclude higher speeds for some time to come.

The immediate problems are operational. They devolve upon the mode of propulsion (turbo-jet or turbo-prop) best suited to present routes, and to the opening up of new routes. They rise from the characteristics and limitations of the turbine engine itself. These limitations at present include the large reductions in power and large increases in fuel consumption caused by small rises in atmospheric temperature, with consequent loss of take-off power on the ground, loss of altitude in flight, and high operating expense.

They also include the high costs of engine overhaul and repair, especially for the turbo-prop; the rates of fuel consumption which, except in the narrow design band of engine cruising conditions, are as yet so excessive as to make today's conventional airline practices of taxi, run-up, take-off, climb, stand-off and descent too expensive for regular commercial work. The last noted bears most heavily upon the turbo-jet, for the turbo-prop, while lacking the turbo-jet's speed potential, combines the advantages of the improved thrust of the turbine with the relative flexibility and effectiveness at part-load of airscrew propulsion.

The solution of these problems lies in engine design improvements, in auxiliary measures to provide extra lift when needed, and in practicable techniques and procedures in flight and in ground handling. Replacement of the present fleets of piston-engined airliners with turbine-engined types will bring with it a whole new set of operational concepts. This is not surprising, since it will be the first change in basic type of airline equipment since air transportation developed on a world scale in the "thirties".

Now that British turbine-engined airliners are trickling into service here and there, the general change-over cannot long be delayed. British Overseas Airways Corporation currently operates nine British turbo-jet "Comet I" airliners on its London to Johannesburg route; Canadian Pacific Airlines looks for early delivery of two "Comet IA" airliners for its Pacific run, and has four "Comet III" airliners on order for 1954. Pan American World Airways expects "Comet III" airliners by the end of 1956, the first foreign airliners ever ordered by an American line; Trans-World Airlines is reported to be ordering British turbo-prop "Viscount" airliners for use in 1955. If the fleet replacements of the world's airlines do come from the United Kingdom, a new balance will have been struck in the aviation world.

American Initiative in the "Thirties"

For over twenty years the United States has led in the commercial design and operating fields. Consequently, today American operators carry more of the world's air tonnage than all other airline operators together, and American aircraft are in the majority on all the routes except the feeder routes. Around the

TABLE 1

SHORT — MEDIUM — LONG RANGE CIVILIAN AIRLINERS

Aircraft Make and Model	Type	No. crew	No. Passengers	Engine Data: Type	Engine Data: No.	Engine Data: Total T.O. hp.	Fuel capacity U.S. gals.	Span ft-in.	Overall Length ft-in.	Prop. No. and diam. ft.-in.	Weight pounds: Gross	Weight pounds: Payload	Speed m.p.h. at altitude ft.: Max.	Speed m.p.h. at altitude ft.: Cruise	Range miles	Initial climb f.p.m.	Service ceiling ft.	Year prototype flew	Remarks
1. BOEING																			
Stratocruiser	PC-L	5-7	60-80	RC	4	14,400	7,790	141-3	110-4	16-6 (4b) Four	142,500	30,000	375 at 25,000	320 at 25,000	3,000	1,100	33,000	1944	Conversion from military XC-97
2. CONVAIR																			
340	CT	3-4	44	R	2	4,800	1,750	105-8	79-2	13-6 (3b) Two	45,000	11,632	320 at 14,500	284 at 18,000	3,200	1,340	27,000	March 1947	Convertible to turbo-prop Turboliner
240	P-L	3-4	40	R	2		1,550	91-9	74-8		41,790	9,770	347 at 16,000	272 at 16,000	1,840	1,520	26,200		
3. DOUGLAS																			
DC6B-1198	PC-L	5	52-92	R	4	9,600	4,700	117-6	105-7	13-6 (3b) Four	100,000	22,300	360 at 18,100	315 at 22,400	3,750 3,750	1,040	26,000	1947	DC-6 from DC-4 prototype DC-4 flew in 1938
DC6B-1225	PC-L	7	52-	R	4	10,000	5,380				103,000	16,190	368 at 19,700		4,010	1,080	26,000		
DC6B-1225A	PC-L	7	54-	R	4	10,000	5,484				107,000	16,898			4,070	1,000	26,000		
DC-7	PC-L		60-	RC	4	14,000	6,600		108-11		122,200		410	370	5,350	1,810	28,200	1951	DC-7 from DC-6
4. LOCKHEED																			
Constellation																			
-649	PC-L	4-6	44-64	R	4	10,000	4,690	123	95-1	15-2 (3b) Four	94,000	19,280	350	328	3,000		25,000	Military prototype Jan. 1943	
-749A	PC-L	4-6	44-64	R	4						105,000				5,500				
Superconstellation																			
-L1049B	P-L	11	65	R	4	10,800	6,570	229	113-7	15-2 (3b) Four	120,000	17,700	332 at 20,000	312 at 20,000	5,250	1,163	21,500		Convertible to turbo-prop
-L1049C	P-L	11	63	RC	4	13,000		260			130,000	19,400	364 at 20,000	305 at 20,000	4,300	1,193	24,100		
5. MARTIN																			
-404	P-L	3	40	R	2	4,800	1,350	93-3	74-7	13-1 (3b) Two	43,650	11,592	312 at 14,500	280 at 18,000	1,625	1,790	29,000	202 flew Nov. 1946	404 from 202 Convertible to turbo-prop
6. deHAVILLAND						pd-thrust													
Comet I	P-L	4	36-28	TJ	4	20,000	7,220	115	93	—	10,500	14,000	—	490 at 40,000	2,500	—	—	July 1949	1st commercial turbo-jet in the world
Comet II	P-L	4		TJ	4	26,000								500				Feb. 1952	
Comet III	P-L	4	55	TJ	4	30,000								550					
7. BRISTOL																			
Type 175	P-L		50-100	TP	4	25,200 hp and 6,400#T	8,300	140	114	16-4 (4b) Four	140,000	25,000		360 at 30,000	4,000	—	—	—	
8. SAUNDERS-ROE																			
Princess	P-S	8	100 200	TP	10	34,000 hp and 8,000#T	17,400	219-6	148	16-6 (8b) Ten	315,000	40,000	—	380 at 36,000	5,500	—	—	1951	
9. VICKERS-ARMSTRONG																			
Viscount 1	C-T	2-5	40-48	TP	4	5,600 hp and 1,424#T	1,750	94	81-2	10-0 (4b) Four	50,000	12,500	341 at 20,000	310 at 25,000 316	2,080	1,525	28,500	July 1948	1st commercial turbo-prop in the world
Viscount 2	C-T			TP			2,065												

CT—commercial transport P—passenger L—landplane S—seaplane C—cargo R—reciprocating engine RC—reciprocating engine turbine compounded TP—turbo-propeller TJ—turbo-jet #T—pounds of thrust b—blades

world the very names of the American airliners—"DC-6", "Constellation", "Stratocruiser"—are as familiar as household words. Their prototypes flew in the early "forties", yet their production models are still being built, are being used to open up new routes, and will see service for years to come.

All are "stretched" versions of prototypes that adhered to the twin-engined or four-engined design formulae developed in the early "thirties". By that master-stroke, American designers, exploiting the new Dutch and German all-metal monoplane techniques that were then making fabric, wood and the biplane obsolete, seized the design initiative. Devising new design formulae and new operating techniques (centred upon the reciprocating-engine and the variable pitch propeller), they established a supremacy that has remained with them up to the present time. Probably the "DC-6", "Constellation" and "Convair" are the ultimate expressions of these formulae, for it is the nature of aircraft design to meet obsolescence at the height of success.

Today, the gas turbine engine offers wholesale increases in thrust at practicable fuel costs. To be fully effective it, however, like its predecessor the reciprocating-engine, requires aircraft design and operating techniques tailored to its particular characteristics. Consequently, the opportunity for a repetition of the American coup has been opened up.

British Initiative in the "Forties"

This time, however, it is the United Kingdom that has seized the design initiative, and is making a spectacular bid for supremacy in the field of airliner design.

Table I shows the position clearly. Only the United Kingdom and the United States are continuing as general suppliers of large airliners, since the development costs run into millions of dollars. The United Kingdom, desperately needing trade, and with a whole market to gain and little to lose by forcing the change-over, has abandoned the reciprocating-engined airliner in the short, medium and long range categories. Regardless of the uncertainty of the aeronautical world as to which type of powerplant (turbo-prop, turbo-jet, or compound diesel) has the greatest commercial advantage, she has put several turbo-props and one turbo-jet airliner into production.

The United States, on the other hand, has produced no commercial turbine-powered (or compound diesel-engined) airliners at all. She has continued the design and production of piston-engined machines, for the very magnitude of American market success acted as a brake on enterprise. Strongly entrenched, and with heavy vested interests in the piston-engined machines, American manufacturers and operators had little to gain and much to lose by an early, perhaps a premature, change-over. Thus, when aircraft were needed for the ever-expanding air routes they stuck to the reciprocating-engine, introduced turbine compounding to give increased speed, and hedged their designs with compromises to permit conversion to turbo-props later on, if expedient.

The Avro Canada CF-100 Fighter.

British Lead in the "Fifties"

American experience with the 20-year-old Douglas DC-group indicates that where the original design has plenty of "stretch" in it, operational economy can be improved over the years by a continuous process of increasing power, altitude, speed, fuel economy, range, payload and size. Table I shows that the same practice is being applied with good effect to today's turbine-engined airliners. However, big aircraft reduce the overhead per passenger and, with pressurized cabins, can be operated at higher altitudes to get higher speeds. Higher speeds in turn improve the power and economy of the gas turbine, especially of the turbo-jet. It is therefore probable that the "stretching" process will be even more effective with the turbine-engined airliners than it has been with the piston-engined types.

Consequently, if with "stretching" the present British aircraft can ring the changes required by the various air routes, they and their variants may be able to establish themselves universally. "Stretching" the "Comet" from "Comet I" to IA to II to III is a step in that direction. Furthermore, since only a relatively small number of commercial airliners are needed (fleets of over 150 being uncommon), large-scale production as the military manufacturer knows it does not apply, the "break-even" point remains relatively high, and competition is discouraged. Once established, the new airliners have an excellent chance of holding their place for a long time, just as the American machines did.

By seizing the initiative, the designers and operators of the United Kingdom have gained what amounts to a 3-to-5-year start on the rest of the world in the commercial exploitation of this new type. Economics, and the backlog of design and operating experience such a lead affords, promises them a firm grip on the immediate and future market for airliners.

Canadian Initiative and Withdrawal

The opportunity that the United Kingdom turned to such good advantage we in North America passed over. Canadian engineers in particular must regret that Canada is not now hitting the market with a jet airliner, remembering that

Canada pioneered that type on this continent. Three years ago, on August 6th, 1949, only ten days after the "Comet" prototype made its record-breaking take-off, A. V. Roe Canada Ltd., of Malton, Ontario, flew its prototype "Jetliner", a 4-engined, 40-passenger aircraft in the short range category, and the first commercial turbo-jet airliner designed and built in North America.

No program of intensive development followed, however. Last year all work on the "Jetliner" stopped in order to concentrate effort on and release plant capacity for military commitments. Last summer press notices hinted that the "Jetliner" might be built under license in the United States, after some development and redesign by an American company to increase its range. Ironically, with all to gain and nothing to lose, Canada bowed out of the field she had pioneered, without attempting to exploit it commercially.

Belated American Efforts

No prototype commercial turbo-jet airliner has yet been designed and flown in the United States, and those that Boeing, Douglas and Lockheed are now reported to be developing are probably 4 to 7 years away from scheduled airline service. No turbo-prop airliner prototype has yet come out of American shops. The Lockheed "Superconstellation" and the Martin 404 are convertible to turbo-props, and the Convair "Turboliner", a standard twin-engined Convair 240 equipped with Allison T-38 turbo-props, was flown on December 29, 1950, to check the feasibility of such conversions. Although compromise designs usually pay in reduced performance for the convenience they afford, these will at least provide operating experience, and probably save something in development costs and time; and time, of course, is of the essence.

Maxims Connected with the Prototype

The three or four years which are the minimum period for designing, developing and putting the first version of the prototype into limited production, must be followed by one or two more spent in analyzing flying qualities and operating performance characteristics, improving them (by major re-design if necessary), perfecting the mechanisms of the various control systems and conditioning systems, preparing production drawings, and organizing procurement and production. A further year of trial runs, of crew training and route familiarization by the airline operator is usually needed.

Indeed, a total of six years from the start of a design to the introduction of the production model into scheduled service is a very creditable achievement, for the times mentioned are minima, and allow for no major hitches. This assumes that the design is a success from the start — and few are, the prototype seldom coming up to expectations on its initial trials. The design field is highly speculative and, as in bringing in a gusher or locating a gold strike, more than one try is usually necessary. It was said of fighters during the Second World War that only about one design in every 28 turned out to be a winner.

Probably three or four casualties to each success is more appropriate to the conventional airliner, but new types bring new problems. Moreover, the market always presents a formidable hurdle for the commercial machine. The British aviation industry, in its diversification of effort, with one turbo-jet and three turbo-props in production, with a fourth turbo-prop, the Bristol "Britannia," past the prototype stage, and with a second turbo-jet, the Handley Page "Intercontinental", under development, shows good appreciation of the speculative nature of aircraft design. It also shows recognition of the circumstance that design is an art requiring continuous practice for success, with design experience building on itself to produce that unique product, the effective airplane.

Canadian Swing to Production of Defence Aircraft

The challenge the United Kingdom accepted so vigorously we on this continent shirked, although the pressure of military commitments bore no more hardly here than there. The Canadian aviation defence program is a demanding one, and a heavy one—how heavy you can judge from the following outline. In 1946, the same year the company commenced the design of the "Jetliner", A. V. Roe Canada Ltd. was commissioned by the R.C.A.F. to design and develop an all-weather, twin-engined jet fighter, the "CF-100", for use in the defence of northern Canada (no suitable fighter being in existence), and a 6,500-pound thrust turbo-jet engine, the "Orenda", to power it.

Prototypes of "Orenda", "Jetliner" and "CF-100" were completed in 1949, a remarkable achievement, particularly for so recently formed and untried a design staff. Two prototype "CF-100", powered by Rolls Royce "Avon" turbo-jet engines were produced, and an "Orenda" version was developed. Last spring pre-production fighters were put into training service by the R.C.A.F. The "Orenda TR5" engine is now in production.

At Montreal Canadair Ltd. is in production for the R.C.A.F. and the U.S.A.F. on the single-engined jet fighter the North American "Sabre F86E". A "Sabre-Orenda"

An artist's impression of the Bristol Proteus-powered "Britannia" in flight.

A British "Canberra" jet bomber of the type shown above established a new record for a flight from England to Australia recently. The bomber, taking off at 8.36 a.m. G.M.T., January 27, 1953, in London, covered the 8,608 miles to Darwin in 22 hours and 1 minute elapsed time. Time out for stops was reported to be 3 hours, so that the actual flying time for the trip was 19 hours and 1 minute.

has also been turned out. Canadair Ltd. is going into production for the R.C.A.F. on the Lockheed "T-33" two-seat trainer, powered by the 5,000-pound-thrust turbo-jet engine "Nene", the latter to be assembled in the new Montreal plant of Rolls Royce Ltd. For the U.S.A.F. Canadair Ltd. is tooling up to build the piston-engined Beechcraft T-36 advanced trainer-transport, in the design of which the company participated.

DeHavilland Aircraft Company of Canada Ltd. is producing for American use its own light liaison aircraft "Beaver", which won an American military design competition in 1951. Canadian Car & Foundry Company Ltd. will produce the *ab initio* trainer Beech "T-34" for the U.S.A.F., and is currently building North American "Harvards" to be used as intermediate trainers by the R.C.A.F. Canadian Pratt & Whitney Company Ltd. has built a new plant at Montreal to assemble Wasp engines for the "Harvards".

These companies are the main suppliers, and subcontract work for them engages the full capacity of many hundreds of other manufacturing firms both large and small. The whole constitutes a well-integrated, single-valued program aimed at providing Canadian sources of supply for the equipment needed for training and defence by the R.C.A.F. and the air forces of other western nations.

The need and importance of this military program, with its wise emphasis on self-reliance, is understood and accepted. Yet, with the example of the United Kingdom before us, to offer it as an excuse for our failure to meet the commercial design challenge of our times is to deny our purpose and function as an industry. The true explanation is that our resource and will failed to live up to the demands made upon them.

This lack of resource, or more accurately *loss* of resource, is perhaps directly attributable to the cumulative effects of 13 years of concentration on military projects. The enormity of war and the immediacy of its needs stultifies civilian values and numbs civilian critical faculties. Moreover, the habit of accepting military technical aims as the only important aims closes the mind to the value and necessity of making efforts also in other directions. Long and close association with military attitudes and procedures reduces independence of thought, and channels initiative away from other fields.

Comparison of today's Canadian aviation industry with the pre-1939 industry shows that today's is much larger and much more stable financially but that in general it no longer sets its own policies, dictates its own design programs, controls its own operations, practices thrift, spends its own money, builds and operates its own plants. It has placed its initiative and independence, and perhaps some part of its integrity, in pawn for that expansion and security.

Military versus Commercial Design

Moreover, the new cleavage that is developing between civilian and military design fields weakens the civilian position still further. In the past, military and civilian research aims were roughly identical. The civilian designer leaned on military objective research for technical information, and for the pioneering of new inventions and techniques. Now, as Sir Harry M. Garner[2] has pointed out, the civilian designer can no longer rely on military research for help, for the design aims diverge widely. The very speed regions to which each group aspires emphasize the extent of the divergence.

The military designer focuses attention on the transonic region, where compressibility introduces problems of instability and high drag, through the supersonic region, and into the transthermal region where frictional heat brings temperature rises that call the strength of the structure into question. With his mind on the robot and the rocket he seeks design formulae for the truly high speed machine. His ultimate success will make military aviation as we know it today a thing of the past, the rocket-propelled guided missile rendering obsolete today's manned interceptors and bombers and tomorrow's pilotless bombers.

Meanwhile the civilian designer is anchored to the subsonic region, until such time as his ingenuity can insure complete reliability for

(*Continued on page 108*)

Fig. 1. View of the Hospital, looking from the southwest.

THE NEW GUELPH GENERAL HOSPITAL

Some Notes on its Architectural and Structural Design

by

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The new Guelph General Hospital was completed by the Pigott Construction Company on July 31, 1951, at a cost of $1,430,000; construction took about 19 months. It has a continuous reinforced concrete skeleton frame and slab-band floors poured in place to form an L-shaped building at a unit cost of $9,000 per bed or $1.24 per cubic foot. The present capacity is 160 beds, generally about 30 on each of the five floors above grade, leaving a service core at the junction of the two wings, arranged for the addition of another wing to accommodate 100 more beds. The building would then have a T-shape.

Exterior walls are of red wire-cut face brick backed by terra-cotta tile. The double-hung wood windows are separated by light-weight sheet-aluminum panels backed up by masonry and grouped in various arrangements on a modular basis. Window sills are also of aluminum; both panels and sills have been anodized for weather protection. Interior partitions are of terra-cotta tile with plaster on both faces, except in damp or steamy rooms, where a ceramic tile facing is used. To allow for terrazzo finishes in the main lobby and special rooms and for a linoleum finish elsewhere, the entire structural floor is 1½ inches below the finished floor lines.

The corridor ceilings are of special acoustic plaster and are suspended from the slab-bands above them to allow room for ducts and pipes.

In plan, the basement is larger than the five floors above it, because it projects 25 ft. 6 in. behind the east wing and adjoins the north wing, extending 156 ft. 7½ in. therefrom. The ambulance entrance is in the basement and leads directly to the emergency operating suite.

A modern well-lighted kitchen as well as storage areas, nurses' quarters, and dining rooms are also in the basement. Kitchen facilities include areas for refrigeration. The mechanical and electrical rooms are also located in the basement.

The first floor contains the X-Ray department, the therapy treatments department and fracture rooms, as well as the admittance rooms, the administrative offices, the board room, the internes' quarters and the main lobby and reception desk.

The second floor is a surgery floor containing three major and two minor operating rooms, and 30 beds in private, semi-private and semi-public rooms.

The third floor has laboratories, a linen room and pharmacy store rooms, as well as a supply room from which the sterile essentials for the whole hospital are issued. These rooms are located in the north wing; the plan of the east wing of the third floor is the same as that of the second floor and contains 30 beds.

The fourth floor is the maternity floor, containing three labour rooms and two delivery rooms with 30 patient beds and 37 nursery cubicles. There are three nurseries, two of which have an examination and inspection room between them, and they accommodate nine babies each. A third nursery contains 15 cubicles and has its own examination and treatment room, which also accommodates a special nursery for premature babies and suspect cases among the normal babies (Fig. 6).

Fig. 2. This photograph of the north wing shows the underside of the floor construction.

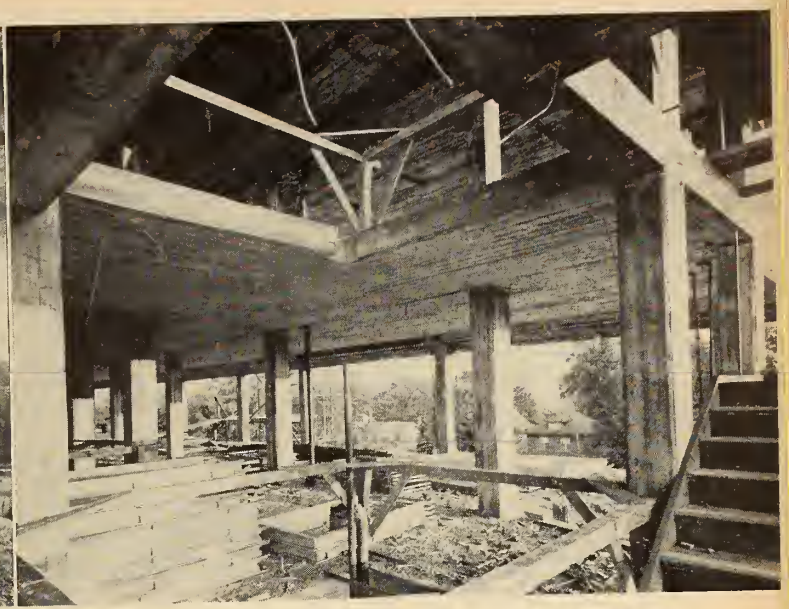


Fig. 3. Openings in the concrete slab-band for ducts and stairs.

The fifth floor is a medical floor, containing 30 beds in the east wing similar to the second floor, except that the pediatrics department is in its north wing. It has a nursery for sick babies, and observation room, a small isolation ward, and an examination room as well as two-bed and four-bed rooms for children in which the beds are separated by steel and glass partitions (Fig. 5).

The sixth floor is the first story in the penthouse and houses the elevator machinery as well as the ventilating supply units.

The seventh floor is the second story in the penthouse and contains the exhaust fans for the whole hospital, which discharge through individual openings in the concrete slab above them into a monitor-type roof ventilator.

The new "Guelph General" is one of the first hospitals in Canada to have its operating suites built in conformity to the latest standards of the National Fire Prevention Association for explosion-proof operating rooms. The floor finish is a special conducting material known as "Hubbellite terrazzo" and all fixtures and fittings on the floors and for a height of five feet on the walls are explosion-proof. There are two large work-rooms each equipped with the best high-speed sterilizing facilities.

This new hospital also conforms to the requirements of the Ontario Government as to minimum floor areas per bed for the various types of rooms—110 sq. ft. for one-bed rooms, 90 sq. ft. for two-bed, 80 sq. ft. for four-bed, and 70 sq. ft. for pediatrics.

The psychological benefits of modern colour therapy are used throughout the hospital. A pleasant

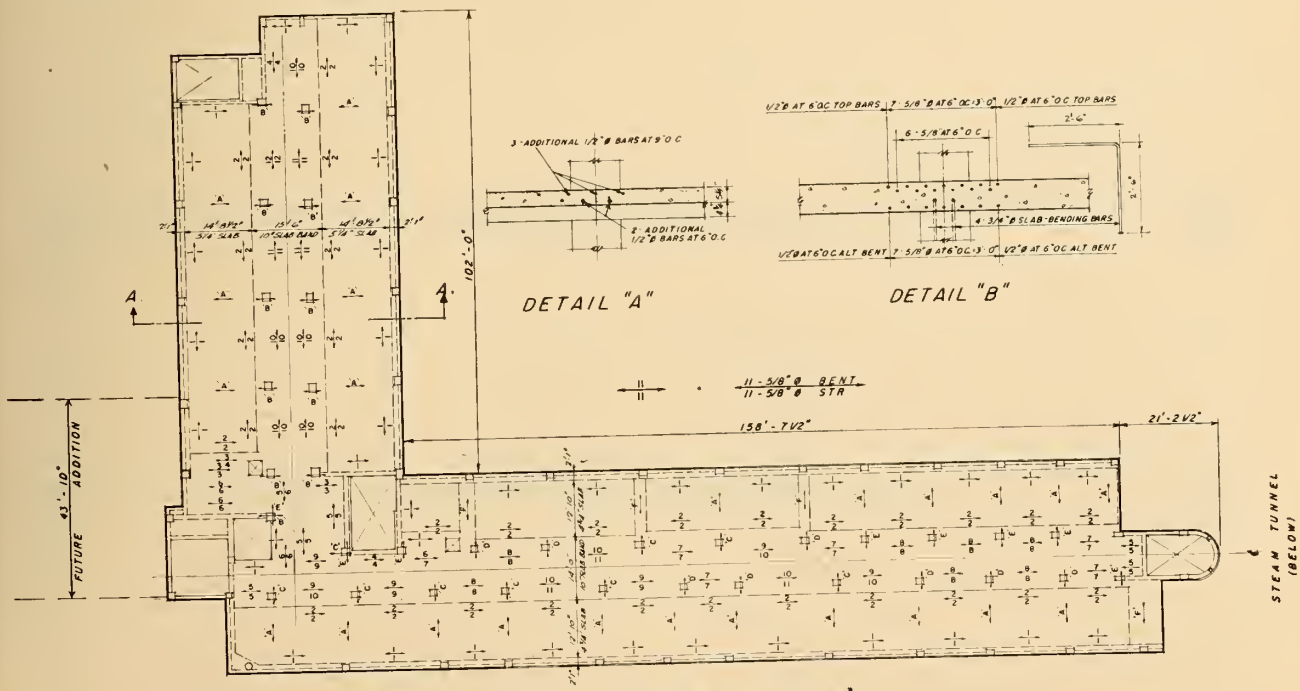
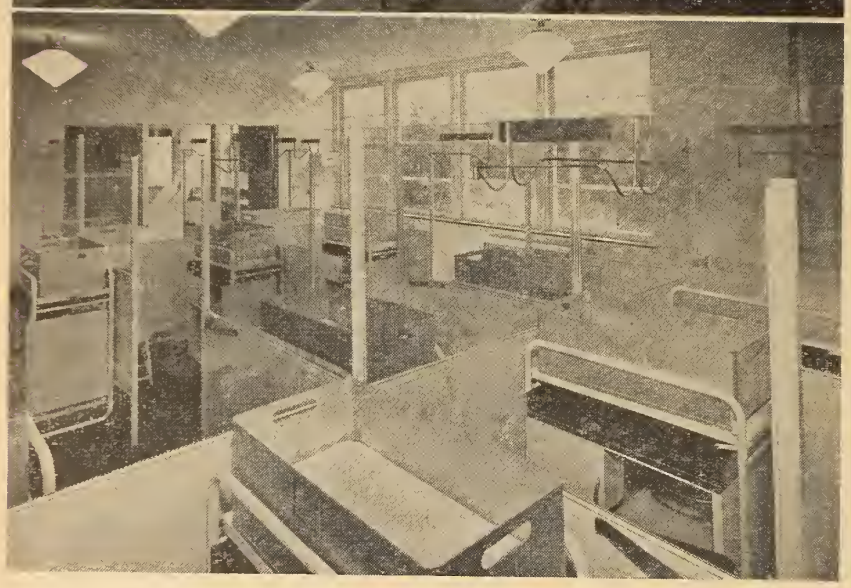


Fig. 4. Typical floor framing plan, structural.



day-room is provided on each floor for the use of ambulatory and convalescent patients and there is an airing-balcony at the end of the east wing. Public telephone booths are located near the day room on each floor, but doctors and nurses use special telephones at the nurses' stations.

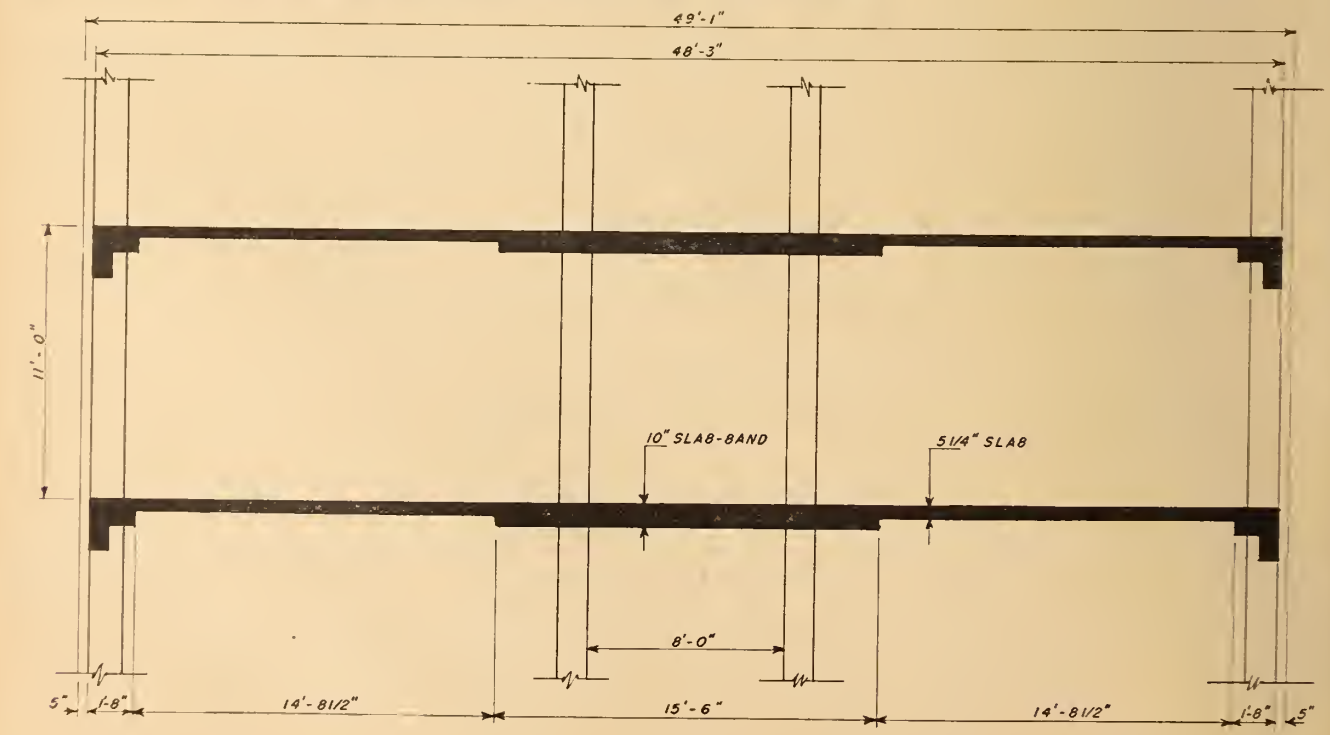
The plumbing installation is somewhat complex. In addition to hot and cold water, vent and waste pipe-lines, many other services are provided, such as oxygen, gas and vacuum lines, as well as special ventilating and supply ducts. There is also a central vacuum-cleaning system, a water softener, pressure pumps and pneumatic tanks to provide adequate water pressure for the upper floors, plus a high-pressure fire line and an auxiliary diesel-driven generator for emergency electrical power supply. The sanitary sewer lines are carried to the rear of the building to connect with the City's sewer system, but storm water is discharged into dry wells.

Convection-type hot-water radiators supply heating. High-pressure steam is generated by a new boiler installed in the existing boilerhouse, enlarged and with a new radial

Fig. 5. Pediatrics department, looking from nurses' station.

Fig. 6. Typical nursery.

Fig. 7. Typical cross-section A-A, through the structural frame.



brick chimney about 125 feet high. Steam is piped to the mechanical room in the basement and, by means of heat exchangers, is used to heat water both for the heating system and for domestic supply. Low-pressure steam is provided for sterilizers, blanket-warmers and kitchen equipment.

General mechanical ventilation is provided by equipment in the penthouse. Fresh air is supplied to the operating rooms to maintain a temperature of 85°F. and a relative humidity of 55%. Separate units provide fresh air to the nurseries and kitchen and for general supply.

In a few special rooms fluorescent lighting fixtures were installed, but in the majority of rooms direct and semi-indirect fixtures were used.

The two passenger-elevators are designed to be operated with an attendant or may be operated automatically. They have push-button controls, and travel between the basement and fifth floor. There are also two electric dumb-waiters operating from the basement to the fifth floor and one hand-power dumb-waiter serving the first and second floors of the north wing.

The operating rooms, X-Ray and radio departments, fire-alarm and intercommunication and doctors' and nurses' call systems require special power provision. It is expected that 60-cycle power will be available soon, so all motors of one-half horse power and over are 60-cycle, while smaller motors and lighting are on 25-cycle circuits. Two motor-generator sets are installed in a temporary electrical building to provide 60-cycle power until 60-cycle power is available from commercial circuits.

Exterior architectural design is strictly contemporary without allegiance to any period style (Fig. 1). Elevations and plans were evolved together naturally and simultaneously, stressing the simplicity and economy of the whole building. The new Guelph General Hospital depends for its appeal on the logical and orderly arrangement of materials, equipment and space, on the dignity of its composition, on the pleasing proportions of the elevations and on the pattern and texture of the exterior brick-work. The double-stretcher Flemish bond pattern gives a pleasing vertical-header appearance which emphasizes the horizontal aspect of the elevation and helps to reduce the apparent height of the building.

This is one of the first buildings in Canada to be built with slab-band floors utilizing the extremely efficient "haunched-slab" principle of design as well as the simple economy of form work.

The essential features of slab-band or flat-plate floor construction are:

1. There is a smooth, uninterrupted under-surface of the concrete floor slabs, except for a shallow break between the thin and the thick portions of the slab (see Fig. 1).
2. The slab-band may be supported on one row of interior columns for narrow buildings, or on two rows spaced on both sides of a corridor for school and hospital buildings.
3. Structural design calculations are simplified by exact analyses of continuity in the structural frame determining the maximum moments and shears at the critical points. This is an advantage in proportioning the several parts of the structural frame.
4. The widths of slab-band and thin slabs may be varied within reasonable limitations to conform to the architectural treatment of the building. The overall width of the building will usually govern the relative widths of the slab-band and the thin slabs; this will also determine whether the thin slab should be one-way or two-way. The longitudinal column spacing also affects the width and thickness of the slab-band.
5. Spandrel beams may be either of rectangular section or of an inverted "L" section or of any reasonable combination. (See

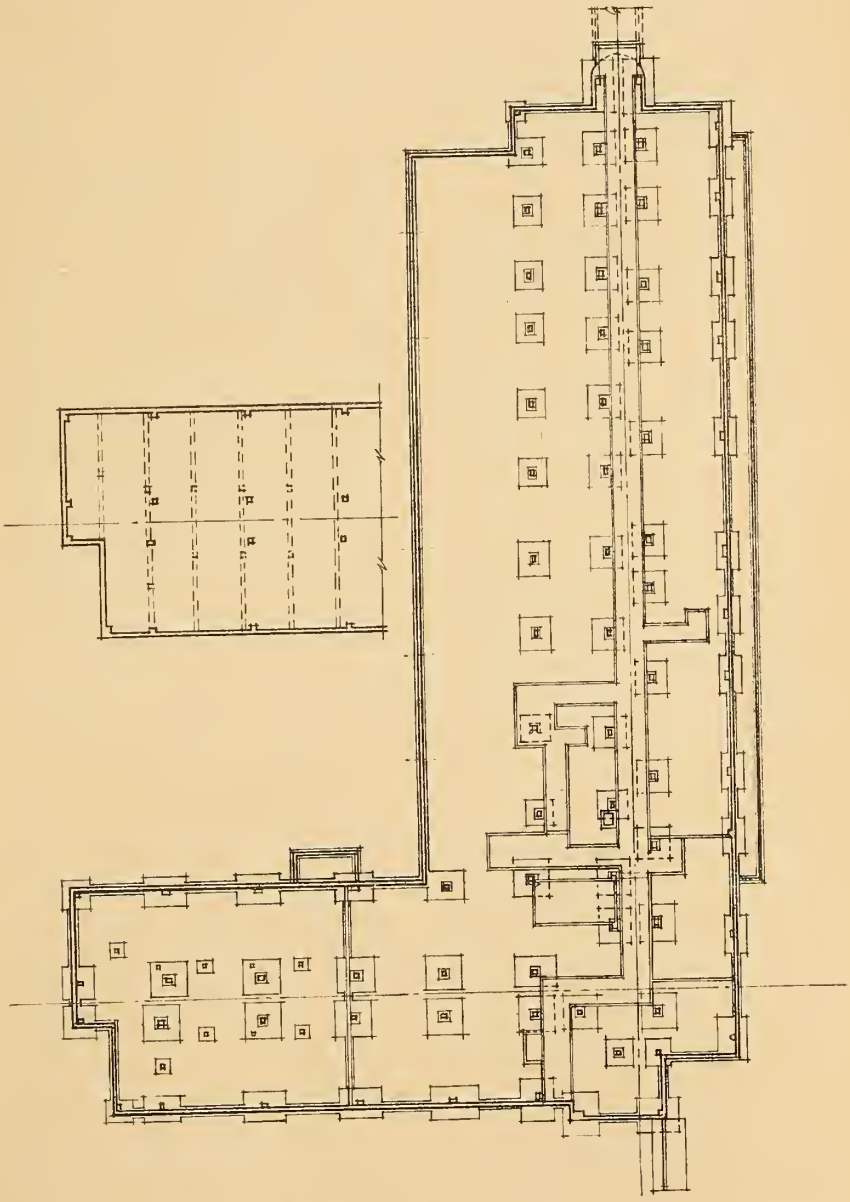


Fig. 8. Basement floor footing plan.

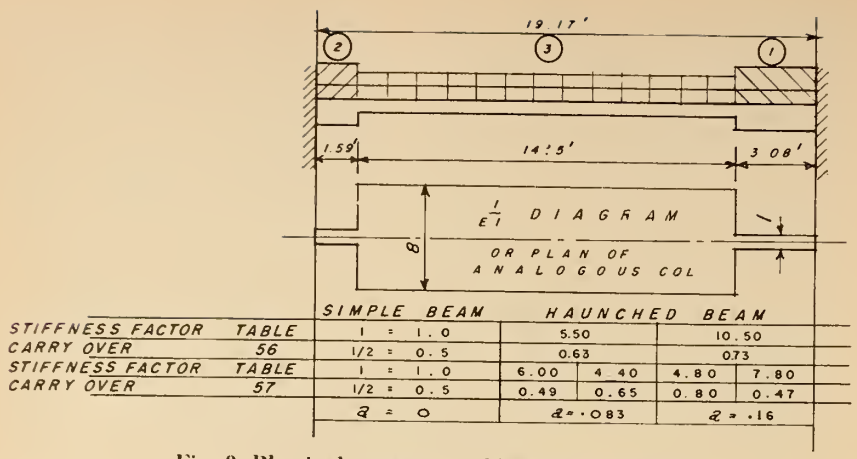


Fig. 9. Physical constants of haunched beam.

Typical cross-section A-A, Fig. 7).

6. There is much freedom in locating interior columns, which do not have to be placed on line with the exterior columns, and interior columns on each side of the corridor do not have to be placed opposite one another.

The advantages of slab-band construction result in economical floors, because:

1. The total thickness of slab-band floor construction is substantially less than that of other types and this decreases floor to floor heights and consequent total building height.
2. Much freedom is provided for mechanical and electrical facilities, especially for air-conditioning ducts in the ceiling space over the corridors (see diagrams).
3. The smooth surfaces of concrete at the bottoms of floor slabs present a pleasing appearance and provide an uninterrupted surface to which ceiling material may be fastened. Many buildings of slab-band construction have only a painted concrete finish.
4. Large openings are generally framed with concrete beams, although it is not necessary in slab-band construction to have beams on all sides of openings such as duct spaces and stair and elevator wells; therefore the trunk line of air ducts may be accommodated at a vertical duct space by being brought into it level and turned up without interference from beams (see Fig. 3).
5. Small openings in slab-band floor construction may be made almost at will without interference with the structural frame, but such openings should be as far as possible from the interior columns.
6. As a result of the flexible plan available in slab-band construction, there will usually be fewer columns required than for any other similar type of floor construction (see Fig. 4).

An example of comparisons in cost of floor construction is as follows:

Type of Floor Framing	*Cost per sq. ft.*
(a) Concrete joist and slab construction with tile fillers and plastered ceiling applied directly thereto	$1.49
(b) Slab-band floor construction with lath and plaster ceiling suspended close to the soffit	$1.22

These are estimates obtained late in 1948. Although the actual figures do not apply today, the relative saving remains about the same.

This slab-band design was developed by the writer after experience obtained with a slightly different application of this principle of floor construction. A two-storey and basement school building was designed using a 9-in. thickness of slab-band, 10 ft. 10 in. wide, centred on two rows of rectangular concrete columns on both sides of an 8-ft. corridor. There was a 6½-in. thickness of two-way slab spanning 18 ft. 9 in. from the edge of the slab-band to the concrete spandrel beams on each side of the building.

For the Guelph General Hospital, after several preliminary design investigations using the two-cycle method of moment distribution, it was decided to use a 10-in. thickness of slab-band throughout, 14 ft. wide in the cast wing, flanked by 4¾-in. slabs on both sides, but 15 ft. 6 in. wide in the north wing, flanked by 5¼-in. slabs. 3,000-lb. concrete and 20,000-lb. reinforcing steel was used. Design criterion and permissible stresses conform to recognized building codes. Haunches near the supports of the flanking slabs both increase the effective depths of the bent-up bars, and decrease the positive deflections at mid-span, as well as the distances between the points of inflection.

Having proportioned the concrete and reinforcing steel in a symmetrically-haunched approximation of a typical lateral bent, a further refinement of analysis was employed by use of the column analogy in determining critical moment values (Fig. 9). The results were close to those previously obtained, but indicated an eight per cent increase in fixed-end moments at the slab-band, with an eight per cent decrease at the spandrel beam. The areas of reinforcing steel required were provided by using No. 4 bars at 6-in. centres, with alternate bars bent up from the flanking slab into the top part of the slab-band and staggered with No. 4 top bars at 12-in. centres across the slab-band. Lateral stiffening of the slab-band is assured by use of No. 4 straight bottom bars at 12-in. centres staggered with the straight top bars. The average area of steel required over the top of the corridor in the longitudinal direction is provided by 11 No. 5 straight bars and 11 No. 5 bars staggered thereto and bent up over the column at both ends for an interior span. Thus the slab-band is reinforced in two directions, but the flanking slab is a one-way slab with only No. 4 temperature and shrinkage bars at 16-in. centres in the longitudinal direction of the building.

The most obvious reduction of materials and labour due to slab-band construction is in the formwork, which may be reused for each floor and for the roof slab. Although the saving in all components as a result of reduced height is substantial, it is not easily calculated in dollars and cents.

Acknowledgments

The writer wishes to acknowledge with gratitude the assistance and advice given by the following:

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We also thank the men employed by the mechanical and electrical

(*Continued on page 108*)

The History and Organization of Surface Drainage in Manitoba

by

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Surface drainage is probably one of the oldest forms of engineering works in Western Canada. Because Manitoba was discovered and settled by water transportation, settlements grew up adjacent to rivers, which meant that they were on comparatively low ground and consequently subject to occasional flooding. It is probably correct to assume that at least some primitive form of drainage was a necessity for the initial development of even small areas of Manitoba land for agricultural purposes.

Soon after Manitoba became a province, railroad connections were completed between Winnipeg, St. Paul and Eastern Canada. The construction of the railroad in the valley of the Red River necessitated many bridges and culverts, since it ran almost at right angles to the natural direction of drainage. Several offtake drains were constructed to the river, either as part of the original construction or shortly after its completion. Some of these, although since rebuilt, still form part of the present Red River Valley drainage system. The coming of the railway created a demand for land; between 1880 and 1900 practically all the good land, naturally suitable for cultivation and within a reasonable distance of the expanding railroad system, was put into use.

As the good quality dry land became scarce, swamp land, which belonged to the Dominion Government, was granted to the province on condition that the latter undertake drainage to make it arable. As early as 1883, some was thus reclaimed. Such work was carried out by the provincial public works department and paid for by the province, although the land was sometimes within a rural municipality. These municipalities were much the same as they are today, each governed by its elected council and responsible for local public works, such as roads and drains.

This is a non-technical paper, originally presented before the Winnipeg Branch, and published here because it is a step-by-step account of the evolution of Manitoba's scheme of land drainage. Many of the difficulties met and successfully surmounted are such as plague any widespread public service, and in principle are as likely to be encountered in, say, rural electrification as in land drainage. All engineers, the funds for whose projects come from the taxation of those benefited, should read this paper.

To assist the municipalities, the provincial government was empowered, under the Public Works Act, to make grants towards the cost of such works. Engineering required for design and construction was usually provided by the provincial department of public works, much as it is today. Under this arrangement a large amount of drainage work has been undertaken in the past and is being undertaken today. Most of the maintenance required has been provided in the same manner, that is, by the municipalities, with financial and engineering assistance from the province.

Occasionally there was a slight variation in the provincial-municipal arrangement, sometimes unintentionally. An example of such a case is one of the older drains still in existence, a few miles southeast of Winnipeg. Known as the "Springfield Drain" it discharges into the Seine River in the Municipality of St. Vital. According to the agreement under which this drain was planned, it appears that several organizations agreed to assist in paying for it, with apparently the province paying the balance. There is no record to show that the province ever received any of the contributions. In 1926 a suit for damages due to alleged lack of maintenance of this drain was brought against the Municipalities of Tache and Springfield by adjacent land owners. The plaintiffs lost the case because it could not be proved that either of the municipalities had shared in the costs of construction. However, the suit must have served its purpose indirectly, as maintenance was undertaken within a year or two and has since been reasonably well sustained. Lately, considerable maintenance has been completed by the municipalities, with engineering and about 50 per cent of the cost being provided by the province.

About 1900 there was great demand for agricultural land. The naturally well-drained lands along the rivers, especially along the Red, were all occupied and it became necessary to push back into the flat swamps behind. Much of this land

was covered with peat. Many areas, such as the "Boyne Marsh" around Brunkild; "The Flats," southeast of Dominion City; "St. Andrews Bog" east of Stonewall and Teulon, were, during wet years, nothing but lakes and sloughs. These swamps were generally located between a natural drainage channel, such as the Red River, and high lands draining towards the river. Over a long period the river has built natural levees along its banks by the deposition of sediment during successive floods. These levees trapped part of the flood waters behind them and, at the same time, prevented free passage of run-off from high lands. Peat deposits were built up by the repeated interaction of vegetable growth and flood waters.

Under these beds of waste lay good Red River clay, practically the same material which was producing the abundant yields of wheat elsewhere in the valley. It was to these areas, at the end of the 19th century, that settlers turned in their desire to obtain farm land. A few small and short municipal drains were constructed, emptying into the nearest stub coulee. The drainage of these comparatively large areas was a tremendous undertaking in that day, both financially and mechanically. It was certainly much greater than was recognized at the time: even today, after more than 50 years of continuous effort, the results are not entirely satisfactory.

When the province was only 25 years old its government realized that reclamation of these waste lands was necessary and justified, that eventually such lands would add financial stability to the province, and that the task of reclaiming them was too extensive to be handled by the young and small municipal organizations of the day. Many of these areas extended into several municipalities, which fact alone would have made municipal administration difficult. Accordingly, the first "Land Drainage Act" was passed in 1895 by the provincial government.

This act provided for the first large scale organized drainage systems in the province, and it may be summarized as follows. Each area fulfilling the requirements of the act was created into a drainage district, consecutively numbered, by order-in-council. The procedure to be followed in forming a drainage district, may be outlined thus:

1. A petition requesting the formation of a district to be presented to the provincial government from a majority of the property owners.
2. The minister of public works to request a survey and an examination to estimate the cost and benefits of the requested work.
3. The engineer to report to the minister, providing complete plans of the recommended works and a description of the land to be included in the district.
4. The minister to submit his report, together with that of the engineer, to the lieutenant-governor-in-council for approval.
5. Upon such approval the minister to publish a notice in the "Manitoba Gazette" and in two newspapers, stating the intention to proceed with the described work, and setting out the estimated cost, lands to be assessed, etc. Land owners now had the opportunity, within one month from the date of the notice, to petition against the proposed work.
6. Assuming no unfavorable petition after one month's notice, the minister to have prepared and presented to the lieutenant-governor-in-council a statement showing the cost of the work, the area to be benefited and the cost of the work chargeable to each parcel of land.
7. The lieutenant-governor-in-council then to approve of the constitution of the drainage district, giving it a number.

Only by following this procedure could a drainage district be organized.

Following the legal constitution of a district, came arrangements for financing the work. The act provided three ways in which these funds could be raised:

(1) By the province's selling debentures on behalf of the district without any provincial guarantee.

(2) By selling such debentures with the guarantee of the province.

(3) By selling direct securities in the name of the province and placing the proceeds to the credit of the district.

In all cases the lands within the district were subject to a first lien in favour of the provincial-treasurer, for payment of assessments for interest and sinking fund. The municipalities were supplied with a statement showing the annual charge for principal and interest over the term of the debentures for each parcel of land, and it was thereafter their duty and responsibility to collect the proper levies annually and remit them to the provincial treasurer.

The supervision of surveys, design, construction and payment for the work was the duty of the then "Reclamation Branch" of the provincial department of public works.

The first drainage district organized under the terms of this act covered part of St. Andrews Bog, a swamp area north of Winnipeg. This drainage District No. 1 was constituted by order-in-council in 1896, with an original debenture issue of £20,500, sold in London.

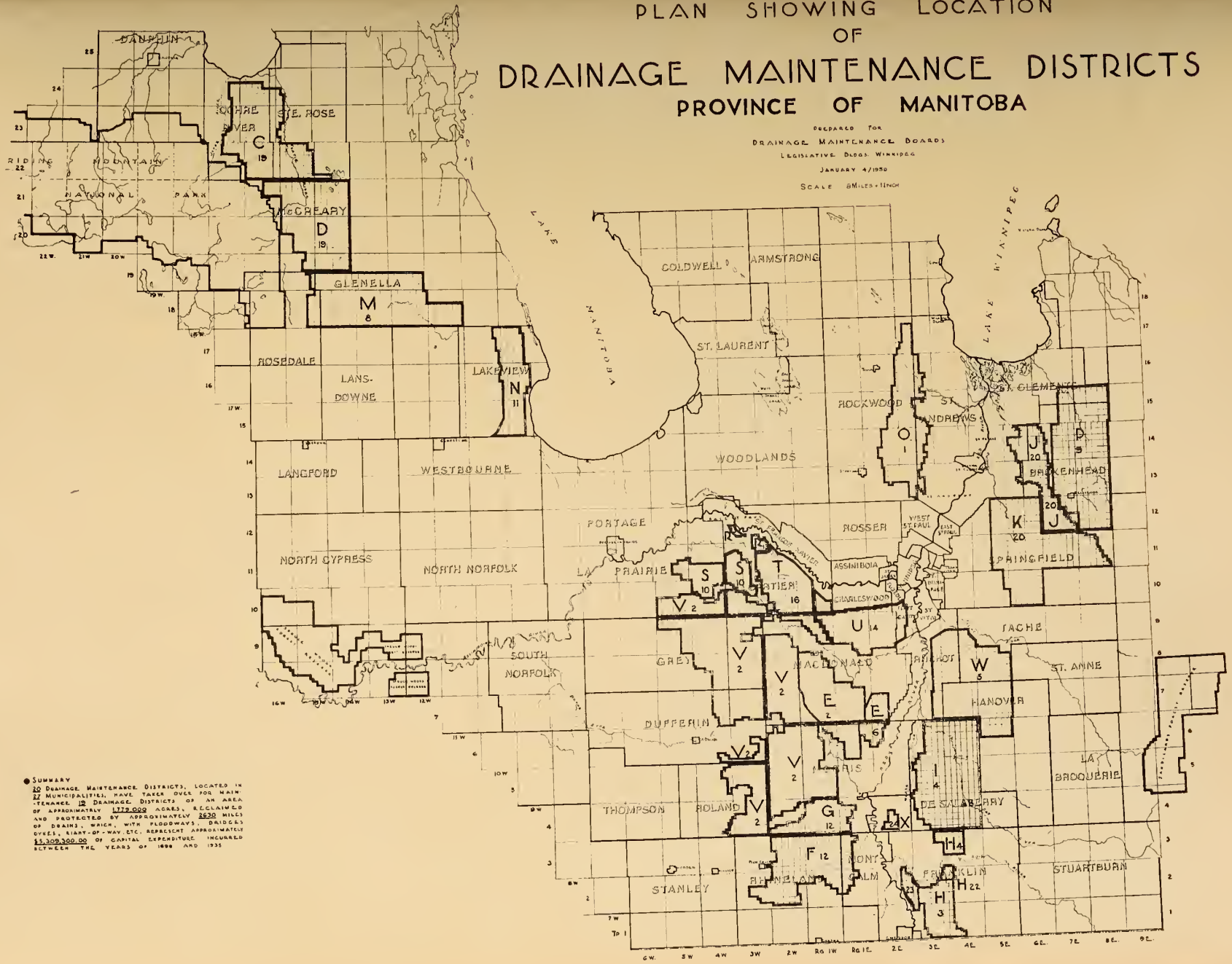
In those days excavating equipment was not hauled overland, nor even shipped to a nearby railroad siding. To carry out construction in Drainage District No. 1 two dredges were built on location. They started digging at the high end of the drain and floated downstream in their own ditch to the outlet. They were self contained units having living accommodation; being powered by steam, they required only a supply of wood and water. The operation of these machines was slow, but they did complete a large amount of excavation in Manitoba's early drainage days.

But like the first products of many schemes, Drainage District No. 1 was far from perfect. Following formation of the district, a petition was presented to the government protesting the work. Many land owners whose property was to be assessed claimed they would receive no benefits. In 1900 a Royal Commission was appointed to study the problem, and in 1903, by order-in-council, over 40,000 acres of land in the district were relieved of assessment, the levies being assumed by the province. Even as late as 1926, when the original debentures became due, it was necessary for the province to make settlement partly from its own funds. But in spite of all difficulties considerable construction was completed in the early days of the district. Maintenance, however, was something unthought of, at least for many years, so that even today this drainage district cannot be considered as one of the most successful, although lately increased interest is being shown in the lands, both by individuals and by the municipal councils concerned. With the recent increased value and demand for land, it appears that at last the "Old St. Andrews Bog", or "Great Marsh", as it was sometimes called, may be put into useful production.

There are several reasons why this

PLAN SHOWING LOCATION OF DRAINAGE MAINTENANCE DISTRICTS PROVINCE OF MANITOBA

PREPARED FOR
DRAINAGE MAINTENANCE BOARDS
LEGISLATIVE BLDGS. WINNIPEG
JANUARY 4/1950
SCALE 8 MILES = 1 INCH



● SUMMARY
20 DRAINAGE MAINTENANCE DISTRICTS, LOCATED IN 27 MUNICIPALITIES, HAVE TAKEN OVER FOR MAINTENANCE 12 DRAINAGE DISTRICTS OF AN AREA OF APPROXIMATELY 1,779,000 ACRES, RECLAIMED AND PROTECTED BY APPROXIMATELY 2630 MILES OF DRAINS, WHICH, WITH FLOODWAYS, BRIDGES DYKES, RIGHT-OF-WAY, ETC. REPRESENT APPROXIMATELY $3,309,300.00 OF CAPITAL EXPENDITURE INCURRED BETWEEN THE YEARS OF 1908 AND 1935

first drainage district did not meet with the success anticipated. Among the most important and still a source of great difficulty and damage in the area, is the presence of natural springs, one of Winnipeg's early water supplies. These springs, flowing in large volume throughout the year, form great masses of ice which are slow to thaw out in the spring. During the summer they flow across the land and down the drains, keeping the adjacent land cold, sour and unproductive. In recent years new drains have provided better control of the summer flow, but it is only in the last ten years that the land has become reasonably suitable for cultivation. Apart from disagreement over the formation of the district, another reason for the district's financial difficulties is that a considerable acreage of Crown lands was included in the original area. As Crown lands are exempt from any kind of taxation under the B.N.A. Act, they did not carry their proper share of the capital costs, which situation was not corrected until the last financial adjustment in the district in 1935.

Although Drainage District No. 1 could not be considered as successful as the government intended, the formation of several other districts has certainly been justified. The largest and probably one of the most successful, from the point of view of both the district itself and of the province as a whole, is Drainage District No. 2. Its area, as constituted, was just under half a million acres, taking in the "Boyne Swamp" and the "Elm Creek Marsh", and situated around the present towns of Fannystelle, Elm Creek, Brunkild, Lowe Farm and Roland. This district was formed in 1898. The first construction program was carried out between 1899 and 1915, at a cost of approximately $830,000. Between 1919 and 1930, further construction was undertaken, including the first double-dyke system. The total capital expenditure in Drainage District No. 2, ending in 1935, was slightly over 2¾ million, or an average of about $6.40 per acre. In general, the history of Drainage District No. 2, except for mechanical difficulties, such as lack of maintenance and undersized drains, appears to have been comparatively peaceful. Considering the population the district is presently supporting and its tremendous annual agricultural production, the investment in money, time and labour certainly seems to have been justified.

Only one other district was formed before the turn of the century. This was Drainage District No. 3, comprising what was known as "The Flats", a low, swampy region situated immediately north of the international boundary and east of the Red River. Water in large volumes came down from the hills to the east of the district, through the many fast flowing coulees, then spread out over the flat lands in the triangle between the junction of the Red and Roseau Rivers northwest of Dominion City. Drainage District No. 3 was formed in 1899, and intensive construction was carried out in two periods, 1900 to 1910, and 1926 to 1930. Construction in the latter period was required through a fault common to practically all the early districts—no provision for maintenance. The area of the district is not large, being only about 36,000 acres. The total capital expenditure has been about $176,000 or about $5.00 per acre. At the time the district was formed this land was selling for about $2 per acre; today it is worth about 50 times that amount. While both land and dollar values have changed considerably during this period, the fact remains that without drainage this land would still be worthless for cultivation. The financial and physical progress of Drainage District No. 3 make it one of the most productive and successful districts in the Province.

With the arrival of the 20th century there was a rushing business in drainage districts. Between 1900 and 1914 there were no less than 18 new districts organized. The first three of these, Nos. 4, 5 and 6, were located in the Red River Valley. Drainage District No. 7, formed in 1902, comprises a small area on the north side of the Assiniboine River, a few miles from the village of Poplar Point. Drainage District No. 8 was originally a large one of nearly 400,000 acres, situated at the toe of the east slope of the Riding Mountains.

Some engineering difficulties were encountered in this district. A large area was finally drained by way of the Grassy River into the Big Grass Marsh, thence through a channel down the centre of the marsh into the Whitemud River. This route involved a distance from the centre of the drainage area to the eventual outlet in Lake Manitoba of roughly 75 miles, against a straight line distance to the lake of only 20 miles. This roundabout route was necessary because of a high ridge, the "Kinisota Ridge", between the marsh and Lake Manitoba. If the water could have been taken through this ridge directly into the lake, the cost of the undertaking would probably have been considerably lower. Much time and money were spent in an attempt to find a satisfactory opening through the ridge, but without success. One report on the subject stated that the best location for a channel would involve a cut of 32 feet and for its 10-mile length 1¾ million cubic yards of excavation. Settling this problem delayed the official organization of the district from 1902 to 1909, when it was finally decided to go around the ridge as described.

Trouble developed from the beginning. The first resident engineer reported that the contractor was not following the specifications and refused to pass payment for the work. This engineer was replaced by another who also refused the contractor's work. The dispute was settled by the government's appointing an arbitrator who reported that, although the contract had not been fulfilled in some respects, it was practically impossible to fulfil it. The contract in question was large for that day, including not only the Big Grass Marsh, but most of the construction in the whole drainage district. It extended over a period of about six years and involved total excavation of about 4 million yards. It is interesting to note that the lowest bidder for brushing and clearing on this job quoted $12.00 per acre.

Following the construction of this channel, and as the surrounding ground dried out, trouble was experienced from drifting sand. Repeatedly the drain was blocked and finally it was abandoned. In recent years, dams have been constructed to maintain the water level in the marsh for the protection of wild life. A sentence in the 1909 report of the chief engineer to the minister of public works says that he doubts if a portion of the Big Grass Marsh can ever be made into arable land.

Other drainage districts formed during the period from 1900 to 1914 were widely scattered throughout the province.

Each and every district, large or small, had its peculiar circumstances, topographical, engineering, political and financial. Not all were successful districts. For example, in Drainage District No. 21, southwest of the Village of Whitemouth, no construction was ever undertaken. It was created in 1914 from about 17,000 acres of poor land, including

several sections of floating muskeg. Surveys and plans were prepared, but as preparations were made for construction it appeared unwise to continue the project and so the district was dissolved. In another case, that of Drainage District No. 7, situated in the Long Lake area north of the Assiniboine River near Poplar Point, some construction was completed on the main outlet drain, but for various reasons this district, too, was dissolved in 1913, the small outstanding debt being assumed by the province. Districts 15, 17 and 18 were dissolved in 1936 after completion of construction and after most of the debenture debt had been paid.

With these few exceptions, all drainage districts, as organized between 1896 and 1914, are still in existence. For 14 years after the outbreak of the First War no new districts were organized, but in 1928 and 1929 three small districts were formed on the east side of the Red River. This completed the formation of the 24 drainage districts organized under the original Land Drainage Act of 1895. During that period drainage district debentures were issued to the amount of $6,824,336. This amount is not large when viewed beside today's costs of public works, and for it drainage was provided for slightly less than 2 million acres at an average cost of about $3.50 per acre.

Photographs above show work completed in 1952 in Drainage Maintenance District "K", Municipality of Springfield, Manitoba. One picture shows the drain known as Cook's Creek Canal as it existed prior to reconstruction and the other shows a reconstructed section of the same canal, though not exactly at the same location. The side slopes on this canal are 5 to 1, and the base width at the point shown is 25 feet.

Throughout the history of the drainage districts there were periods of general dissatisfaction with the services provided. Claims were made by ratepayers, often supported by their municipalities, of such matters as alleged inefficient construction, unfairness of taxation, and lack of maintenance. When it is remembered that the organization and construction of these districts extended over some 33 years, beginning when Manitoba was only 25 years old, and that in many ways the problems dealt with were unique in Canadian history, it is understandable that such difficulties should arise. The various governments concerned realized that adjustments were necessary to meet changing circumstances and attempted to settle such differences by appointing independent commissions to investigate and to advise. From the formation of the first drainage district in 1896 to date there have been four commissions appointed by the Government.

The first has been referred to, being the Royal Commission appointed in 1899. The second was the Manitoba Drainage Commission headed by the late J. G. Sullivan, M.E.I.C. It was appointed in March, 1918, and reported to the government in December, 1921. Its responsibilities, in general, were to investigate inequalities in taxation on the lands in the various districts; to determine the possibility of a more equitable method of assessing lands for the cost of future drainage works; to determine whether additional works were required for proper drainage in existing districts; and, finally, to study and to recommend on the advisability and location of new drainage districts. This commission was given the authority to engage engineers and to make surveys as it thought necessary. Under this authority a large amount of topographical information was obtained about the drainage districts southwest of Winnipeg, and watershed boundaries were defined more accurately than previously. As a result, the commission recommended that several districts be extended to take in newly developed land which was contributing by artificial means to the flow reaching the district. Other recommendations included the appointment of a permanent, independent board to administer the drainage act; that no new districts be formed where development and the demand for land would not fully warrant the expenditure and, finally, the enlarging and double dyking of several of the existing main channels. Considerable information for future construction was provided by this commission, but the government did not accept all of its recommendations. In particular, it did not establish the independent board of administration.

The third commission appointed by the government came in 1935. It was known as "The Land Drainage Arrangement Commission", or the "Finlayson Commission", headed by Professor John Finlayson, M.E.I.C., of the University of Manitoba. Its main purpose was to investigate and make recommendations regarding the financial position of all districts at that date, and to recommend a system of providing

orderly maintenance of the districts throughout the future. During a few years immediately preceding the appointment of the commission, the government had received severe criticism from drainage district ratepayers and their municipalities, who felt they were being unfairly taxed. These claims were based on one or more of three general complaints.

1. Districts were forced to bear the expense of carrying large volumes of foreign water brought artificially into them. In many cases it was claimed that district drains were too small and that reconstruction was necessary.
2. Inequitable distribution of drainage levies, having regard for the ability of the land to pay, for benefits received and for the long standing Crown lands problem.
3. Districts had been improperly organized and drains incorrectly located and constructed.

In some districts taxes were considerably in arrears, and thus sinking funds were deficient. Maintenance of the districts in general had also been badly neglected, which in turn slowed up the payment of taxes. Last but not least, the difficult economic conditions of the early 1930's even further aggravated an unsatisfactory situation. To find a mutually agreeable answer to all these problems was the duty of the Finlayson Commission.

A searching investigation was made of the financial set up of each district. In summary, it was found the total debentures issued up to 1935 amounted to approximately $6,824,000. By retirement of debentures and by sinking fund credits this amount was reduced to $3,963,000 as the net total outstanding debt. The commission also made a detailed inspection of all the districts and held meetings with all municipal councils affected, hearing all complaints, criticisms and suggested remedies.

The main recommendations of the commission, as reported to the government in 1936, may be summarized as follows:

1. Of the $3,963,000 outstanding indebtedness as of 1935, the province should assume $1,783,000 leaving the balance to be assumed directly by the municipalities concerned.
2. The drainage maintenance districts be established comprising, in general, the previous drainage districts; these maintenance districts to be administered by a board of trustees, with the province to contribute one-third of the annual expenditure for maintenance.

Recommendation 1 should not be considered as a handout to the districts, but was, in large measure, compensation for Crown land benefits, foreign water costs and probably certain mistakes made by the governments in the formation of some of the early districts. In general, the good quality land was left to carry its assessment, but the unproductive land, which possibly should never have been drained, was considerably relieved of taxation. Today, some 16 years after this financial adjustment, a large part of the $2,180,000 debt left on the districts has been paid off and by about 1961 all districts should be debt free.

Except for the amount of provincial contribution to maintenance which will be referred to later, these recommendations of the Finlayson Commission were confirmed by inclusion in "The Land Drainage Arrangement Act" of 1935. This act gave authority to make the recommended financial adjustments and provided for the first organized maintenance of the drainage works by establishing drainage maintenance districts, each to be administered by a board of trustees. Since 1936 these boards have proved very effective and today construction and maintenance work in all districts is under the administration of these boards.

Each maintenance district was established by order-in-council, which was incorporated into the act. These districts cover all existing drainage districts, although the boundaries are sometimes varied by dividing districts or adding land, the intention being to limit the area of a maintenance district to one watershed. The act further provides that municipalities within or partly within a drainage maintenance district shall be liable for the maintenance of the drainage works, but that the work of maintenance shall be under the supervision of the board acting as agent for the municipality. There is a board for each district, consisting of one trustee appointed by the council of each municipality within, or partly within, the district, and one trustee appointed by the province, who shall be the chairman of the board. The board has full and complete jurisdiction in its district over:

1. All matters concerning the maintenance of the drainage works within the act, with the provision that all work shall be approved by the minister of public works and by his drainage engineer and, except for jobs under $50 in value, shall be under the supervision of this drainage engineer or of some other engineer approved by the minister.
2. The determination of annual contribution to be made to the maintenance board by each municipality within the district and, subject to the approval of the minister of public works, the amount of the contribution, if any, to be made to the maintenance board by the province.

The act also provides for the appointment of an accountant and clerical staff, an independent audit of its records, and an annual report to the comptroller-general of the province and to the minister of public works. Other provisions of the act provide for, and control the construction of, new works and the extension of existing works: the use of district drains by outside municipalities or individuals and, in the case of disputes over liability for maintenance work, provision of an independent board of arbitration.

The operation of the drainage maintenance boards has proved effective in improving maintenance of the original drainage districts, and in their early years satisfied both the province and the municipalities. There was, however, one point which was not anticipated at the time of organization. The Finlayson Commission had recommended that the province pay one-third of the annual maintenance cost, but in establishing maintenance districts, provision was made for the province to contribute annually to the boards only an amount equal to one-half of one per cent of the capital expenditure in each district. During the first five years of the boards' operations, this amount was about one-third of the total expenditure for maintenance, the balance being provided by the municipalities. In 1942 two conditions occurred which upset this balance; the first was a period of wet years starting about 1941, the second was the sharply rising cost of construction. The effect was that, since the provincial contribution was fixed, the municipalities were called upon year by year to put up a larger portion of the annual expenditure. By 1946 the municipal contribution had increased to such an extent that the provincial share was only about 12 per cent of the total and, in spite of this, the larger drains and floodways were not receiving proper maintenance.

This situation, occurring during a period of wet years when crop loss was extensive, aroused considerable agitation among land owners and municipalities for an increased provincial contribution to maintenance and reconstruction costs. The "foreign water" problem, which first made its appearance in the days of the Sullivan Commission, had grown considerably in importance. While previous commissions had made some recommendations for relieving this situation, the province had not always put them into effect. Even since the days of the Finlayson Commission, some ten years previous, a considerable mileage of road and drain construction in the higher lands outside of the maintenance districts had occurred. The maintenance boards believed they should not be shouldered with the cost of enlarging their drains to carry the resulting increased flow, but that the lands from which it came should bear their fair share of this cost. These two points of contention resulted in the appointment of the fourth commission to investigate Manitoba's drainage problems.

On January 21, 1947, the Government appointed Mr. M. A. Lyons, M.E.I.C., retired deputy minister of public works, to investigate and to report on these matters. Mr. Lyons studied the various problems in all the districts, giving particular attention to the foreign water problem which, to a large extent, was the basis of the unsatisfactory financial position of the boards. In his report to the government of December 20, 1949, he gave several reasons why it was not practical to attempt to assess on the higher lands outside of the district, their proper share of the cost of carrying water through the districts. For instance, the area of the watershed was largely indeterminate and subject to variation due to road and other construction. Precipitation over large watersheds varies and, therefore a uniform levy might be unfair. The main difficulty, however, in attempting such an assessment is the fact that the upstream land owners are not legally responsible for the natural flow from their lands, but only for that created by artificial means, such as drain and road construction, clearing and cultivation of land, etc., and it is practically impossible to separate costs between the two types of flow. In summarizing the problem, Mr. Lyons remarked, "It is not the duty of the drainage district to receive and remove foreign water flowing onto the land in the district, due to assistance by an artificial agency". In his recommendation, as an answer to the foreign water problem, he suggested that the drainage works be divided into two classes:

1. Those drains carrying foreign water, that is, water originating outside the maintenance districts, on which he recommended that the province pay two-thirds of the cost of future maintenance and construction.
2. Those drains intercepting and carrying only local water originating within the boundaries of the district, on which the province should pay one-third of the cost of future maintenance and construction.

The land owners in each case, through their municipalities, were to pay the remaining cost.

The province accepted the main recommentations of the Lyons Report by order-in-council in November, 1951, making it fully effective for the fiscal year of 1952.

It is on this basis that the drainage maintenance boards are now operating. Their organization and authority may be summarized as follows:

There are 24 drainage maintenance districts in the province, involving 27 rural municipalities. The total assessable area is 1,870,862 acres. The drainage system now being maintained consists of approximately 100 miles of double dyke floodways, 2,400 miles of open drains and about 2,200 bridges, varying in span from 6 feet to approximately 150 feet. The average annual expenditure for maintenance is about $200,000 with the 1952 budget set at about $225,000 or an average of about 13 cents per acre of land drained. It is anticipated that a construction appropriation of $300,000 will be available in 1952, making the total expenditure for the year well over half a million dollars.

The larger part of the drainage works is the ordinary open ditch, with the excavated material thrown out as a dyke. Considerable diffidulty has been experienced, particularly west of the Red River, with drains filling with snow in the winter and not thawing out soon enough to carry the early spring runoff. This, combined with the increasing volumes of water to be carried from upstream development, has led engineers to experiment with double-dyke floodways. As originally constructed, these comprised a second drain parallel to and 200 to 600 feet away from the original channel with the dyke thrown in the same direction. During spring flows when the channel is full of snow or ice, or during excessive summer floods, the main flow of water is carried above natural ground level and between the parallel dykes. During extreme runoff, these floodways have carried flows between 3 and 4 feet deep and up to 500 feet wide between the dykes.

The main advantage of this design is the low cost of excavation per unit of capacity, and the comparative freedom from snow or ice blockage. They can, of course, be constructed efficiently only through flat, uniform country. Their main disadvantage is the wide right-of-way required, and the difficulty and expense of traffic crossings. This latter problem has been solved on the lesser travelled roads by constructing a concrete slab at ground level across the floodway section and bridging only the two ditches. Most floodways have developed from an original open channel with the old adjacent dyke. With the construction of the second dyke and the confinement of the flood waters between the dykes, excessive erosion of the old dyke has occurred, with resulting high maintenance costs. In new floodways or in the reconstruction of old ones, this fault will be eliminated by keeping the main channel in the centre of the floodway and building the new dykes equal distances back from the channel. Side slopes will be reduced from the old 1½ to 1 to either 4 or 6 to 1, in the belief that this will minimize the severe slope erosion which occurred, even in flat country, and will allow for seeding and annual mowing of the slopes.

Project design, even today, is severely handicapped by lack of accurate long-term precipitation and runoff records. There are no reliable runoff factors; rule-of-thumb methods and previous designs and experience have to be relied upon. Lately, most local, small watershed drains in flat country, such as in the Red River Valley, have been designed for a runoff of 3 or 4 cubic feet per second per square mile. Such design appears to provide reasonable protection and keeps costs within economic limits. In the case of larger floodways, where a greater safety factor is a necessity and where the headwaters are in the early, rapid runoff portions of the watershed, a much higher capacity factor is used, sometimes as high as 15 to 20 cubic feet per second per square mile.

In looking back over the history of organized drainage in Manitoba as presented here, it may seem that it was beset by errors, mistakes and poor judgment on the part of the province and dissatisfaction, disputes and unrest among the land owners. To a limited extent this is true. However, to judge and to appreciate past actions correctly, they must be viewed, not in the light of today's conditions, but in the light of conditions existing at the time. The various events described occurred over nearly 60 years, during which time the province has grown from little more than a local settlement to its present position. None of the rapidly changing conditions—financial, political, agricultural, mechanical and others—have affected the natural resource surface water, with which the drainage organization deals, but each change brought with it a different outlook, a different attitude and a different method of handling the same problem. Taxation and financial growth of the province brought new outlooks on the methods of assessment for all public services.

Thus the commissions appointed to sit in judgment at the various stages of drainage history were not so much necessitated by mistakes in previous judgment, as they were a means of bringing about reforms required to meet the natural growth and development of the province.

Regardless of past events in the history of drainage, the agricultural communities of Manitoba, and therefore the province as a whole, owe a great deal to those who, in 1895, had the courage and foresight to provide for organized drainage. Without this drainage, much of the nearly 2 million acres now under cultivation in drainage districts, would still be waste swamp. On the average, land within drainage districts is more productive than that outside the districts. In 1942, 16.4 per cent of all taxable land in Manitoba was in municipalities containing drainage districts, and this 16.4 per cent produced 22 per cent of the provincial farm income for that year. In two representative groups, comprising 15 or 20 municipalities each, the group containing drainage districts had an average income of $6.02 per taxable acre compared to only $4.60 for the group without drainage districts.

Past work, worry and ambitions have been justified, and will continue to be justified, in the eyes of all those benefited—the individual, the community, the province, and the nation. √

THE NEW GUELPH GENERAL HOSPITAL

(*Continued from page 100*)

consulting engineer, by the general and all sub-contractors, and by the architect.

The Portland Cement Association supplied the pamphlets and handbooks for which the writer is deeply grateful.

We would like to mention, individually, by name all of the men who contributed to the drawing and detailing of all parts of the hospital building as well as to the construction and supervision thereof. However, the list of names would be quite long and the possibility of omitting even one name prompts us to acknowledge generally all persons who contributed in any way to the construction of the New General Hospital which stands today as a silent tribute to their skill and ingenuity.

Also, we would like to acknowledge a paradox in that many of the hints on the use of the column analogy used in the final analysis of this reinforced concrete structure were obtained from a text-book entitled *Theory of Modern Steel Structures, Volume II — Statically Indeterminate Structures* by Prof. L. H. Grinter, Dean of the Graduate School of Research at the University of Florida. √

THE INITIATIVE IN AIRLINER DESIGN

(*Continued from page 95*)

those aircraft conditioning systems upon which the well-being of his passengers depends. Right now he needs applied research leading to improvements in conditioning and control systems, in operational economy, in safety devices for landing and taking-off, in aerodynamical or mechanical means of increasing aircraft effectiveness.

That modern military research will not provide answers for his pressing problems our current R.C.A.F. Research and Development Program[3] demonstrates only too well. Supersonic research, wind-tunnel and structural testing for the "CF-100" fighter, radar development and research, missile aerodynamics and control, and the development of an air-to-air guided missile, operational research in connection with air defence, aviation medicine, new techniques in air navigation, de-icing research; none of these are projects which will further commercial development greatly.

Moreover, since they tie up our entire aeronautical research facilities, they reduce the field of Canadian aeronautical research to their own confines and limit the sweep of Canadian aeronautical development. Every aeronautical engineer whose perspective extends back twenty years must question the wisdom of the indefinite continuation of this policy.

Initiative, Will and Resource

Perhaps the impetus responsible for the "Jetliner" came originally from the United Kingdom, the home of the parent company of A. V. Roe Canada Ltd. It aroused a Canadian response, however, and continued as a vigorous Canadian effort until the crisis developed in Korea, and the tempo of military production was stepped up. Then the effort died, perhaps because a growing military "blind spot" limited Canadian vision to military development projects only, perhaps because Canadian will and resource could not measure up to the double challenge. Canada's withdrawal from the commercial turbo-aircraft field left the United Kingdom, the original and strong contender, in full possession of the field. If time shows that the initiative in airliner design has indeed passed to the United Kingdom, the explanation may lie in the circumstance that the United Kingdom alone, despite a heavy military load, had the will and resource to undertake the commercial exploitation of the aircraft gas turbine engine, and to push it to a successful conclusion.

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2. Sir Harry M. Garner, "Prophecy and Achievements in Aeronautics." *Journal of the Royal Aeronautical Society*, July 1952.
3. Dr. J. J. Green, "R.C.A.F. Research and Development". *The Engineering Journal*, June 1952. √

Report of Council For the Year 1952

Together with Committee and Branch Reports

Another year, another report and another long step forward in the progress of the Engineering Institute of Canada. 1952 was again a year crowded with activities and development. The tempo of Institute life is so closely integrated with the progress of Canada that it will be no surprise for the membership to learn that new records were made in almost every activity during the year.

Membership

The most ready although not necessarily the most accurate gauge by which to judge a society's progress is its membership. The Institute's performance for the year has been outstanding and at the conclusion of the twelve months period the new total for all classifications was 15,526. The same figure for last year was 14,659. This increase of 867 is very gratifying. Yet when the increase in population is concerned it can be realized that there is still room for a better showing.

The total of members is not the whole story. Another quite important item is the transfer from one classification to another. There were in all 1,378 transfers, the greatest number being from Student to Junior, a total of 1,155. Membership now stands with the greatest number of Members and Juniors that it has ever seen, namely, 12,478.

New Branches

Another measurement of the progress of an organization such as the Institute is the expansion in the number of branches. As it is through the branches that the Institute actually exists, it is important to see that the number increases with the increase in the size and activities of the country.

New branches were inaugurated at Port Hope, Nipissing and Upper Ottawa, North-Eastern Ontario in addition to which charters were authorized for five more, namely Bathurst, N.B., Amherst, N.S., New Glasgow, N.S., Corner Brook, N'fld. and Orillia, Ontario. These will all be inaugurated during the term of office of President Stirling. This addition of number of branches, brings the total in all to forty-five. Great credit is due to the Field Secretary Col. L. F. Grant for this tremendous expansion.

Expansion at Headquarters

Of all the things that occurred in 1952, perhaps the most important from the Headquarters' point of view was the construction of a mezzanine floor at the rear of the auditorium in Headquarters premises. It has given additional office space of approximately 700 sq. ft., and has provided an outlet for the Engineering Journal organization that was seriously needed. The complete cost of the project is approximately the equal of two years rental in commercial premises of the same area.

The President's Activities

Each president of the Institute in turn has set up a new record for the extent of his activities, but the 1952-1953 president has pushed the record to levels that would have been thought impossible only a few years ago. In spite of the decision of Council made some years ago that presidents should not try to visit all branches, each president in turn has carried out his full task. Dr. Stirling like the others plans to visit every branch, every branch section and every university.

So far he has covered completely the provinces of Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. This has required approximately two and a half months of his time. He has travelled almost 22,000 miles in carrying out his duties. He has appeared before meetings of one kind or another several times. Already he has inaugurated one branch and will inaugurate five more before his term is completed next May.

In addition to the regularly arranged visits to branches, the president has taken on many special trips, including one week in New Orleans for the UPADI Conference, several days in Chicago for the Centennial of Engineering and others. Before the conclusion of his term he will visit all branches in Quebec, and the maritime provinces including Newfoundland.

While it is considered a great honour to be elected president of the Institute, there is but little doubt that few honorary offices in Canada exact as much of the incumbent as does the presidency of the Institute. The Institute is indeed fortunate to have such outstanding men accept this great responsibility.

Field Secretary

As will be seen from the report of the field secretary, which is part of this report of Council, this officer has led a very active life and has produced wonderful results for the organization. Although Colonel Grant's office is in Toronto, his interests and his activities are all over Canada from coast to coast and everywhere he has gone he has enhanced the reputation of the organization he represents. The Institute may well be proud to have such an outstanding personality devoting his full time to the rendering of a service to the membership.

The Journal

With the increasing activities of the membership, the *Journal* has expanded also. The increase in the amount of advertising has made it possible to publish more technical papers. The Publications Committee looks forward to a continuation of expansion and to a steady improvement in the publication from all points of view.

At the moment the Publications Committee and the editorial staff are considering several changes in the appearance of the publication. It is hoped and expected that before the end of 1953 some if not all of these changes will have been put into effect.

Although authorized by Council the *Journal* is still without a technical editor. At the moment consideration is being given to the applications of some interested parties who seem to have the necessary qualifications. It may be that within a few weeks a decision will be reached. With the appointment of a full-time editor it is expected that many improvements will appear in the *Journal* and that its usefulness will be increased materially.

The Publications Committee wishes to express its appreciation to the many authors who have contributed such excellent papers throughout the year. The quality of these is such that many publications both in Canada and other parts of the world are reprinting the

papers with the Institute's authorization. Without the support of these authors, it would be impossible to turn out such an excellent periodical.

Counselling and Guidance

The Canadian Committee on Counselling in Engineering and Science was reorganized during the year. The committee now consists of two members from each of the following three institutes—

Canadian Institute of Mining and Metallurgy,
Chemical Institute of Canada, and
The Engineering Institute of Canada.

During the year each of the provincial professional associations was invited to elect one member to the committee. In this way the organization has been made representative of all engineers throughout the country.

The greatest work of the committee has been the publication of a new pamphlet for high school students. The manuscript was prepared during the year but at this date it has not been turned out in the form of a publication. The committee meets again in January and it is expected shortly thereafter the material will be put into the hands of the printer.

Efforts have been made to get in touch with all persons who have been counsellors in the past, to assure their continued co-operation. In many instances it has been necessary to make new selections, but this work too is under way but was not completed by the end of the year. It is expected to have one or more counsellors in every centre where there is a high school, so that these young prospects for the profession may have available to them competent persons to assist them in making decisions.

International Relations

In these days of uncertain world conditions, every effort towards international understanding is worth while. Since its inception the Institute has enjoyed excellent relationship with sister societies in other parts of the world, and right now is seeing a program of greatly increased activities. Some of the events of the year in this field are touched on briefly in the following paragraphs.

ECPD

The Engineers' Council for Professional Development continues to be one of the Institute's great interests. This influential body has seven members in the United States and the Engineering Institute in Canada. It is now in its twenty-first year of activity, and its importance continues to increase.

During the year there was an outstanding event in ECPD's history as far as Canadians are concerned. For the first time a Canadian was made chairman of the organization. Colonel L. F. Grant, a past-president and now the field secretary of the Institute, after many years of close association with ECPD was elected unanimously to this high office in the month of October. Previously he had been vice-chairman for three years. The importance of this appointment cannot be over-estimated from the Canadian point of view. When it is remembered that the American members of ECPD are the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Institute of Chemical Engineers, the American Society for Engineering Education and the National Council of State Boards of Engineering Examiners, it will give an appreciation of the esteem in which Colonel Grant is held and the appraisal that is placed on the Engineering Institute. Between them the membership of ECPD totals 175,000. It is a great honour and a great responsibility to head up such an organization.

One of the chief activities of the year has been the participation in a special conference on engineering education promoted by the European and United States Engineers Conference (EUSEC). While this was not called until January, 1953, the arrangements were all completed in the year to which this report refers, therefore it is appropriate that mention should be made of it. Colonel Grant went to London, England, as head of the ECPD group, and at the same time carried out certain other duties for the Institute in the Old Country. However these latter come into the 1953 year and will not be reported at this time.

Centennial

Perhaps the most noticeable event on the international program was the celebration of the Centennial of the American Society of Civil Engineers in Chicago during the month of September. The Institute was one of the societies invited to participate in the program, and many members were there for all or part of the program.

During the course of the events the Institute had a reception for its members and for the officers of other societies. This function has been reported on already in the columns of the *Engineering Journal* and therefore reference only is made to it at this time. However, it was a most outstanding occasion and the Institute is proud to be among the organizations officially recognized as paying tribute to the great American Society of Civil Engineers.

UPADI

The second meeting of the Pan-American Engineering Conference took place in New Orleans during the last week of August. The Institute was represented by five of its members including the president. The others of the delegation were James A. Vance, Verne King, Dean K. F. Tupper and the general secretary. Subsequently the Institute had the pleasure and honour of entertaining many of the South American delegates during their post-convention tour of Canada.

British Visitors

Following the Centennial of Engineering in Chicago, the British delegation consisting of the three presidents and three secretaries of the Institutions of Civil, Electrical and Mechanical Engineering, came to Canada for a tour of eleven days. This too has been reported previously in the *Journal* but reference is made to it again in the annual report because from the international point of view this is one of the most important events of the year. It would be a highlight on any program.

The group was taken by motor from Detroit through Ontario to the City of Quebec, where they embarked for their return journey. At several points they had opportunities to meet the members of their own societies and also members of the Institute. It was a splendid opportunity for "old" Canadians, the new Canadians and representatives of the Mother Country to renew contacts and to develop good international relations.

The members of the British delegation were, The Institution of Civil Engineers, President Allan Quartermain, Secretary E. Graham Clark; the Institution of Mechanical Engineers, President Sir David Pye, Secretary Brian Robbins; the Institution of Electrical Engineers, President Sir John Hacking, Secretary W. K. Brasher. It would be pleasant to think that Canadians could look forward to similar visits from time to time in the future.

IAESTE

These letters stand for the International Association for the Exchange of Students for Technical Experience. This organization has been operating for five years, but it was only in 1952 that Canadians were invited to participate in it. It is an international body participated in by eighteen different countries. The purpose is to arrange summer training in one country for students enrolled in universities in another country. In 1952 thirty-five hundred students were exchanged on this basis.

The Institute has accepted the invitation to be the co-ordinating organization for these activities in Canada. Professor Henri Gaudefroy of Ecole Polytechnique, Montreal, has accepted the chairmanship of the committee, and the organization work is just now under way. Full details will be published later in the Journal, but at the moment it is recognized that this will develop into a great influence for the promotion of better international understanding among professional people.

French Government Fellowship

During the year the Cultural Department of the French Government offered the Institute a fellowship for one student to study in France. The final arrangements for the functioning of this fellowship are in the process of being negotiated now and therefore a full account will not be presented to the membership until a later issue of the *Engineering Journal*. However, for the moment it is important to note this bond between the great Republic of France and Canada.

Foreign Engineers in Canada

During the year an undetermined number of engineers born and educated outside of Canada have migrated to this country. It is interesting to note how frequently the names of these people are appearing in the lists of new members of the Institute and of other Canadian organizations as well. It is apparent that these new Canadians are being absorbed rapidly into our Canadian ways and our Canadian life. They are

a valuable acquisition to a new country like this and it is the earnest hope of the Institute that the organization may be useful to them, not only in establishing themselves now but in their entire future professional career.

Roll of the Institute

The membership of all classifications now totals 15,526 which again is a record. New names added for the year 1952 amounted to 1,466, but deaths, resignations and removals reduced the net figure to a gain of 867.

During the year 1,407 candidates were elected. These were classified as follows: Members, 366, Juniors, 149, Students, 890, Affiliates, 2. The elections for the previous year totalled 1,018. Fifty-nine reinstatements were effected. Life Membership was conferred on 40 members under the revised by-law 26.

Transfers from one grade to another were as follows: Junior to Member, 223, Student to Member, 10 Student to Junior 1,155, a total of 1,378.

Removals From the Roll

There have been removed from the roll during the year for non-payment of fees and by resignation, Members, 137, Juniors, 276, Students, 101, Affiliates, 10, a total of 524.

Deceased Members

During the year the deaths of 75 members of the Institute (including one Honorary Member) have been reported as follows:

HONORARY MEMBER

Cleveland, Ernest A.

MEMBERS

Allan, George William
Atkinson, Charles Clifford
Bell, Frederick John
Bell, Richard Thomas
Blanchard, Arthur C. D.
Bown, William Edmond
Brandon, Harry Elmer
Burt, Andrew
Christie, William
Cole, Albert Liddiard
Dill, Charles Wm.
Dodd, Geoffrey Johnstone
Doody, Cyril William
Draper, Charles F.
Duff, William Alexander
Fairbairn, John Macfarlane
Fife, Thomas
Frigon, Augustin
Galler, Leon
Gilbert, Gordon Macdonald
Griffin, Frank Frederick
Harrison, William
Harvie, Thomas White
Hawley, Eric Farwell
Hicks, Henry B.
Horsburgh, John Graham
Jenkins, George Aubrey
Kean, David Jacques
Lang, John Leiper
Lee, Leonard Alldwyn Cole
Linde, Konstantin
Lippe, Louis Ernest Herve
Macdonald, John Angus
McNeily, Alexander R. G.
Macphail, John Goodwill
Mershon, Ralph D.
Michie, Victor
Miller, Eben Carlyle
Moon, Allan Ramsay
Mooney, John Patrick
Morrow, Harold A.
Nash, James Cundiff
Near, W. Percival
Peacock, Francis Toy
Pearce, Eldridge Burton
Pounder, John Allan
Ramsay, William Beattie
Rogers, Claude Henry
Rowand, John Allan
Sanderson, David Reynolds
Steenbuch, Harald L.
Stevens, Frederick
Stewart, Donald Laughlin
Swan, David
Taylor, Willard Davidson
Thomson, T. Kennard
Venart, Charles Herbert Somerville
Watt, William Clark
Wilson, Barry
Wood, Thomas Archibald

JUNIORS

Bailey, James Martin Monroe
Cartier, Jacques
Ford, Robert
Kelly, William John
Milovick, Michael
Takeshige, Maurice Yasue
Urquhart, Donald John
Williamson, Gerald Leask

STUDENTS

Belanger, Gaetan
Goldstein, Harold
Lamb, George Otto
Pesacreta, Greg Noro
Phillips, Donald Leroy
Thomas, David John

ERRATUM

Due to a most unfortunate error, the name of Donald John Bazett, Jr.E.I.C., was included in last year's list of deceased members. We are pleased to report that our information proved to be incorrect, and that Mr. Bazett is presently employed in the United Kingdom.

Total Membership

The membership of the Institute as at December 31st, 1952, totals 15,526. The corresponding number in 1951 was 14,659.

	1951	1952
Honorary Members.	23	26
Members	6,039	6,459
Juniors	5,170	5,993
Students	3,352	2,981
Affiliates	75	67
	14,659	15,526

Respectfully submitted on behalf of the Council,

J. B. Stirling, M.E.I.C.,
President

L. Austin Wright, M.E.I.C.,
General Secretary

●

Membership Committee

The Committee is looking for some sound advice on a matter of fundamental importance to the welfare of the Institute: how to increase the enrollment of students. Inasmuch as each student should be interviewed individually it is a time-consuming program. The services of a number of people will be required if the time spent on interviewing is to be kept within tolerable limits. It is thought that considerable could be done with the assistance of the members of the branches in the respective university cities.

The valuable services of the Field Secretary in organizing new branches has added to the membership as well as supplied branch organization in locations that are taking on greater engineering significance.

The membership is becoming better balanced as the large number of students enrolled in the last six years mature to Juniors and Members.

H. R. Sills, M.E.I.C.,
Chairman

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Board of Examiners

Council during the year 1952 referred to the Board of Examiners nine applications for Member and one for Junior.

During the same period eleven candidates for Member and one for transfer from Junior to Member were successful in passing the examination of the Board. One application which had been pending from 1951 was withdrawn, due to the departure of the candidate to reside permanently in another country following his retirement.

Applications still under consideration will be reported on as and when the findings of the Board have been completed.

C. A. Robb, M.E.I.C.,
Chairman

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Committee on Employment Conditions

This Committee wishes to report to Council that no specific problem was brought to its attention during the last year.

G. N. Martin, M.E.I.C.,
Chairman

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Legislation Committee

During the fiscal year 1952-53, no point of legislation was submitted for study to this committee and consequently it was inactive during the whole period.

All amendments proposed this year are the result of study and recommendations made during the fiscal year 1951-52.

Brig. J. P. Carriere, E.D., A.D.C., M.E.I.C.,
Chairman

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Finance Committee

A substantial increase in membership and a large amount of *Journal* advertising during the year 1952 are the main items contributing to the largest receipts in the history of the Institute and amounting to $342,083.68. This large revenue however is largely offset by increased printing costs, together with a normal increase in operating expenses leaving a credit balance of $460.06. A voluntary assessment was again suggested to members by agreement of Council and resulted in the receipt of almost $6,700.00, which was very much appreciated and of considerable assistance in financing the Institute during the year.

The advertising in the *Journal* resulted in a revenue somewhat in excess of the cost of editing and publishing it, leaving a moderate credit balance for this activity. This is very satisfactory, as for some years the *Journal* has been published at a loss. The *Journal* however is still in need of a full time editor and every effort is being made to secure a suitable person.

The mezzanine floor which was installed in the rear section of the assembly hall to provide extra office accommodation was financed partly out of operating costs and partly out of the Building Maintenance Reserve fund and is proving very satisfactory. With the continuing growth in membership and with the consequent increasing work to provide adequate service to the members, the present building is becoming too small and ineffective. In anticipation of providing increased facilities in the future a building fund has been set up. At the recommendation of the Finance Committee two years ago Council agreed that an effort should be made each year to add to the building fund an amount equal to one dollar for each paid-up member including students and juniors. This was done for the year 1952 and $15,000.00 was credited to the building fund, making a total of $40,000.00 now set aside for this purpose.

With the increased number of branches scattered across the country extra field service is urgently needed to enlarge on the good work being done by our Field Secretary. A determined effort is being made to find an additional field secretary as the work has become too great for one man to handle. To care for all the extra activities and requirements of a rapidly growing membership extra revenue will be required.

The Finance Committee met regularly throughout the year and reported at each Council Meeting the financial status together with recommendations regarding resignations of members, removal of members in arrears and reinstatement of previous members.

The Committee has had an opportunity to work closely with the General Secretary and his staff during the year and feels that the very satisfactory results obtained were due in no small measure to their very capable work and excellent co-operation.

IRVING R. TAIT, M.E.I.C.,
Chairman

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Treasurer's Report

Growth of the membership is again reflected in the increase in the income of the Institute from membership fees from $128,837.89 in 1951 to $150,465.78 in 1952. This is an increase of some 17

Comparative Statement of Revenue and Expenditure

For the Year ended December 31, 1952

REVENUE

	1952	1951
MEMBERSHIP FEES:		
Arrears	$ 7,640.60	$ 3,277.60
Current*	129,537.92	116,572.47
Advance	759.25	470.20
Entrance	5,833.99	3,468.00
Voluntary assessment	6,694.02	5,049.62
	$150,465.78	$128,837.89
PUBLICATIONS:		
Journal sales	95.17	109.50
Journal advertising	189,421.18	174,974.51
	$189,516.35	$175,084.01
INCOME FROM INVESTMENTS	1,490.24	1,166.35
REFUND OF HALL EXPENSE	400.00	565.00
SUNDRY REVENUE AND PROFIT OR (LOSS) ON SALE OF SECURITIES	211.31	(576.42)
	$342,083.68	$305,076.83

*Membership fees include Journal subscriptions

EXPENDITURE

	1952	1951
BUILDING EXPENSE:		
Property and water taxes	$ 1,567.21	$ 1,529.31
Fuel	1,040.92	865.94
Insurance	610.56	654.14
Light, gas and power	799.66	810.44
Caretaker's wages and services	1,650.00	1,532.42
Maintenance, alterations and repairs	6,176.63	2,726.05
	$ 11,844.98	$ 8,118.30
PUBLICATIONS:		
Salaries	19,077.20	11,699.90
Printing and sundry expense	115,283.15	114,475.79
Advertising Commission and management	48,348.47	43,391.40
	$182,708.82	$169,567.09
OFFICE EXPENSE:		
Salaries	53,400.91	49,141.34
Telegrams, postage and excise	4,108.16	3,461.47
Telephones	1,454.42	1,703.97
Office supplies and stationery	10,072.23	10,488.51
Audit and legal fees	1,270.67	1,065.05
Messenger and express	378.97	289.85
Miscellaneous expense	4,045.52	2,448.44
Depreciation—furniture and fixtures	1,279.75	986.45
	$ 76,010.63	$ 69,585.08
GENERAL EXPENSE:		
Students' conference	2,827.33	1,097.85
Council and annual meetings	5,034.52	880.32
Travelling	8,916.98	7,689.45
Branch stationery	228.08	239.38
Institute prizes	568.36	371.89
Library salary and expense	9,323.21	9,140.27
Interest, discount and exchange	625.06	365.02
Committee expenses	259.63	293.63
Cost of membership in other societies	2,812.04	2,211.02
Sundry expense	1,053.72	859.44
Pension plan and reserve	1,769.47	7,665.72
Membership directory	—	480.00
	$ 33,418.40	$ 31,293.99
REBATES TO BRANCHES	$ 22,640.79	$ 21,161.17
TOTAL EXPENDITURE	$326,623.62	$299,725.63
TRANSFERRED TO BUILDING FUND	15,000.00	5,000.00
SURPLUS FOR YEAR	460.06	351.20
	$342,083.68	$305,076.83

per cent. and it is interesting to note that the corresponding increase of this item in 1951 over 1950 was likewise about 17 per cent. Included in the above totals, the voluntary assessment yielded $6,694.02 in 1952, compared with $5,049.62 in 1951.

Total revenue from publication was $189.516.35, an increase of $14,432.34 over the figure for 1951. Total expenditure on this item was $182,708.82, an increase of $13,141.73 over the figure for 1951. Thus the indicated gross profit for the year shows a moderate increase of $1,290.61 over that for 1951. As in the past, no charge has been made in the accounts for items such as office space and general overhead, these costs being absorbed in the general operations of the Institute.

From the year's operations the sum of $15,000 was placed in the building fund reserve, bringing the total in this fund to $40,000. The net surplus for the year, after this transfer, was $406.06.

During the year the investment portfolio of the Institute was increased from $57,393.55 to $76,043.55, these figures being costs of securities. The approximate market value of the portfolio as of December 31st, 1952, was $74,400.

R. E. JAMIESON, M.E.I.C.,
Treasurer

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Library and House Committee

Last year's report stated that studies were being made relative to the provision of additional accommodation for the Publications Department. Three meetings were held by the 1951 Committee under the chairmanship of Mr. R. N. Coke, to study this matter. They recommended that a 17-foot wide balcony be constructed across the back of the main lecture hall in the Headquarters Building. This made available an additional 700 square feet of excellent office space at an overall cost of less than $5,000.00. This recommendation was approved by Council.

The chairman of the new Committee was appointed at the meeting of Council held in Vancouver on May 9. Arrangements were made by the new Committee to immediately take over the supervision of the construction of the new balcony.

Two meetings of the 1952 Committee were held during the month of July. A

Comparative Statement of Assets and Liabilities

As at December 31, 1952

ASSETS

		1952	1951
CURRENT ASSETS:			
Cash in hand and in banks		$ 13,781.19	$ 27,624.62
Accounts receivable—less reserve		19,840.04	20,538.65
Arrears of fees—estimated		3,500.00	3,500.00
		$ 37,121.23	$ 51,663.27
INVESTMENTS AT COST:			
Property of Engineering Institute of Canada	$56,635.22		
Property of special funds account (approximate market value $74,400.00)	19,408.33	76,043.55	57,393.55
SUNDRY ADVANCES		3,350.00	250.00
DEPOSIT WITH POSTMASTER		400.00	400.00
PREPAID INSURANCE		187.00	485.00
GOLD MEDAL		—	45.00
LIBRARY—at cost, less depreciation		1,448.13	1,448.13
FURNITURE AND FIXTURES—at cost, less depreciation		11,517.74	8,878.07
LAND AND BUILDING—assessed valuation		36,000.00	36,000.00
		$166,067.65	$156,563.02

LIABILITIES

		1952	1951
CURRENT LIABILITIES:			
Accounts payable		$ 8,963.54	$ 14,613.37
		$ 8,963.54	$ 14,613.37
SPECIAL FUNDS:			
As per statement attached		19,408.33	19,213.93
RESERVES:			
Building fund		40,000.00	25,000.00
Building maintenance		1,500.00	2,000.00
Contingent reserve		20,000.00	20,000.00
Pension fund reserve		10,366.50	10,366.50
SURPLUS ACCOUNT:			
Balance as of December 31, 1951	$65,369.22		
Add: excess of revenue over expenditure for year as per statement attached	460.06		
		65,829.28	65,369.22
		$166,067.65	$156,563.02

AUDITORS' CERTIFICATE

We have examined the statement of assets and liabilities of The Engineering Institute of Canada as of December 31, 1952, and the statement of revenue and expenditure for the year ended on that date and have obtained all the information and explanations we have required. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances.

In our opinion the above statement of assets and liabilities and accompanying statement of revenue and expenditure are properly drawn up so as to exhibit a true and correct view of the state of the affairs of the Institute at December 31, 1952, and the results of its operations for the year ended on that date, according to the best of our information and the explanations given to us and as shown by the books of the Institute.

PEAT, MARWICK, MITCHELL & CO.,
Chartered Accountants.

MONTREAL, P.Q., JANUARY 20, 1953.

comprehensive program of painting and decorating was carried out and necessary roofing and minor building repairs were completed. Repairs were also made to the heating system in order to place it in first class condition for the next heating season.

The Committee was requested by Council to investigate and report upon the offer which was made to Council by Mr. J. M. Robertson, M.E.I.C., Montreal, to present to the Institute an electric clock. This clock was examined by members of the House Committee and was found to be a very fine electric clock made entirely by Mr. Robertson. The Committee recommended the acceptance of Mr. Robertson's very generous offer and further recommended that a suitably inscribed plate be prepared and attached to the clock recording the particulars of the gift, and that arrangements be made on some appropriate occasion to have Mr. Robertson, in person, formally present the clock to the Institute.

A. S. RUTHERFORD, M.E.I.C.,
Chairman

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Nominating Committee 1953

Chairman: F. W. Bradshaw

Branch	*Representative*
Newfoundland	.....
P.E.I.	D. I. D. Rozman
Cape Breton	H. G. McCann, Jr.
Halifax	W. C. Risley
Amherst District	L. F. Kirkpatrick
Moncton	R. T. Sansom
Fredericton	M. W. Black
Saint John	W. M. Brenan
Saguenay	B. L. Davis
Lower St. Lawrence	P. E. Roger Thomas
Quebec	C. H. Boisvert
St. Maurice Valley	A. M. Hubley
Eastern Townships	J. C. Critchley
Montreal	R. B. Wotherspoon
Cornwall	P. H. Nasmyth
Ottawa	A. C. Ross
Kingston	J. W. Brooks
Belleville	F. C. Adsett
Port Hope	A. F. Alexander
Peterborough	A. L. Killaly
Toronto	W. E. Bonn
Hamilton	W. E. Brown
Kitchener	A. J. Girdwood
Niagara Peninsula	C. G. Cline
London	G. E. Humphries
Border Cities	G. W. Lusby
Sarnia	S. V. Antenbring
Sault Ste. Marie	R. A. Campbell
North East. Ontario	John E. Lenhoff
Nipissing & Up. Ot.	J. W. Millar
Sudbury	A. D. Finlayson
Lakehead	A. J. Mickelson
Winnipeg	G. W. Moule
Saskatchewan	W. M. Berry
Lethbridge	A. L. H. Somerville
Edmonton	C. E. Garnett
Calgary	T. M. Parry
Central B.C.	H. R. Hatfield
Kootenay	H. P. Hamilton
Vancouver	S. H. deJong
Vancouver Island	H. D. Dawson

Papers Committee

Referring to the by-laws it will be noted that this Committee has no responsibility either for papers for meetings of the Institute as a whole, or for meetings of the Institute Branches. The by-law merely says "advise and assist".

No requests were received during the year for advice or assistance.

A complete report of this Committee was submitted for the year 1951 by Henry Gaudefroy, M.E.I.C. That report was fully endorsed.

E. R. SMALLHORN, M.E.I.C.,
Chairman

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Admissions Committee

I am pleased to report as follows on the activities of the Admissions Committee for the year 1952:

The Committee held nine meetings previous to the Council meetings and a total of 1,720 cases were reviewed and are broken down as follows:

Applications for admission	448
Applications for transfer	139
Applications through Professional Associations:	
(a) Admissions	123
(b) Transfers	114
Student applications	879
Special cases	17

L. A. DUCHASTEL, M.E.I.C.,
Chairman

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Employment Service

For the first six months of 1952, conditions in the employment field were much the same as those of the past three or four years. There was a heavy demand for skilled engineers and too few available to fill the vacancies. However, during the last six months of the year, demand began to fall off slightly and the variety of job opportunities became somewhat narrower.

This trend has been felt more in the ranks of the senior engineers and the foreign-born engineers who have recently come to this country. It has not been noticeable in the junior age group, which is still very much in demand. Last year's report indicated that demand for junior engineers would likely continue for some time, since industry can absorb larger numbers of younger members than the universities are presently graduating.

The Employment Office had fewer requests from men now in jobs. This could mean that more engineers are satisfied with their places of employment and their working conditions, or that the opportunities for other jobs are becoming fewer.

As far as European engineers are concerned, the Canadian immigration authorities took a step in mid-summer which greatly cut down the flow of professional men from across the Atlantic, with the exception of British and French nationals. All others must now show proof that they have an engineering job assured and contracted for in this country before they are granted a permit to enter Canada. British and French engineers are not bound by this restriction.

Since the employment picture had tightened somewhat in any event, this restriction eased some problems that had faced this office before when trying to place European candidates. Language difficulties, special skills for which there was little demand in this country, and the seniority in age, were all handicaps in finding ready employment for many of these men. It led to much discouragement and disappointment on their part.

While some industries have slowed down their expansion and so need fewer skilled men, others are steadily going ahead. The most active still is the construction industry. This has been concentrated mainly in the outlying sections of the country—in the far West, Labrador, and in Newfoundland. The opportunities in Eastern Canada in this line of work are far fewer. But if applicants are willing to face the more strenuous conditions in the North and the far West, there are many well-paid and interesting jobs to be obtained.

Defence work has been active, too, and there are vacancies for those skilled in electronics. Since there is a shortage of native Canadian professionals in this line, many engineers from the United Kingdom have come in to carry out this work at important centres.

This office had another year of heavy correspondence. Letters are received from and sent to all corners of the globe. Every effort is made to supply helpful information on the employment situation, acceptable qualifications for employment, projects under way, housing conditions and many other matters. During the year, the Employment Service sent out 2,360 letters.

While on the subject of correspondence, there is one point that employer-members could note and act on to the benefit of this office. Many applicants state that their applications, which are routed through this office to employers, often fail to get an acknowledgment. While there may not be a job available for the applicant in the firm he is contacting, an acknowledgment does permit this office to turn its efforts elsewhere, and to concentrate on the more likely places to effect placement.

Some 325 jobs were listed in the pages of the Employment Bulletin during 1952, and this publication continues to be widely circulated both in Canada and other parts of the world. The Employment Service succeeded in placing 175 applicants, and this together with 81 placements made by the Toronto Office, made up a total of 256 for the year. These bare figures, of course, do not represent all the placements which were made, for many were not reported.

The year ahead looks like another active period, especially in the field of construction with several large hydro power projects getting under way. The Employment Service will continue to do its utmost to carry out a two-fold-job—that of trying to fill the needs of industry in the engineering field and satisfying the requirements of individual engineers who want to be placed. It is not always the easiest thing to do—fitting the man and the job—but that is the true and only real purpose of the Employment Service.

(MISS) A. SUMMERS,
Employment Service

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Publications Committee

The year 1951 saw many new all-time high records established for *The Engineering Journal* but 1952 eclipsed practically all of them. The total number of copies printed was 187,584—an average of 15,632 per month. The total circulation was again the largest of all Canadian technical publications and averaged over 15,321 copies per month. At the same time the number of pages of technical news material amounted to 866 as compared to 807 in 1951, or an average of 72 pages per issue.

Advertising revenue exceeded the forecast and established a new record but expenses were likewise considerably

higher and tended to offset the increased revenue to an appreciable extent.

Publication costs were up from the previous year to the extent that the average gross cost of production for 1952 was 71.1 cents per copy or $8.53 per subscriber for the full year. The corresponding figure for 1951 was $7.38, representing an increase of just over 15 per cent. From these figures it will be apparent that the regular 75 cent selling price for individual copies of the *Journal* barely covers cost and that the regular independent domestic subscription rate of $6.00 per copy shows a substantial loss.

A further source of expense is the tremendous number of changes of address in connection with the *Journal* mailing. During 1952 an average of approximately 750 mailing stencils were changed monthly due solely to address changes. In addition there were many hundreds of other new stencils made in connection with elections and transfers of members. During December alone there were more than 2,000 new address stencils typed.

As usual many letters of commendation were received from members and other readers with regard to the editorial content and general format of the *Journal*. Another indication that the *Journal* is looked upon with favour by most of our members is the fact that so many notify Headquarters of address changes beforehand in order to avoid delay in receiving their copies. Furthermore there is a steady demand for "missing issues" which have gone astray in the mails through improper forwarding.

During the year, continuous efforts were made by the *Journal* staff and the members of your Committee to secure technical papers on the latest engineering developments in Canada. Many of our members as well as some other engineers responded and prepared many excellent papers which have been published. The thanks and appreciation of the Committee are extended to all contributors.

There were 59 technical papers in all, published during 1952 and the breakdown by engineering branches follows:

Aeronautical	2
Chemical	5
Civil	11
Electrical	9
Mechanical	14
Mining	2
Miscellaneous	16
	59

During recent years the accommodation for our *Journal* staff has become more and more congested with the result that early in 1952 the Library and House Committee, with the endorsation of the Finance Committee, obtained Council approval to proceed with the construction of a gallery or mezzanine at the back of the main lecture hall or auditorium of the Headquarters building. This was fitted out as a publications office and the entire staff, apart from the editor and assistant editor moved in during the month of September. The new accommodation has proved to be most satisfactory and the working conditions for the staff are now excellent.

Your Committee held seven meetings during the year and all were well attended by its members as well as by the staff at Headquarters.

HENRI GAUDEFROY, M.E.I.C.,
Chairman

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Prairie Water Problems Committee

Our report last year referred to the appointment of the Royal Commission on the South Saskatchewan River Development. In as much as your Chairman and one of the members of your Committee are on this Commission and as the report is in the hands of the printer but has not yet been released by the Government it would seem inopportune to discuss the activities of this Committee at the present time.

G. A. GAHERTY, M.E.I.C.,
Chairman

●

Committee on Professional Interests

This Committee has not been called upon to study any particular problem during the past year. However, it might be useful to review here some of the Institute activities in 1952 which came within the sphere of interest of the Committee.

Although the scope of its activities has been enlarged from time to time, the original terms of reference of the Committee called for the promotion of co-operation between the Institute and the provincial professional associations. It was, therefore, gratifying that the committee on arrangements for the Annual Meeting held at Vancouver last May, made provision for a discussion at that meeting on the subject of "the fields of interest and activity of The Engineering Institute of Canada and the provincial professional associations." The subsequent publication in the *Journal* of the discussions which took place at the meeting has been very helpful in thus placing on record the objectives sought by this Committee in promoting co-operation.

The very successful Maritime Professional Meeting held in September at St. Andrews, N.B., under the joint auspices of the maritime branches of the Institute and the associations in New Brunswick and Nova Scotia, was a further indication of the active co-operation existing in these provinces.

Co-operation at the international level was continued through the agreement existing between the Institute and The American Society of Mechanical Engineers. In the same field, your Committee was particularly pleased to note that the Institute field secretary, Lieutenant-Colonel Grant, was elected chairman of the Engineers Council for Professional Development, the first time such an honour has been bestowed upon a Canadian.

Further evidence of the position the Institute has achieved in world engineering bodies is the fact that it was the only Canadian engineering organization invited officially to the Centennial of Engineering celebrations held in Chicago in September on the occasion of the 100th anniversary of the founding of the American Society of Civil Engineers. The previous month, President Stirling with Past-President Vance, Dean K. W. Tupper, Verne King, and General Secretary L. Austin Wright, had officially represented the Institute at the second convention of the Pan-American Federation of Engineering Societies in New Orleans, in which 14 countries took part.

One of the functions of this Committee is the promotion of new branches of the Institute in Canada. Largely owing to the efforts of the headquarters staff, and the field secretary in particular, the following new branches were established and inaugurated during the year:

Nipissing and Upper Ottawa branch
Port Hope branch
Northeastern Ontario branch

Applications were also approved by Council for the establishment of branches at Cornerbrook, Newfoundland, and Amherst and New Glasgow, N.S.

LOUIS TRUDEL, M.E.I.C.,
Chairman

●

Committee on the Training and Welfare of the Young Engineer

During the past year, the Committee on the Training and Welfare of the Young Engineer has been reactivated.

Studies have been made to ascertain the areas in which the Committee might be of most use in assisting undergraduates just out of college to attain their objectives.

UNDERGRADUATE LEVEL

In the undergraduate field it has been noted that a considerable percentage, in some cases as high as thirty per cent, of freshmen do not proceed to graduation.

Among the reasons for this condition may be counted the following:

a. Inadequate preparation at High School level.
b. Inadequate counselling in High School.
c. Financial.
d. Lack of serious effort on the part of the student.
e. Lack of ability, including sickness.
f. Short-term enrollment. the student who drops out to take a lucrative job.

Somewhere along this line there would appear to be, in some measure, an unnecessary loss, not only to the student, but also to the profession and to the community in general.

WELFARE

The Committee's terms of reference concerning welfare could be brought to bear on the above problems. Further publicity among the members of the Engineering Institute is recommended for the following purposes:

a. To stimulate contributions to the Harry Bennett Education Fund.
b. To induce practicing engineers to extend more freely the hand of friendship to students, especially the freshmen who are away from their homes.
c. Short-term enrollment should be discouraged, as expensive facilities are thus inefficiently occupied. This condition appears to call for the Junior College.

GRADUATE LEVEL

E.C.P.D.

The committee on Professional Training of Engineers' Council for Professional Development recommends the six point program entitled "The First Five Years Of Professional Development" as a basis for the setting up of courses to assist young graduates recently out of college to attain professional status.

The six points of the program are as follows:

1. Orientation and Training.
2. Continued Education of Graduate Engineers.
3. Integrating the Young Engineer into his Community.
4. Registration of the Young Engineer.
5. Self-appraisal Methods for Valuable Characteristics in Engineering.
6. Reading-Lists.

TRAINING

Large industrial firms usually conduct Orientation and Training Courses for their young engineer employees. Young engineers in certain other areas lack these opportunities for continuing their studies and training.

STUDY GROUPS

Under the leadership of Colonel L. F. Grant, Item No. 2 of the above program has been successfully initiated in the form of Study Groups in a number of centres in eastern Canada. There are twelve groups presently operating and a further six groups are due to commence in January, 1953.

When organized, the members of a Study Group arrange their own series of lectures by special speakers in subjects suitable for their professional development.

Our Committee on Training and Welfare aims to sponsor similar Study Groups in areas not already covered.

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GEORGE B. MOXON,
Chairman

●

Library Report

Last year's report outlined in detail all the library services available to members. The chief observation on reviewing 1952 is a greater volume of activity in all sections of the work.

The daytime attendance and use of the reading room shows an increase of fifteen per cent over that of last year, and the evening attendance, that is, the six to eight o'clock period each Thursday there is a Montreal branch meeting, shows an increase of twenty-five per cent.

Books and standards received for review were valued at $2,055, as compared with $1,680 last year. This represents 324 volumes of books, and 255 codes and standards. No book is ever accepted and acknowledged for review without being both listed, and reviewed in as early an issue of the *Engineering Journal* as possible after it is received.

New gifts and exchanges in the periodical group showed a total value of $76.50, making a complete total value of publications received in this manner, of $734.00.

Additions to the library as a whole totalled 4,403 items, making an overall total of 18,000 in the collection. Bibliographies prepared covered 35 different subjects, as compared to 37 last year. In some instances these bibliographies are re-used in a very short time, in cases of almost identical requests from entirely different sources and parts of the country. This year 330 photostat prints were ordered by members, as compared to 116 last year.

Inter-library loans showed an increase of over 25%, 47 borrowed by us from other libraries, and 337 borrowed by other libraries in and out of the city, from the Institute library. Most of these latter represent work done by us for our members, through the facilities of their own company librarians, who, in turn, come to us for the information required.

Out of 308 orders by mail for books, it is interesting to note that 54 of these were letters referring to a specific page, or pages, in the library Book Notes.

A total of 1,745 letters were received during 1952, of which 904 were requests for information, or for research projects or bibliographies. Enquiries by phone totalled 4,647, an increase of 10% over 1951, and people coming into the library for information totalled 2,696. This brings the number of enquirers by phone, mail, and in person, to 8,247. The total number of books taken from the library for use was 1,276, and 5,769 books, magazines, pamphlets and indices were used in the reading room. Assuming these all to be a search for information in some form, these figures come to the impressive total of 15,292.

Letters sent out totalled 1,199, acknowledgment and single sentence pieces of information on post cards, 414, and invoices, 415.

The number of new borrowers registered in the library during the same period was 883, making the total number of active borrowers and library users as of December 31, 602, as compared with 508 last year.

Wherever you may live, or be working, your enquiries are invited on any problems or information required involving reference material, photostatic reproduction of articles, books, subscriptions to publications of professional organizations, or films and filmstrips, either technical or popular.

EMILY KEELEY,
Chief Librarian

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Canadian Standards Association

The C.S.A. has again been very active during the current year, whether measured by the number of projects under development or by the number of meetings that were held. Approximately 38 new Standards have been issued and 128 more have been undertaken and are presently in various stages of production.

The Sectional Committee on Building Materials carried out a great deal of work in which co-operation has been established between them and the National Research Committees on Building Codes. The Sectional Committee on Concrete is again reviewing the general specifications on reinforced concrete design, construction and materials, and have issued a number of new specifications on particular items.

The preparation of the sixth edition of the Canadian Electrical Code has of course involved the Sectional Committee on Electrical work, and many of it's working committees, in a large number of important meetings, some of them very long and arduous. Part One of the Code will probably be completed and published in the early Spring of 1953. The Committee on Part Two has also been active and has issued at least six new Standards dealing with approvals specifications. The Electrical Code — Parts Three and Parts Four, have also furnished occasion for much labour inside the Association and considerable progress has been accomplished along many lines.

The Sectional Committee on Steel Construction has published a revised edition (the fourth) of Specification S-6 for Steel Highway Bridges, and is dealing with a host of suggestions regarding the use of structural steel work in buildings.

The Welding Section has also been busy and has issued two new Standards covering electrodes and safety codes besides making progress with Specifications for resistance welding, marine welding, etc.

Other sections that have had a great deal of work thrust upon them are those on Mechanical Engineering, Fire Prevention, Illumination, Timber Construction, Packaging and Photography.

During the year the new By-Laws have been carried to completion and were unanimously adopted at a special General Meeting, as a result of which, a new and more efficient Constitution of the Association will be brought into being in the early future, and preparations are now in hand for the election of a Board of Directors which will become the new managing body. The old Main Committee, which has been responsible during so many years for the approval and issuance of Specifications, will be replaced by a Technical Council somewhat similarly constituted, but the Old Executive Committee appointed by the Main Committee, will disappear and be replaced by this Board of Directors elected by all the contributing and voting members.

It is generally felt that this modernization of the Association's Constitution will be a great step forward in the effort to make the C.S.A. of even wider importance and usefulness in it's services to Canadian industry.

P. L. PRATLEY, M.E.I.C.,
Representative of the Institute

●

Canadian Chamber of Commerce

In looking back over old reports your representative on the Canadian Chamber of Commerce has discovered that he reported the 25th Annual Meeting of the Chamber in 1950. This was a slight exaggeration. It was their 21st Annual Meeting. As no protests were heard, one concludes either that no one read the report, which is probably correct, or that whoever did read it failed to notice the error. However, the correction is made in the interest of accuracy which should be one of the attributes of the engineer.

And so, having cleared the record. I can now proceed to reporting the Chamber's 23rd Annual Meeting. It was held in the Royal York Hotel on October 21st, 22nd and 23rd, 1952, and was a very successful meeting. The business of the meeting actually began on the previous day, the 20th, with a session of the Policy Committee which lasted all day and well into the night. This committee considers declarations of pol-

(*Continued on page 126*)

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Abstracts of Reports from Branches

Note — For Membership and Financial Statements see pages 124 and 125

Belleville Branch

There were eight general meetings throughout the year, which have been reported in the *Journal*. The topics of the various addresses represented a wide variety of engineering subjects. The attendance was exceptionally good at all meetings and particularly so at the December meeting when the geology of the Belleville District was ably described by the provincial geologist.

The annual visit of the E.I.C. president was the occasion of a dinner and dance which was well attended by the members and their wives. A most interesting visit to the Nylon Plant in Kingston during November heightened the interest of our members.

The chairman, secretary-treasurer and one other member of the Branch went to Peterborough in October to join with that Branch on the occasion of the president's visit. It should be noted also that several members of the Peterborough Branch were present when the president visited this Branch.

Border Cities Branch

Branch highlights for the year were the formation and successful operation of a Ladies' Auxiliary and a Professional Development Course, both of which have contributed greatly to the Branch in greater interest and greater memberships.

The majority of meetings were held at Assumption College, commencing at 8.00 p.m. Attendance was found to be much better than it had been at previous dinner meetings. A very successful second annual dinner dance was held during the visit of President Stirling.

Calgary Branch

During the year eight general meetings were held, dealing with a variety of subjects. Technical topics included: "Developments in Concrete for Construction", "Pulp and Paper Plants", "Railroad Dieselization", "Insert Gas Shielding in Arc Welding", "Sulphur and Propane Recovery from Natural Gas". Non-technical subjects included a medical practitioner's talk on "Mind over Matter" and a motion picture on the "Operation of an Investment House". The question periods at the conclusion of each of these programs indicated wide interest in the subjects under discussion.

Four meetings of a special nature were held during the year. On the occasion of the visit of Dr. Ira P. Macnab, Institute president, in April and again upon the occasion of the visit of Dr. J. B. Stirling in November, the Branch held a dinner meeting followed by a social evening and dance. The members of the Branch entertained the ladies at a dinner and dance in February. In May the Branch sponsored a joint meeting at which Mr. W. H. Johnson of Washington, D.C., spoke on "Frost Action in Highways". Mr. Johnson came to Western Canada under the auspices of the National Research Council.

Weekly meetings of the Luncheon Club were held throughout most of the year. A short talk or other form of program followed lunch. The popularity of these meetings was indicated by a consistently good attendance.

Cape Breton Branch

The regular monthly supper meetings of the Branch were well attended and the speakers all presented informative and interesting addresses. Two senior high school students, who have expressed an interest in engineering, are invited to our supper meetings. This has proved popular with the students and faculty of the high schools of Sydney.

Plans were made in late 1952, to conduct a Professional Development Course during 1953. Colonel Grant, the genial and well-informed field secretary, was of great help in guiding plans for this proposed course.

The Cape Breton Branch had a successful and active year and looks forward to 1953 as another progressive year.

Central British Columbia Branch

The past year has been generally successful. At joint meetings with the Central B.C. Branch of the British Columbia Engineering Society there have been excellent addresses on a variety of engineering subjects.

Highlights of the year were the eventful April visit of President I P. Macnab and Mrs. Macnab, though they were absent from the meeting arranged in their honour due to railway line difficulties, and the visit of President J. B. Stirling and Mrs. Stirling in November. Several members of the Branch were able to attend the Institute's annual meeting in Vancouver, and representatives were present at the council meeting and the Branch Officers Conference. A student guidance committee has made a good start in guidance work.

Three executive meetings, and seven general meetings were held.

Eastern Townships Branch

The winter season's activities ended with the annual meeting on Saturday, May 31, which was held at one of the hotels at the popular resort area of North Hatley, about 20 miles from Sherbrooke. The ladies were invited and the meeting was followed by dancing. Guest speakers were Dr. J. B. Stirling, newly elected president of the Institute, and Dr. L. A. Wright, general secretary, who discussed their experiences at the annual meeting just completed in Vancouver.

Activities of the new season commenced on October 10 with a meeting at which some films and a talk were presented by a representative from the Northern Electric Company. The meeting of November 8 featured a visit to the new baseball stadium under construction, and a talk on "Prestressed Concrete". The final meeting of the year was held on December 15, at which some films were shown under the sponsorship of Canadian Industries Limited.

New methods were adopted for the handling of Branch activities during the new season and committees were appointed to handle various phases of Branch work.

With the encouragement of the field secretary of the Institute, Dr. L. F. Grant, a Junior Engineer's Lecture Course is well under way, with an enrolment of 31.

Regular meetings are held monthly during the active season, and all meetings are held on Fridays unless special circumstances arise. One distinguishing feature of all meetings to date, has been the success in obtaining sponsors among the local industrial concerns, through whose courtesy very enjoyable buffet lunches have been served at the meetings.

Edmonton Branch

After a successful season, the annual meeting of the Branch took place in April 1952. On this occasion the president of the Institute, Dr. I. P. Macnab, and Mrs. Macnab were the honoured guests as they stopped in Edmonton en route to the annual meeting in Vancouver.

The fall season commenced with a dinner meeting on October 7, when the program for the season was announced. In October a new form of Branch meeting was inaugurated consisting of a buffet supper followed by a discussion, with illustrative slides, of the work of Leonardo da Vinci.

In December President J. B. Stirling and Mrs. Stirling spent three days in Edmonton. He was accompanied by Mr. and Mrs. E. B. Jubien, of Montreal, and by Dr. L. Austin Wright. The crowded schedule of this visit included the regional meeting of council, and the annual banquet and dance of the Branch.

Fredericton Branch

The Fredericton Branch has been in operation for just one year, having received its charter on December 8, 1951. The year's activities have been very successful, with ten general meetings, and nine executive meetings. The nature of the general meetings has been varied, including dinner meetings with speakers, smokers with films or speakers, and one Ladies' Night. In August the members of the Branch enjoyed a cruise on the St. John River and in May the graduating engineers from the University of

New Brunswick were entertained by the Branch.

One dinner meeting was held at Andover for the special benefit of the non-resident members. Following the dinner the engineers made a tour of the New Brunswick Power Commission's new hydro electric development at Tobique Narrows, and witnessed the demolition by Army engineers of a bridge over the Tobique River.

A course for junior engineers was organized and has been enthusiastically received.

Halifax Branch

In carrying out the year's work the Branch has had less contact with Headquarters than usual for two reasons; one was that the annual meeting was held in Vancouver and Halifax Branch representation was very small; and the other reason was that the presidential tours have been arranged in such a way that there has been no visit to Halifax during 1952. On the other hand, the Branch has been visited by the general secretary and the field secretary, and also many of the Branch members attended the Maritime Professional Meeting at St. Andrews, where the president and Mrs. Stirling were in attendance.

There has been nothing outstanding in Branch meetings which have been held throughout the year, with the customary buffet supper as a feature. A very successful year was experienced by the Committee on Professional Development Courses and it was felt that the work accomplished has been exceptionally good.

Hamilton Branch

Membership in the Branch increased considerably during 1952. Total membership as of December 20, 1952 was 456 compared to 400 for last year. This increase was due to the efforts of our Membership committee and the high influx of young Engineers to the Hamilton area.

The eight meetings held this year were well supported by the membership. A visit to Sir Adam Beck Generating Station No. 2 commanded the largest attendance. The November meeting was held in conjunction with a buffet supper which proved exceedingly popular with a result that several meetings of this nature will be planned for next season.

The Engineers' Ball held in October during the president's visit was an excellent affair though moderately attended.

Three committees deserving special mention were the Students' and Juniors' Paper Competition committee, the Professional Development Program committee and the budget committee. Eight contestants participated in the paper competition all of whom presented excellent papers. Fifty-nine Branch members took part in the second season activities of the Professional Development Program. Three groups were organized, each group studying different subjects. Several local companies expressed keen interest in the course. The budget committee was active in devising ways and means for the Branch to operate within its income.

The Branch records with regret the passing of J. C. Nash, corporate member.

Kingston Branch

The Kingston Branch enjoyed a very successful year with a good attendance at all nine meetings. One of our two dinner meetings was attended by President J. B. Stirling, while our other one concluded with a dance. Two meetings were held at the R.C.E.M.E. Officers' Mess at Barriefield, one a joint meeting with the Professional Engineers and the other a smoker. A trip was made to Brockville in order to have a meeting with our members at that centre. The Branch also sponsored a Student Papers Night for the presentation of papers by Queen's students and R.M.C. Cadets. A visit was made to one of our local plants engaged in the manufacture of diesel locomotives. Two buffet supper meetings were held at which very interesting subjects were presented.

The executive was successful in preparing and editing the Branch by-laws which were distributed to all Branch members.

Kitchener Branch

The executive considers that the Kitchener Branch has had a most successful year. A pattern of meetings which apparently appeals to the members has now been established and it is expected that this system will continue during 1953.

In January there was the very successful annual dinner meeting at the Granite Club in Kitchener. In March the Branch held a joint meeting in Brantford with the Grand Valley Group of Engineers and it has been decided to make this an annual affair with the meeting place alternating between Brantford and Kitchener. The famous roast beef dinners of the Kerby House are known throughout the Province. In April the engineers' ball and ladies' night was held. This annual event is acquiring a fine reputation in the area.

In June a field trip was made to the new hydro development at Niagara Falls and it has now been decided to establish an annual field trip to some large engineering works in the area. No formal meetings were held during the summer months and in September the annual golf tournament was held at the Grand River Golf Club and Country Club.

The president made a very successful visit to the Branch in October. This meeting was particularly well attended and it was most gratifying to see the interest shown in the president's visit by the members at large.

A number of outstanding speakers were obtained during the year and in general the meeting attendance has substantially increased over that of 1951.

All regular meetings are held at the officers' mess, Knollwood Park, Kitchener. Excellent facilities for conducting engineering meetings along with a social hour afterwards are provided by the mess. Lunch of cold meats, cheese and pickles is usually provided for the members after the meeting and it seems to add a touch of informality and a chance for members to get to know each other.

Approximately 185 notices are mailed out to engineering personnel and officers in the area. Average attendance is about 40 people per meeting. All meetings are conducted on an informal basis and it appears that the above type of meeting has proved most popular with the members.

Kootenay

The Kootenay Branch has just completed its most active year to date.

Ten well-attended executive meetings and six regular Branch meetings were held. In addition two banquets, each attended by 150 members and guests, were given in honour of the visits of E.I.C. presidents, Dr. Macnab and Dr. Stirling.

A smoker and film showing, attended by 200 members and guests, proved to be a very effective way of interesting potential members in the activities of the Branch, and another gathering of this type is planned for the coming year.

A tour of the concentrator at the newly opened Bluebell Mine at Riondel and a visit to the site of the Kootenay Lake Transmission Line crossing was the only field trip sponsored during the year.

Of the six regular Branch meetings, five were luncheon or dinner meetings with an average attendance of 38. Refreshments were served at the close of the remaining meeting, but the attendance was only 13. These figures are of interest because they indicate that members like to eat before settling down to listen to a speaker and Branch business.

At the close of the year, nine lectures had been completed of the scheduled 18 comprising the Professional Development Course for Junior Engineers. Thirty-seven junior members are enrolled for the course, and to date, this undertaking has been highly successful.

This Branch was well represented at the annual meeting in Vancouver, with ten members in attendance. Two members, Mr. E. M. Stiles and Mr. W. G. Small, presented papers at this meeting.

The Branch Councillor, Mr. A. H. W. Busby, attended the Regional Meeting in Edmonton on December 6.

Lakehead Branch

The Lakehead Branch had a very successful year in 1952, holding nine meetings, five in Port Arthur and four in Fort William.

In an effort to promote closer co-operation between the various other technical societies and associations and the E.I.C., three meetings were joint meetings.

One was held co-operatively with the Technical Section, Midwest Branch, Canadian Pulp and Paper Association at which Dr. L. R. Thiesmeyer, president of the Pulp and Paper Research Institute of Canada, spoke on "Guaranteeing the Industries' Future".

At the Branch annual meeting the main speaker was Mr. Oswald O. Johnston, president of the Professional Engineers of Ontario. The professional engineers who are not members of the E.I.C. were invited to this meeting.

One meeting was arranged as a panel discussion on Town Planning. The local architects were invited and took part in the discussion.

At our annual Ladies' Night the Branch was honoured by the presence of President and Mrs. John B. Sterling.

The program committee also introduced the plan to hold meetings periodically, at which general interest topics would be discussed instead of technical subjects. At two such meetings "Stocks and Bonds", and "Wills, Estate Planning and Succession Duties" were discussed.

Our Annual Dance in January was attended by over 85 couples.

The year's program was concluded with a visit to the Fort William plant of the Canadian Car and Foundry Company to inspect the bus and aircraft production lines.

Members of the Student Guidance Committee addressed the students at the Lakehead Technical Institute on the advantages of membership in the Engineering Institute of Canada. These students were guests at some of the meetings during the year. The committee also gave lectures on engineering at Career's Nights at the secondary schools in both cities.

Lethbridge Branch

A summary of the Branch's activities in 1952 results in the following statistics. There were five regular meetings with an average attendance of forty-eight. At two special meetings the average attendance was eighty-one. Fifty-six members participated in a field tour. The executive met seven times, with an average attendance of five members.

Lower St. Lawrence Branch

The executive of the Branch held two meetings, and four various meetings took place in January, February, November and December.

On January 31 a group of twenty-two attended a special Junior evening. Following dinner there were talks by Mr. Marcel Fradette, on proposed improvements to Matane Harbour; by Mr. André Leroux, on the economical angle of home construction; and by Mr. André Michaud, on the Corporation de Téléphone of Quebec.

Leo McLaren presided at the annual social evening on February 16. After cocktails and dinner, Mr. Jacques Brillant spoke to the 56 people attending, on the ways and customs of some Europeans, and the evening concluded with a dance.

The field secretary of the Institute, Col. L. F. Grant visited Rimouski on November 12. The executive accompanied the secretary to dinner, and a meeting followed.

A social meeting took place on December 13, consisting of dinner, films and dancing. Mr. Boudreau, president for the Province of Quebec of the National Film Board, as guest speaker, described the origin, organization and production of the National Film Board.

Moncton Branch

The Branch held three technical meetings during the year. These were all dinner meetings and were well attended. Addresses were given by A. W. Purdy, who spoke on the Drama of Portland Cement; G. V. Eckenfelder, on the Spray River Power Development; and A. F. Small, on Power from the Bay of Fundy Tides. A Ladies' Night and Dance was held at the beginning of the year and was highly successful. Late in November, the Branch made an inspection tour of the new cement plant at Havelock. An invitation was extended the engineering students of Mount Allison University and about thirty-five accompanied Branch members on the trip to Havelock.

Montreal Branch

The Branch executive has endeavoured to continue the development of technical sections instituted as a result of the 1949 questionnaire. Results have been most encouraging.

Some interesting attendance figures are available. For January-May there was an average attendance of 88 at 13 general meetings, and 88 at 12 technical session meetings; corresponding figures for the October-December period are 88 at 11 general meetings, and 104 at 15 technical meetings, with a total weekly attendance averaging 200.

The work of the reception and attendance committee has been outstanding.

The executive has been exploring means of securing maximum co-operation with other societies. In this connection a joint meeting was arranged between the Military Engineers Association and the Branch. Another step in this direction was the joint M.E.A. - R.C.E. - E.I.C. Oyster Party on October 17.

On September 19 the Branch combined forces with the local members of the Institution of Civil Engineers, the Institution of Mechanical Engineers and the Institution of Electrical Engineers to honour the distinguished presidents and secretaries of the three British institutions, on their return home through Canada from the Centennial of Engineering in Chicago.

The junior section has had a very active year, as usual. They played a leading part in an E.I.C. week on McGill Campus organized by undergraduate members at McGill.

During the year the activities of the junior section were designed to meet the social and generally non-technical requirements of the young engineer. The program was highlighted by the "Beef Session" — an open forum discussion which provided an opportunity for the membership both young and old, to air their views on E.I.C. activities and the responsibility of their Associations and Societies. Attendance at the forum topped all records.

The junior section arranged Students' Night for a general branch meeting. On the social side, the golf tournament, the oyster party, and the annual dance provided enjoyable outings. The junior element in the Branch was pleased at the recognition of its views by Council. A representative of the executive is now invited as an observer to all local Council meetings. They also commend the steps taken to arrange for incorporation of all junior members. Chairman of the section was R. E. J. Layton.

The program committee of the Branch, headed by T. N. Davidson, co-ordinated the program of Thursday general meetings, these meetings being sponsored by one of the Branch sections ordinarily. The chemical section, with W. H. Gauvin as chairman, was responsible for two Thursday meetings, and 3 section meetings. The civil section, with Chairman R. Quintal, arranged four section meetings as well as three general Branch meetings. The electrical section organized one Branch meeting. In addition, meeting on alternate Mondays, a program of 12 meetings was carried out in co-operation with A.I.E.E. Chairman of this Section was J. Hahn. The management section, with D. A. J. McDonald as chairman, contributed five Thursday meetings, and held three section meetings on Tuesdays. Five meetings of the mechanical section were held. That section, with J. R. Haughton as chairman, also arranged for four Thursday Branch meetings. The transportation section organized four Thursday meetings. Its chairman was D. J. Munro.

Niagara Peninsula Branch

The Niagara Peninsula Branch had a very successful year in 1952. Seven general meetings were held in addition to the annual dinner dance. In April a most interesting plant tour of Atlas Steels Limited, Welland, was arranged. The Branch was again fortunate in being able to make a tour of the Sir Adam Beck Generating Station No. 2 Development of the H.E.P.C. at Queenston in September. The Branch had the pleasure of entertaining the presidents and secretaries of the Institution of Mechanical Engineers, the Institution of Electrical Engineers and the Institution of Civil Engineers from Great Britain on September 15.

President J. B. Stirling and Col. H. G. Thompson visited the Branch in October. The first series of weekly non-technical lectures of the Professional Development Course was completed in March. The Branch is sponsoring a second lecture series of the Professional Development Course for the 1952-53 season. This has been the highlight of the year's activities. Considerable interest and enthusiasm have been displayed by the Branch members and the courses have been very successful.

Nipissing and Upper Ottawa Branch

The inception of the Branch goes back to February 4, 1952, when Col. L. F. Grant, field secretary, first met with the Institute members and juniors of the district. At that time, discussion was carried on as to the activities that could be undertaken by the engineers as a group, details of similar non-resident group activities, and the feasability of forming a branch in the district. It was decided that a survey should be taken and a branch formed if the results were favourable. Mr. J. S. Cooper was appointed provisional chairman.

On April 9 President and Mrs. Macnab, accompanied by Dr. L. Austin Wright, visited North Bay where they met at a dinner meeting with about thirty engineers and ladies. At that time a decision was made to form a branch, and Mr. G. L. Hood was appointed provisional chairman, with Mr. D. K. Campbell, as provisional secretary-treasurer.

Subsequent meetings were called by the provisional chairman on May 30, June 6, September 12, and October 4, and November 3. Bylaws were prepared and submitted to Council, and a provisional slate of officers was appointed to serve until the next annual Branch meeting.

The inaugural charter night was held at the White Oaks Inn, Temiskaming, on November 8, with sixty-six couples in attendance, and representatives from Headquarters. The first regular meeting, a supper meeting with 37 present, took

place at North Bay on December 3. Mr. G. L. Green, Imperial Oil Co. Ltd., Sudbury, the guest speaker, discussed "Lubrication of Industrial Machines".

North Eastern Ontario

Since the inauguration on April 10, 1952 the Branch has had two meetings, one in Iroquois Falls with the visit of President Macnab and Dr. Wright, and the other in Kapuskasing with the visit of President Stirling on November 6, 1952. Together with these branch meetings there have been three executive meetings and a number of section meetings.

The eastern section, which includes Cochrane, Iroquois Falls, Timmins and Matheson, held three meetings. Talks were given on "The History and Progress of the Canadian Pacific Railway" and "Trends and Problems in Industrial Management", the latter being covered in a series of lectures. Also, they have had a lecture on the finer points of public speaking, and hope to develop a program where each member will be taking part to improve his public speaking technique.

The western section (Smooth Rock Falls, Kapuskasing, and Hearst) has held two section meetings, and was host for the branch meeting on the occasion of the president's visit on November 6. At the first section meeting, the guest speaker was Mr. E. Mills, on the staff of the Kapuskasing Branch, Imperial Bank of Canada.

The second meeting included a lecture and demonstration on various types of process control instruments.

It is felt that the most popular meetings were those dealing with topics not particularly of a strict engineering nature, but rather of the general information and general professional development type.

The Branch has been established for only eight months, and of this, at least two months have been without activity because of the summer vacation period.

The executive has proposed among other things, the following novel features which will no doubt be used in the next year: a branch curling bonspiel, and a distinctive Ladies' Night.

One thing that is found most disconcerting is the problem of branch intercommunication. The North-Eastern Ontario Branch officially covers the entire district of Cochrane. This is an area extending roughly from Matheson on the south to Hudson's Bay on the north, and from Abitibi Lake on the east to Nakina on the west. This large branch area has been split into two sections, and therefore it is expected that most activities will take place in section meetings, rather than in branch meetings. Thus the number of branch meetings will be held to a minimum of probably two or three a year.

The increase in membership since inauguration has been very encouraging. There are now 27 members, 36 juniors, and 14 students, as compared with a registration of 22 members, 21 juniors, and 12 students, at inauguration.

Ottawa Branch

The policy of meeting at lunch time has continued as it appeared to be the most favoured method in Ottawa, though other forms of meetings were carried out also.

Co-operation with other institutions was maintained. Joint meetings were held with the Canadian Institute of Mining and Metallurgy, the American Institute of Electrical Engineers, the American Society for Metals and The Engineers' Wives Association.

During the year an attempt was made to secure speakers on various phases of engineering in order to interest all Branch members. There were two meetings a month usually, three in March and October. In January the annual meeting took place, and also a meeting at which Dr. L. Austin Wright spoke on Institute affairs. H. R. Smyth of the Radar Development Group, National Research Council, and William Kalbfleisch, of the Department of Agriculture, were the speakers at February meetings. Mr. R. B. Graham of Aluminum Company of Canada spoke on the Company's British Columbia development in March; Roy A. Crysler of Canada Cement Company discussed "Prestressed Concrete"; while in March, also, the branch was invited to attend a demonstration lecture on the Nimrod automatic computer of Ferranti Electric.

The Junior Section arranged the meeting of April 10, with Mr. Morrison of Canadian General Electric as speaker; and on April 24 Mr. H. C. Mesereau of Canadian Industries Limited gave a paper on the manufacture of nylon and other synthetic fibres.

A field trip to the Electric Reduction Company, Buckingham, Quebec, took place in May; as well as a meeting featuring a talk by J. R. Montague of the Ontario Hydro on the subject "More Power from Niagara".

In September the Branch entertained visiting British engineers touring Eastern Canada; and at a later September meeting Mr. R. C. Gessel of R. G. LeTourneau, spoke on "Engineering Problems in the Development of Earth Moving Equipment". In October the Ottawa Branch of M.E.A.C. extended an invitation to an address by Major General Tuck of the War Office, London. The president of the Institute visited the Branch in October; at another October meeting Mr. N. E. Hayes of C.G.E. discussed "Television in Canada."

Mr. R. G. N. Cavell, of the Department of Trade and Commerce; and Dr. John Convey of the Department of Mines and Technical surveys, were speakers at two November meetings, one being a joint meeting with the Engineers' Wives Association. On December 4 at a meeting held at the filtration plant, Mr. W. E. MacDonald, Commissioner, spoke of the expansion of the city water works, and on the need for civilian defence.

Peterborough Branch

The papers presented at meetings of the Peterborough Branch during the past year have as usual covered a wide field of engineering activity. Nine evening meetings and the annual summer outing were held and it is gratifying to report that the average attendance was 58, as against 50 for 1951.

The two meetings at which local speakers presented papers were very well attended. A symposium on titanium by several of the younger engineers drew a large attendance, but the outstanding address on the Gut Dam by Mr. A. L. Killaly was the highlight of the season Mr. Killaly is not only one of our charter branch members but was the engineer in charge of the construction of this dam. He showed many original pictures of its construction and charts and data made during its planning at the turn of the century.

The branch usually arranges a courtesy dinner for the guest speaker and, if time allows, a visit to some local plant. After the meeting, the speaker is usually entertained at an informal gathering.

A considerable drop in non-resident membership has taken place in the past year due to the formation of the new Port Hope Branch this year and the new Branch at Belleville last year. However, a small increase in the number of resident members and a much greater interest in Branch affairs by the local members seem to compensate for this.

Prince Edward Island Branch

During the past year this branch has held only five meetings, because much time during the early months of this year was devoted to committee meetings finalizing the Branch bylaws and branch organization.

At the annual meeting on May 9, Branch officers were elected. Shortly afterwards Mr. W. K. Sharpe was compelled to resign as chairman as he was taking a new position out of this Province, and he was replaced as chairman by V. A. Ainsworth.

After the summer months, during which activities were suspended, monthly dinner meetings have been arranged. This type of meeting, which was found to be successful, included the showing of technical films. In the future it is proposed to have speakers, discussions and papers on the program. Depending on weather conditions during the winter months, every third meeting will be held in Summerside, as about one third of the members are in that area.

Quebec Branch

The executive committee of the Branch met seven times for the transaction of business, with an average attendance of eight.

The program of activities has been varied and well attended.

Under the general heading of "The Engineer and his Activities", a series of lectures has been organized for eighty interested members. Part of the lectures were given in the months of October and November of 1952, and the program will continue until April of 1953.

The Branch entertained the Dominion Council at a dinner at Lake Beauport, May 15, 1952. Also the distinguished presidents and secretaries of the British engineering institutions were guests of the Branch before they embarked at Quebec on their return trip to England.

In January, 1952, 100 were present at the banquet in honour of Maurice Bourget, M.E.I.C., on his return from the general meeting of UNO in Paris. The annual meeting of the Branch was on January 21, 1952. At the March meeting several interesting films were shown to an audience of 95, and in April Dr. Bruce Graham, and Leon Valois, gave papers on the subjects of "Chibougamau and its Mining Possibilities", and the "Projectograph". The executives of the Rimouski, Saguenay and St. Maurice

Branches were entertained at a buffet at the Cercle Universitaire.

There was an attendance of 90 at the annual golf tournament. In October the series "The Engineer and His Activities" commenced with a symposium on "The Engineer and his Fellow-members", with Rene Dupuis, Jean St. Jacques, and J. P. Drolet. Subsequently the subject "The Engineer and his Speech" was treated by P. Boucher; "The Engineer and Law" by Jean Turgeon, Q.C.; "The Engineer and Finance", by A. E. Walton; "The Engineer and Philosophy" by Dr. Chs. de Koninck; and "Social Repercussions of the Industrial Expansion in Quebec".

The year's activities were concluded with a dance and buffet supper at the Quebec Winter Club, on December 5, 1952.

Saguenay Branch

A total of sixteen meetings were held, eleven by the Branch and five by the Junior Section. Throughout the year attendance at all meetings was excellent, and a diversified program included eight technical papers, three field trips, three social events, and two general business meetings. Two of the technical meetings were held jointly with the local branch of the Chemical Institute of Canada. Five speakers from outside the district were obtained for the technical papers, and the other three were Branch members.

Saint John Branch

One of the highlights of the past year was a visit to the Canada Cement Company's plant at Havelock, N.B., when approximately 30 members of the Branch were shown through the plant.

Another highlight of the year was a smoker held in the middle of June. It was found that this was a bad time of year to draw very many of the members to a Branch function.

The papers presented at the Branch meetings were as follows: "Reconstruction of our Nation's Capitol", "Finland's Industrial Post War Development", "Power Sites on the Saint John River". In addition Col. Grant gave a talk on Professional Development Courses.

It was hoped to have an agenda for Professional Development Courses by the first of the year, and to have the courses in operation as soon as possible.

Sault Ste. Marie Branch

During 1952 the Sault Ste. Marie Branch held only six general meetings. They were dinner meetings four of which were honoured with a guest speaker. The papers presented by the speakers were of a general nature rather than technical.

In April Branch members were guests at a monthly meeting of the local branch of the American Society of Metals.

In November when the president visited the Branch a Ladies' Night was held at the Country Club. This was a variation from former practice and was accepted very well by everyone.

In 1952 the Branch made it a practice to send meeting notices to all members of the Association of Professional Engineers, not belonging to the E.I.C. This practice was started in 1951 but will not be extended into 1953. Instead, any member may bring as his guest any engineer who is not an E.I.C. member. Guests will be charged the same for their dinner as E.I.C. members.

The average attendance at meetings during 1952 was slightly higher than that for 1951.

Saskatchewan Branch

Eight executive meetings were held during the year for the transaction of Branch business.

Branch Chairman J. G. Schaeffer visited Lloydminster, Prince Albert, Swift Current and Yorkton, in the fall. In these centres he met many of the local members, and these meetings proved to be valuable in demonstrating to non-resident members the interest of Branch officers in their welfare and activities. The Branch has decided to continue this practice whenever possible.

A highlight of the year's activities was the visit to the Branch by Dr. J. B. Stirling and his party on November 17, 1952. A successful meeting was held with the executive in the afternoon and with the general membership in the evening.

All lecture meetings were held jointly with the Association of Professional Engineers of Saskatchewan. A wide variety of subjects was covered. These meetings were generally well attended, and the interest of members was made evident by the lively question period usually following the lecture.

It was noted that the younger engineers were showing an increasing interest in meetings and Branch activities.

St. Maurice Valley Branch

During 1952 seven general meetings were held, generally with fair attendance. Talks relating to Canada were popular, especially those on Canadian economy and Canadian industrial expansion. The last meeting of the year was given by Mr. Barry Graham on Kitimat. In respect to attendance and interest it was a fitting occasion to end the year's activities.

A "Junior Speech Night" was held in March, at which four junior members gave 20-minute talks. Cash prizes were offered.

A golf tournament was held in September but owing to unfavourable weather the attendance was poor.

Both the Shawinigan Falls and the Three Rivers Junior Sections were active during the year. One of the most interesting meetings was that given by Dr. L. Austin Wright on the shortage of engineers. A lively discussion resulted.

Several speakers have already been procured for the new year.

Sudbury Branch

The Branch held eight dinner meetings during the past year, there being no meetings during the months of June to September. Attendance averaged 53, which compared favourably with last year's average, despite the fact that several non-resident members were lost to the newly organized North Bay-Temiskaming Branch. Dinner meetings still appear to be favoured by the majority of the members.

Two Ladies' Nights were held, one on the occasion of the annual meeting and the second at the time of the president's visit.

Toronto Branch

During 1952 the most popular meetings of the Toronto Branch were the field trip to Niagara Falls to see the Sir Adam Beck Power Development of the Ontario Hydro Electric Power Commission, and Ladies' Night held on the occasion of the president's visit to our branch. Several applications for membership have been received as a result of the work done by the field secretary's office in connection with Ladies' Night.

As to general meetings, the best attendance was noticed on the occasion of the visit of the British engineers, and for a talk by Mr. Kendrick, general manager of Alcan's development at Kitimat, B.C.

It is generally felt by the executive committee that results attained were not in proportion to effort expended. Excellent papers were arranged by the papers committee and presented at the meetings. The publicity committee has been working on a new method of publicizing meetings and it is hoped this will have a beneficial effect on attendance.

The Professional Development Course sponsored by Colonel Grant has helped revive interest in the Institute. It is noteworthy that a large number of junior members who attend meetings regularly are those who have taken the course.

Vancouver Branch

Vancouver was the host to the Institute annual meeting in May 1952. Eleven other meetings were arranged, dinners and field trips, and the average attendance was eighty-seven.

In January a meeting was held at which A. S. Sager spoke on "Fish and Power", and in February Students' Night took place. In March there were two meetings, a Seattle field trip, and film night. In April, T. Morgan addressed a dinner meeting in New Westminster on "Utilization of Sawmill Wood Wastes".

Another field trip was arranged in June, this time to the West Coast Woollen Mills. In July Dr. Carl Terzaghi spoke to a joint meeting of the Branch with the B.C. Engineering Society, on "Earth Dams—Design and Construction"; and in July also the Branch and the Society made a field trip to R.C.S.M.E. A group of members visited the Stevenson Cannery in August. Two October meetings included Ladies' Night, and a joint meeting with the Society, at which H. L. Kennedy discussed "Some Factors Affecting the Quality of Concrete".

Vancouver Island Branch

The branch program consisted of seven lecture meetings which were combined with the members of the Victoria Branch, B.C. Engineering Society; each organization being responsible for alternate programs. The joint meetings have proven very satisfactory and the attendance naturally increased.

The main event of the year was the dinner and dance attended by 81 visitors to Victoria, following the annual convention in Vancouver. The Branch was highly honoured in having the president and three former presidents in attendance, together with members of council and other well known engineers from across Canada and the United

BRANCHES	Belleville	Border Cities	Calgary	Cape Breton	Central British Columbia	Cornwall	Eastern Townships	Edmonton	Fredericton	Halifax	Hamilton	Kingston	Kitchener	Kootenay	Lakehead	Lethbridge	London
MEMBERSHIP																	
Resident																	
Hon. Members	1	..	..	..	1	..	..	1	..	1	..	2	..	..	..	..	..
Members	33	74	202	41	17	21	30	225	62	227	152	60	25	22	38	31	70
Juniors	24	85	120	33	20	10	36	201	10	58	165	55	25	26	37	16	71
Students	8	42	47	7	10	14	22	96	54	83	126	160	10	18	20	6	18
Affiliates	2	3	1	1	..	8	..	2	..	1	..	7	..	..	5	..	2
Total	68	204	370	82	48	54	88	525	126	370	443	284	60	66	100	53	161
Non-Resident																	
Hon. Members	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	
Members	1	18	12	15	3	6	26	23	11	91	2	12	3	15	12	21	14
Juniors	2	12	15	6	1	3	27	42	14	62	2	14	..	15	20	11	13
Students	..	8	9	2	3	3	16	18	..	64	1	12	..	20	15	2	7
Affiliates	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..
Total	3	38	36	23	8	13	69	83	25	218	5	38	3	50	47	34	34
Grand Total Dec. 31st, 1952	71	242	406	105	56	67	157	608	151	588	448	322	63	116	147	87	195
" " Dec. 31st, 1951	84	232	374	113	59	62	88	607	158	627	388	281	58	108	155	75	189
Branch Affiliates, Dec. 31st, 1952	13	3	47	24	15	..	20	2	..	..	8	..	3	1	5	46	.
FINANCIAL STATEMENT																	
Balance as of Dec. 31st, 1951	258.23	909.00	626.40	621.90	84.44	204.32	151.49	1,046.12	..	236.99	402.50	348.98	121.84	161.21	278.71	238.56	363.11
Income																	
Rebates from E.I.C. Hq	200.10	593.70	132.00	197.00	99.90	156.90	331.33	350.18	267.25	192.00	803.25	295.00	182.70	252.30	298.20	28.00	506.68
Payments by Prof. Assns	..	..	658.96	175.40	..	..	..	741.52	132.00	799.60	..	..	..	..	..	113.94	..
Branch Affiliate Dues	113.00	27.00	245.00	200.00	93.50	26.00	209.68	..	..	..	108.00	80.00	30.00	..	35.00	114.00	..
Interest	..	11.74	30.21	..	..	..	2.11	.	..	3.63	54.43	1.59	.84	..	3.00	..	3.00
Miscellaneous	243.44	690.25	..	655.50	148.45	5.00	..	755.25	706.72	46.10	481.00	29.59	125.79	900.88	2.40	74.80	801.50
Total Income	556.54	1,322.69	1,066.17	1,227.90	341.85	187.90	543.12	1,846.96	1,105.97	1,041.33	1,446.68	406.18	339.33	1,153.18	338.60	330.74	1,311.18
Disbursements																	
Printing, Notices, Postage①	61.18	171.26	555.64	79.72	41.56	34.26	70.45	470.09	197.24	373.19	419.74	46.75	43.91	105.58	50.13	60.68	189.98
General Meeting Expense②	203.36	303.54	304.10	..	163.94	..	241.24	287.03	291.50	11.00	277.20	85.84	23.30	39.50	..	40.72	173.63
Special Meeting Expense③	315.54	583.85	260.85	997.53	..	183.78	..	831.04	263.26	137.75	.	222.03	117.52	965.41	299.17	221.61	504.68
Honorarium for Secretary	..	..	..	..	..	..	..	100.00	..	100.00	..	..	..	..	17.15	25.00	..
Stenographic Services	..	25.00	..	..	5.00	..	..	..	9.00	80.00	50.00	..	10.00	..	..	..	..
Travelling Expenses④	..	..	..	..	50.00	21.95	..	..	..	75.00	..	..	..	34.70	..	..	..
Subs. to other organizations	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Subs. to *The Journal*	20.00	6.00	48.00	..	30.75	2.00	34.00	..	..	..	8.00	12.00	..	..	10.00	..	..
Special Expenses	10.15	142.15	34.00	15.00	..	..	..	91.90	..	104.67	..	75.09	..	31.22	..	23.15	133.99
Miscellaneous	3.85	1.57	8.32	54.15	..	7.30	..	129.03	84.22	90.50	1,068.48	50.12	38.83	13.33	5.57	55.29	..
Total Disbursements	614.08	1,233.37	1,210.91	1,146.40	291.25	249.29	345.69	1,909.09	845.22	972.11	1,823.42	491.83	233.56	1,189.64	382.02	426.45	1002.23
Surplus or *Deficit*	*57.54*	89.32	*144.74*	81.50	50.60	*61.39*	197.43	*62.14*	260.75	69.22	*376.74*	*85.65*	105.67	*36.46*	*43.42*	*95.71*	308 95
Balance as of Dec. 31st, 1952	200.69	998.32	481.66	703.40	135.04	142.93	348.92	983.98	260.75	306.21	25.76	263.33	231.83	124.75	235.29	142.85	672.06

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.

②Includes rental of rooms, lanterns, operators, lantern slides and other expenses.

③Includes dinners, entertainments, social functions, and so forth. ④Includes speakers, councillors or branch officers.

Branches as at December 31, 1952

Montreal	Newfoundland	Niagara Peninsula	Nipissing and Upper Ottawa	North Eastern Ontario	Ottawa	Peterborough	Port Hope	Prince Edward Island	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Sudbury	Toronto	Vancouver	Vancouver Island	Winnipeg
..	..	..	..	..	2	..	1	..	..	..	1	..	..	..	2	..	2	..	..	1
1,473	32	106	26	27	384	46	17	22	129	79	69	72	61	143	24	27	618	267	85	268
738	25	97	17	36	172	40	10	5	100	74	23	89	78	50	17	18	533	168	38	184
1,254	33	39	5	14	173	22	2	7	251	42	8	58	14	17	6	10	305	262	23	164
16	..	2	..	..	4	6	..	..	2	..	1	1	1	2	1	3	7	3	..	4
3,484	90	244	48	77	735	114	28	34	482	195	102	220	154	242	50	58	1,465	700	146	621
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
73	24	7	8	..	38	2	..	..	8	2	7	11	..	133	4	3	43	21	14	20
44	23	4	13	..	47	..	..	..	14	2	7	5	..	81	2	4	75	41	14	40
54	16	1	8	..	39	1	..	..	13	..	1	8	..	40	1	2	26	36	11	28
..	..	..	..	..	..	..	..	..	1	..	..	..	..	8	..	1	1	..	..	..
171	63	12	29	..	124	3	..	..	36	4	15	24	..	262	7	10	145	98	39	88
3,655	153	256	77	77	859	117	28	34	518	199	117	244	154	504	57	68	1,610	798	185	709
3,655	118	235	..	..	853	133	..	30	488	186	267	246	142	519	130	109	1,544	801	188	721
4	..	..	1	..	10	2	..	..		5	13	1	..	..	13	..	1	..	1	29

*For voting purposes only, there should be added to Montreal Branch, an additional 655 members, 388 resident in the United States, 172 in British possessions and 95 in n countries.

6,950.18		744.60	..	..	759.33	227.00		23.60	693.57	487.65	630.57	330.52	180.53	207.31	809.96	375.37	2,428.12	316.84	263.68	2,325.54
5,809.93		531.46	100.00	159.70	1,311.80	186.00		75.00	692.21	516.30	194.00	563.70	402.60	61.00	224.00	222.00	2,478.25	1,336.50	386.70	616.00
..		..	..	..	..	..		..	..	..	122.00	..	..	1,058.82	..	..	..	..	..	706.25
31.00		..	..	..	50.00	12.00		..	..	21.00	90.00	..	..	..	59.00	60.00	10.00	..	3.00	140.00
90.00		17.01	..	..	27.10	1.34		..	..	..	..	..	..	..	9.00	..	37.51	13.08	..	36.00
1,031.94		..	267.00	524.10	..	230.19		..	433.40	701.95	28.68	171.25	144.23	..	343.25	283.15	149.05	254.30	907.22	144.68
6,962.87		548.47	367.00	683.80	1,388.90	429.53		75.00	1,125.61	1,239.25	434.68	734.95	546.83	1,119.82	635.25	565.15	2,674.81	1,603.88	1,296.92	1,642.93
3,226.01		208.36	18.82	20.23	620.77	125.50		13.35	150.68	24.80	69.05	65.09	5.12	60.00	79.09	64.89	988.61	490.57	89.78	671.46
113.90		1.00	65.50	15.00	123.35	37.25		25.18	391.55	45.00	13.00	63.25	50.00	740.00	198.51	71.28	226.38	15.00	15.93	78.70
1,439.79		181.39	..	271.93	189.64	228.41		7.50	372.75	917.13	207.20	278.14	196.15	..	309.94	197.43	288.77	299.46	1,032.19	410.40
..		75.00	..	..	..	..		..	125.00	40.00	60.00	..	..	120.00	25.00	25.00	150.00	50.00	50.00	100.00
900.00		15.00	..	29.00	125.00	..		5.00	40.00	..	30.00	..	4.00	..	..	..	2.00	20.00	..	68.95
58.22		..	..	..	..	10.00		..	..	66.94	..	..	..	135.84	..	..	..	..	..	25.00
..		..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	3.00
6.00		..	..	..	..	2.00		..	..	8.00	30.00	..	..	..	20.00	..	2.00	..	..	82.00
566.53		156.06	..	..	251.98	..		..	55.73	..	..	170.15	136.28	..	28.88	48.25	313.31	171.10	..	286.87
714.79		14.42	.30	..	58.02	76.05		1.17	18.94	62.90	39.28	1.00	..	..	313.03	20.48	398.77	197.64	..	23.30
7,025.24		651.23	84.62	336.16	1,368.76	479.21		52.20	1,154.65	1,164.77	448.53	577.63	391.55	1,055.84	974.45	427.33	2,269.84	1,243.77	1,187.90	1,749.68
62.37		*102.76*	282.38	347.64	20.14	*49.68*		22.80	*29.04*	74.48	*13.85*	157.32	155.28	63.98	*339.20*	137.82	404.97	360.11	109.02	*106.75*
6,992.82		641.84	282.38	347.64	779.47	177.32		46.40	664.53	562.13	616.72	487.84	335.81	271.29	470.76	513.19	2,833.09	676.95	372.70	2,218.79

*Montreal Branch balance includes $105.01 surplus rom Junior Section entertainment account, not hitherto incorporated in Branch figures.

States. The year was marked by a second visit from the president, who, when making his annual visit was given a formal dinner in his honour.

One field trip was made to the B.C. Cement Company plant at Bamberton, where the members saw the process, from the blasting at the quarry, right down to the finished sacks of cement.

Winnipeg Branch

During the year the management committee held six meetings at which the average attendance was ten. In addition to these a number of members of the committee visited the Brandon section on three occasions.

There were ten general meetings of the Branch with an average attendance of 78. In the Brandon section nine meetings drew an average attendance of 23. Attendance at ten electrical section meetings averaged 102; and at 12 meetings of the students' section, 88.

CANADIAN CHAMBER OF COMMERCE

(*Continued from page 116*)

icy of the Chamber of Commerce and resolutions which have been submitted by member Boards of Trade, and either approves them for submission to the Annual Meeting, refers them to the Executive Council for further consideration or rejects them. The length of the session indicates that this is no rubber-stamp committee. The discussions are thorough and sometimes quite heated, but the declarations that are finally adopted are truly representative of the opinion of Canadian business men from coast to coast. Later, at a plenary session of the Annual Meeting, these recommendations of the Policy Committee were submitted for the adoption of the Chamber.

Three of the five plenary sessions of the meeting were taken up with panel discussions. The first of these, dealing with "The New Competition" brought out the change that is taking place in the nature of competition in our economy. Although competition between the same kind of products on the basis of price and quality has never been keener than it is today, a new competition has been introduced by the development of alternative materials and new ways of satisfying human wants.

The other two subjects dealing with "Responsibilities of Labour and Management in Economic Education" and "Immigration and its Relation to Canadian Resources" are also of timely interest not only to business men but to Canadians as a whole and provoked some likely discussion.

Shortly after the Annual Meeting the policy declarations and resolutions are presented to the Prime Minister and members of his cabinet by a delegation headed by the president of the Chamber. Several of these policy declarations deal with fiscal and economic policies of the Government, probably the most important being that dealing with Public Finance and Taxation. Pointing out the danger of increasing state control with rising taxation and some of the inequities involved in the present tax structure it urges on the Government economy and efficiency in spending and recommends certain reforms that would make taxation more equitable.

Other policy declarations that are of particular interest at this time deal with the advantage of increased Immigration, the necessity for maintaining and fostering International Trade Relations and a commendation of the Government for its actions in connection with the St. Lawrence Waterway.

The business of the Canadian Chamber of Commerce between Annual Meetings is carried on by its General Manager, Mr. W. I. Morrell and a secretariat under the direction of the President and the Executive Council. Meeting twice a month, the Executive Council is in a position, through a number of active committees, to keep in close touch with business conditions on this continent and abroad, and to present to the people and to the Government an informed opinion from organized business on such questions as the economic, financial, industrial and agricultural interests of Canada.

J. A. McCrory, M.E.I.C.,
Representative of the Institute

The year's most important engineering event!

E.I.C. ANNUAL MEETING
Halifax, N.S.
MAY 20-21-22

The complete program will be printed in the March issue of the *Journal.*

Forms for reservations will be mailed to members early in April.

Plan **NOW** *to Attend!*

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

I.A.E.S.T.E.

Canadians are going to become familiar with another alphabetical title. Just recently arrangements have been completed to have Canada join seventeen other nations who are already members of the International Association for the Exchange of Students for Technical Experience, known internationally as IAESTE. At the request of the organization and with the approval of several Canadian universities, the Engineering Institute has agreed to set up the necessary committee through which Canadians may participate in the project.

The purpose of IAESTE is to provide vacation experience for engineering students of one country in the industry of another country. That there is a desire for such exchange, and that the present system is working is proven amply by the fact that in the five years it has been functioning the number of students exchanged has increased from 920 in 1948 to 3,500 in 1952. The signs are that 1953 will continue this acceleration.

The exchange works this way. A student in France who has completed the year just prior to graduation, wishes to get some experience in British industry. He applies to his university and his name is sent in to the French Committee. This committee sends the name and certain necessary details to the British Committee. The British committee through its many contacts finds an employer who will give him the sort of experience he is seeking. The student is paid wages while he is working, but must provide his own keep and his transportation both ways. He must return to his home at the end of the summer experience.

Each committee in the seventeen countries gathers the names of its own people and sends them to all the different countries in which experience is sought. They also receive from all or any of the 17 countries the names of those who want to come there for experience, and then find the openings for them.

It is not necessary that the exchange should balance in any country. For instance last year Sweden received from other countries 820 students and sent out to other countries only 273. Great Britain received 602 and sent out 488. On the other hand Denmark received 91 but sent out 184, and Austria received 164 but sent out 325.

The countries participating are Sweden, Great Britain, Germany, France, the Netherlands, Austria, Finland, Switzerland, Yugoslavia, Denmark, Norway, Spain, United States, Italy, Belgium, Israel, Iceland and Canada.

The lists of companies in each country that receive students read like a "who's who" of industry. In Great Britain the list in the 1952 report shows 165 companies participating and 24 universities and colleges. In France the figures are 170 industries and 60 educational institutions. These few figures will demonstrate that the project is well established and is a going affair.

For Canada, at the request of Council, Henri Gaudefroy of Ecole Polytechnique has accepted the chairmanship of this committee. Right now the committee is being set up and put into motion. Already over 50 students have filed forms to come to Canada in the summer of 1953, so quick action is required.

The main task for this year is to find the necessary openings with Canadian employers. It is not likely that many Canadian students will

Cover Picture

On the cover is a photograph of a distillation column manufactured by a leading Montreal engineering works for a large Canadian chemical company. This column, when erected, will be over 70 feet high and was completely assembled in the shop with all its internal parts.—*Photo courtesy Canadian Vickers Limited.*

be seeking experience abroad, and the committee feel they should not encourage Canadians to participate this year. The whole effort is new to Canada and it appears as if every attention should be concentrated in placing those who wish to come here.

The committee will be canvassing industry shortly. Most of those companies that have heard of the project have promised to participate. It is hoped that all employers will react the same way.

Perhaps the greatest profit of this whole endeavour, is the opportunity for these young men, these future leaders of their countries, to learn something about the other countries. If through these many exchanges, a respect for and a friendship with other countries can be developed in the minds of the coming generation it should go a long way towards promoting peace and establishing stability at least throughout that portion of the world where they are still on speaking terms with each other.

The Institute is happy to participate in this important international project, and to share with organizations in other countries this great effort towards broader education and better understanding.

Any one desiring further information should write to Headquarters of the Institute.

E.I.C. Reception for U.K. Members

As mentioned in last month's issue of the *Journal*, Past-President Col. L. F. Grant was in London, England, last month to represent the Engineers' Council for Professional Development (E.C.P.D.) at a meeting of the European and United States Engineers' Conference.

Advantage was taken of this visit to hold a reception to which were invited all members of the Engineering Institute of Canada resident in the United Kingdom, as well as the officers of several of the leading engineering societies of the British Isles.

The reception took place at the headquarters of the Institution of Electrical Engineers at Savoy Place, London, on Friday, January 9 last.

Col. and Mrs. Grant received in the charmingly decorated rooms of the Institution and were ably assisted by Mrs. W. K. Brasher, wife of the secretary of the Institution of Electrical Engineers.

A list of the guests who attended is given below:

Norman Robertson, High Commissioner for Canada.
Licut.-Gen. Sir J. F. M. Whitcley, former Commandant Canadian Defence College, Kingston, and Lady Whiteley.
Maj. Gen. C. N. Tuck, R.E., Engineer-in-chief, the War Office.
Air Commodore M. Costello, R.C.A.F., Canadian Joint Staff, and Mrs. Costello.
H. F. Cronin, president, Institution of Civil Engineers.
A. S. Quartermaine, past-president, Institution of Civil Engineers.
E. Graham Clark, secretary, Institution of Civil Engineers.
Col. C. B. Leason, president, Institution of Electrical Engineers.
Sir. John Hacking, past-president, Institution of Electrical Engineers, and Lady Hacking.
W. K. Brasher, secretary, Institution of Electrical Engineers and Mrs. Brasher.
B. Granter, M.I.C.E., president, Institution of Structural Engineers and Mrs. Granter.
Major R. F. Maitland, secretary, Institution of Structural Engineers.
Dr. A. M. Ballantyne, secretary, Royal Aeronautical Society.
Sir William Fyfe, former principal Queen's University, and Lady Fyfe.
Dean Thorndike Saville, New York University.
Sir Arthur Fleming and Dr. William Abbot of the Athlone Fellowship Mission.
J. F. McKinnon, Canadian Department of Labour.
Robert Mortimer, Canadian Department of Labour.
Lieut. Col. H. C. Smith, R.E.
Edward Kidd.
J. Somerville.
Lieut. Brian, R.C.N.
Dr. J. K. Robertson, formerly of Queen's University.
E. H. Allen, M.E.I.C., and Mrs. Allen.
S. R. Banks, M.E.I.C.
W. Herbert Bateman, M.E.I.C.
J. K. Brooks, M.E.I.C.
B. H. Colquhoun, M.E.I.C., and Mrs. Colquhoun.
V. L. Dutton, M.E.I.C.
H. B. Fergusson, M.E.I.C.
John E. K. Foreman, M.E.I.C.
Albert Holland, M.E.I.C.
Howard Johnson, M.E.I.C.
Col. A. J. Kerry, M.E.I.C.
Capt. H. L. M. King, M.E.I.C.
J. O. Lake, M.E.I.C.
Dr. S. D. Lash, M.E.I.C., and Mrs. Lash.
G. E. Lloyd, M.E.I.C.
A. S. Lowe, M.E.I.C., and Mrs. Lowe.
G. G. Meyerhof, M.E.I.C.
W. Michalski, M.E.I.C., and Mrs. Michalski.
C. H. Oakes, M.E.I.C.
R. C. Peck, M.E.I.C.
J. E. Pepall, M.E.I.C., and Mrs. Pepall.
G. L. Philipps, M.E.I.C., and Mrs. Phillips.
J. F. Semple, M.E.I.C.
A. U. Shiach, M.E.I.C.
P. Simpson, M.E.I.C., and Mrs. Simpson.
A. L. Tregillus, M.E.I.C., and Mrs. Tregillus.
D. J. Bazett, JR.E.I.C., and Mrs. Bazett.
E. G. Bennett, JR.E.I.C.
S. Cherry, JR.E.I.C.
Lt. J. F. Clarabut, JR.E.I.C.
E. L. Fytche, JR.E.I.C.
J. M. Gardner, JR.E.I.C.
Capt. F. G. Johnson, JR.E.I.C.
Lt. R. A. McKay-Keenan, JR.E.I.C., and Mrs. McKay-Keenan.
H. R. W. Marsh, JR.E.I.C., and Mrs. Marsh.
J. B. Nuttall, JR.E.I.C.
A. P. Sentance, JR.E.I.C., and Mrs. Sentance.
F. W. Slingerland, JR.E.I.C.
F. G. Tanton, JR.E.I.C.
D. T. Wright, JR.E.I.C.
Jean-Roch Brisson, S.E.I.C., and Mrs. Brisson.
D. H. E. Cross, S.E.I.C.
S/L (L) C. D. de Genzo, S.E.I.C.
D. H. Franklin, S.E.I.C.
B. K. Laramy, S.E.I.C.
J. Szogyen, S.E.I.C., and Mrs. Szogyen.
D. H. Waller, S.E.I.C.
R. J. Klein and Mrs. Klein (Formerly Miss K. Delaney of the E.I.C. Staff, Montreal, P.Q.).

Switzerland Host for Third International Soil Mechanics Conference

The Third International Conference on Soil Mechanics and Foundation Engineering will be held in Switzerland in 1953. The Conference will be held in three parts: the first in Zurich from August 16 to 21; the second will feature a 4-day excursion through the Swiss Alps in order to show the delegates examples of geotechnical and foundation engineering; the third part will be the official closing of the Conference in Lausanne.

The aims of the Conference are a review of recent developments, the co-ordination of research in the field of soil mechanics and foundation engineering and the advance-

ment of international relations by facilitating personal contacts between members of different delegations.

Like the first two conferences held in Cambridge, Mass., 1936, and in Rotterdam, 1948, this Conference will be attended by several hundred engineers from all over the world, among them most of the prominent scientists in this field. Scientific papers submitted to the Conference are all published in advance. At the Conference, in each of the eight main sessions a section of the papers will be reviewed by a general reporter, an authority in his field, followed by prepared and free discussion on the subject. Each session of the Conference will be accompanied by lectures on Swiss developments and by some general lectures by prominent authorities.

Canadian participation in the Conference will be made through the Associate Committee on Soil and Snow Mechanics of the National Research Council, which is the official Canadian representation to the International Society of Soil Mechanics and Foundation Engineering. Six papers by Canadians have been submitted to the Conference on subjects including airport runway design, prevention of frost heaving, performance of a flexible bulkhead, and studies on failures of low earth dams, on the water tightness of steel sheet pile walls and on the settlement of a large building on clay.

During the Conference visits will be paid to the Laboratory for Hydraulic Research and Soil Mechanics at the Swiss Institute of Technology. Several small excursions will be arranged to points of interest and scenic places for the ladies and for members who do not want to attend some of the sessions. The 4-day excursion will take all delegates and the ladies to some of the famous spots of the Swiss Alps as well as to points of technical interest such as to a new earth dam, the Swiss Institute for Snow and Avalanche Research (9,000 feet above sea level), the first tunnel through the Alps (9.4 miles long), by coach over some of the main alpine pass roads, to hydro-electric power developments, etc.

Information on the Conference and application forms for the Proceedings (3 volumes, cost approximately $17.50) can be obtained by writing to the Secretary, Associate Committee on Soil and Snow Mechanics, c/o Division of Building Research, National Research Council, Ottawa.

C.C.A. Meets at Montreal

Meeting at Montreal from January 18 to 22 for their 35th annual convention, the Canadian Construction Association elected John N. Flood of Saint John, N.B., as their national president for 1953. Membership in the association now stands at 922. Attendance at the meeting recorded a new all time high at close to 1,100. Sunday, the opening day, was devoted to registration, a luncheon for managers and secretaries of the various Builder's Exchanges from Coast to Coast, and a meeting of the Association's management committee.

As is customary, the Monday morning session was devoted to committee reports. J. M. Pigott, chairman of the Apprenticeship Committee, told the meeting that the situation has not changed since last year. While Quebec has some 10,000 young men under apprenticeship, there are only 5,000 active apprentices in the industry throughout all remaining provinces, whereas a total of 31,000 or a rock bottom minimum of 15,000 are needed to fill requirements. This was due, he observed, to lack of interest among employers, and little or nothing was being done to change their attitude. A special committee appointed last March to work closely with the Association had held many conferences, but as yet no action had been taken.

A. C. Ross, chairman of the Labour Relations Committee, drew attention to the fact that, in spite of little change in the cost of living index, and although an increased period of employment had greatly increased "take-home pay", demands for increases had been greater than ever before. While one could not quarrel too much with such demands if accompanied by increases in productivity, production in most building trades was steadily declining. Strikes and work stoppages had far exceeded the previous year in man-days lost. The heaviest losers, he pointed out, were the workers themselves, with the poor suffering public helping to foot the bill. In conclusion, he observed that recent changes in the I.L.O. directorship personnel augured well for a more impartial attitude.

R. A. Seasons, speaking on legislation, expressed the Association's approval of the removal by the Federal Government of deferred depreciation regulations, steel restrictions and steel inventory limitations. Representations had been made to Ottawa, he said, for abolishing the federal sales tax on all construction materials, and for amending labour legislation to require secret ballots by trade unions when voting on strike action. He recommended that the Association should again urge that these changes be made. R. J. Merlo, for the Equipment Committee, expressed the industry's feeling that unreciprocated tariff concessions available in Canada afford an unfair relative advantage to the foreign contractor.

Chairman Leigh, reported that the C.C.A Housing Committee had been re-established this year in view of the poor showing in house building volume over the first six months of 1952, when it fell to the lowest level since 1946, while completions at that time were forecast for 1952 at half the Association's recommended target of 100-125 thousand. Though the tempo has increased the past six months, he said, the backlog is still Canada's most pressing problem. He suggested that more plentiful plumbing and electrical supplies might soon permit the Government to proclaim the Home Improvement Loans section of the N.H.A. The committee advocated a vigorous double barrelled publicity program by the industry, financial institutions and governments, to publicize methods followed in various parts of Canada in overcoming problems, and for fostering the latent desire for home ownership.

Chairman Turner-Bone of the "Payment by Results" Committee told how many U.S. Builder's Exchanges in the United States unanimously oppose incentive schemes and even have by-laws prohibiting their use. On the other hand many European nations favour piecework systems or payment by results. His committee, he said, agreed that favourable reaction from labour is essential if a bonusing system is to succeed. Any such scheme should be developed in conjunction with labour, as is done in Britain.

Speaking on materials, chairman Drummond forecast an improvement in the supply situation of cement in 1953. Due however to a decline in housebuilding, decreases in brick gypsum lath and some plumbing items had taken place. Prices have been generally stabilized and there has been an almost complete return to the firm price system. Continued efforts should be made, he felt, to develop methods leading to economies in materials usage, and

thus prevent a waste of Canada's resources.

Defence Construction

During the morning session delegates also heard a short address from R. G. Johnson, president of Defence Construction Limited, who stated that D.C.L. had under its administration close to $450 millions worth of work, involving over twelve hundred contracts. These excluded married quarters housing built by C.M.R.C., airports let through the Department of Transport, and industrial contracts in the defence supporting category. About 70 per cent of the work let in the past two and a half years is now at or near completion. Total volume for the 1953-1954 fiscal year may be somewhat under 1952-1953, for defence work is now at its period of peak activity. Yet between the carry-over and new work, contractors and suppliers engaged on defence programs should continue quite busy. The major part of work remaining is for the army.

The speaker called attention to development of several innovations in the way of structures by engineers engaged on defence: the cantilever hangar, with 120-ft. steel cantilever projections to keep ahead of aircraft design; the poured-in-place concrete arch hangar with 160-ft. span, with prestressing used to take the thrust of the arch at ground level; the 120-ft. span precast concrete arch hangar; the largest building in Canada featuring precast construction in roof slabs and beams; and the largest Canadian building featuring prestressed concrete.

Retiring President's Address

Colonel Henri Vautelet, representing His Worship Mayor Camilien Houde, welcomed the Association to the City of Montreal at the opening luncheon meeting on Monday. In his presidential address, President P. G. Wilmut of Montreal referred to construction as a "$4 billion-a-year" industry, involving more work than that performed by those engaged in agriculture, forestry or mining, giving employment on- and off-site to about 16 per cent of our total work force. One out of every six dollars spent for end products and service is spent on construction, he stated.

Observing that the 1952 construction cost rise of three per cent had been the lowest for any year in the postwar period, due mainly to more stable material prices, he predicted that levelling off of consumer prices would stem the demand for higher wages. If so, there should be another record year of activity ahead. Though housebuilding was well below capacity levels and industrial construction continued spotty, institutional and defence construction should continue at 1952 levels, while engineering construction would continue to contribute a major portion of volume.

Pointing out that much higher road standards were needed, while less money was being spent today per motor vehicle registration than in prewar years, he called for further co-operation between Provinces and the Federal Government in connection with all roads of national importance.

In conclusion, he predicted our present system of payment per hour worked, which gave no encouragement to a worker to give his best effort, would some day become obsolete. In spite of obstacles in the way of establishing a system of incentive pay, he urged the industry to find a way whereby workers, while guaranteed a minimum rate per hour, could increase earnings by putting forth their best efforts.

Housing and Highways

The guest speaker at the annual banquet was the Hon. Robert A. Winters, Federal Minister of Resources and Development. Speaking of housing, he predicted a greater number of starts this year than in 1952 when only 68,000 new units were started compared with 92,000 in 1950. This decrease, he said, had been because housing needs came second to defence. The only limiting factor now on new housing starts, he stated, was the lack of municipal services: water, sewers, police and fire protection, and educational facilities. The success of municipalities in making land available would probably be the determining factor in the volume of new housing in 1953, yet he expressed optimism for a higher level of housebuilding than in the year just passed.

Turning to highway construction, Mr. Winters announced that $24½ millions had been spent on the Trans-Canada Highway by federal authorities last year, compared with $11 millions in 1951. At year end, commitments for work undertaken by provinces with federal approval totalled $91½ millions compared with $57.3 millions a year ago. Work on the highway, he felt, would likely proceed at a faster pace this year.

Highway construction was again the subject of the address to the Road Builders' luncheon meeting the second day, with H. H. Hale, executive secretary of the American Association of State Highway Officials, as guest speaker. Noting that American motorists spent $1¾ billions yearly for car insurance or $300 millions more than State highway departments allowed for road improvement, Mr. Hale told his listeners that more than $32 billions were needed to bring present U.S. highways up to today's standards in order to ensure greater safety. In Canada, as in the U.S.A., road building is big business. With highway construction such a costly problem, he questioned where the money was to come from for badly needed road improvement. Discussing federal aid, he made clear that the budget autonomy of the individual states had not been invaded or imperilled by the acceptance of grants-in-aid from the Public Roads Administration in Washington.

At the Association's first annual "Panel on Supply", discussions led to the conclusion that steel and cement would probably continue in short supply for most categories of construction during 1953, and possibly for the next two or three years at least.

National Building Code Ready

The National Building Code of Canada, revised edition 1953, will be published and available after Easter this year. This was the announcement made at the morning session on the third day of the convention by R. F. Legget, director of Building Research, National Research Council. Paying tribute to the many C.C.A. members who had assisted in revising the existing 1941 Code by working on technical panels and committees, he explained that an associate committee of fifteen interested Canadians had been at work on the revision for four years, assisted by 10 technical committees and 19 technical panels.

The associate committee's first objectives are first, to maintain the Code as an up-to-date and living document, and secondly, to promote the uniformity of building regulations throughout Canada. Achievement of the first should be the speediest way of achieving the second.

The revised version is provided for the use of all provinces and municipalities when adopted legally by them. It is essentially a set of minimum regulations for protection of public safety in respect to health, fire prevention, and structural efficiency. An abridged version will follow later, as also will an edition in the French language. Revision will be continuous by the Division of

Building Research, National Research Council, for many years to come.

Of special interest to the Association, he said, was "Part 8—Construction Safety Measures", drafted by a special committee representing contractors and those concerned with safety requirements, under the chairmanship of C.C.A. Past President Albert Deschamps. A limited number of copies of this section are now available in pamphlet form.

At the final luncheon meeting a tribute was paid to all Quarter Century member firms of the Association, all of whom were seated at the head table. Introductions were made by Vice-President Eddie Smallhorn, who recalled in turn the histories of each firm, its founders and officers, and the loyal support each had given to the Association, from the beginning. Past-President Allan Ross responded to the toast, recounting a few anecdotes relating to the Association's early years.

Policy Statement and Resolutions

Following discussions at daily business sessions by the various sections of the Association, of draft resolutions proposed by the management committee, resolutions adopted included the following: advocation of a Federal-Provincial Highway Commission to deal with highways, and elimination of level crossings; continuing support for all research programs; greater standardization of building by-laws based on the 1953 Code; and orderly program of selective immigration on a larger scale; amendment of workmen's compensation legislation to guard against double assessment on workers outside their home province; amendment of labour relations legislation to provide for secret strike ballots; an early start on the Seaway and use of the Canadian construction industry on it to the fullest extent; a minimum target for a housing program of 100,000 to 125,000 dwelling units; sales tax exemption to include all construction materials; cessation of the Federal Government's allowance of importation of foreign construction equipment on a temporary basis.

In a statement of policy, the Association pledged fullest co-operation by labour, management and government to improve efficiency and reduce costs through increasing productivity; increasing apprenticeship and immigration programs; all possible action to accelerate the flow of materials; firm price quotations by primary producers, manufacturers and suppliers; co-operation with national defence, defence production, the industrial defence board and civil defence authorities; and continuing efforts to reduce housing costs.

This photo did not arrive in time to be included with the others of the western tour in the January issue, but it is too good to pass up even at this late date. The Vancouver meeting was on the president's birthday and here we have the secretary Stuart Lefeaux, presenting a suitable cake with a less suitable knife. On the president's right is Dean H. J. MacLeod and on his left the newly elected chairman, Hugh Libby, and the general secretary.

Correspondence

December 3, 1952.

Secretary,
Engineering Institute of Canada.

Dear Sir:

Once again I have pleasure in extending to any of your members resident in Australia or visiting Australia at the time, an invitation to be present at our Annual Conference for 1953, which will be held in Melbourne from 16th to 21st March.

We will be pleased to receive any such members under the same conditions as members of this Institution. A circular with the programme of the Conference is attached hereto.

If you become aware that any of your members are likely to be in Australia at the time, would you convey to them an invitation to attend the Conference and advise them to communicate direct with the Conference Organizer.

C. H. D. Harper,
Secretary,
Institution of Engineers,
Australia, Science House,
Gloucester Street, Sydney.

The following letter has been sent in the hope of correcting at least one of the many misstatements that are being made these days about the relationship of engineers' remuneration to that of the trades. It is now published in the *Journal* in the belief that students at other universities and graduates as well will be interested in it. Engineers' remuneration, particularly in certain age groups and classifications, is bad enough, without making it appear worse by faulty thinking.—Ed.

January 7, 1953.

The Editor,
McGill Engineer,
McGill University,
Montreal, Que.

Dear Mr. Editor:

Last year in the January issue of your publication you had an article that finished up with a statement to the effect that engineers were underpaid. To prove this point the article stated "a bricklayer is getting about $6,000.00 per".

It was a matter of great disappointment to me and to many other engineers to think that anyone at McGill would accept a statement of that kind as accurate. On the surface it should have aroused anyone's suspicion, and a very simple enquiry of any one of a number of agencies

or a little arithmetic would have revealed the grossness of the error.

As far as bricklayers are concerned, the situation is this—the average figure for bricklayers working in Canada turns out to be 1,500 hours per year. At $2.00 per hour this gives them an income of $3,000.00 per year. To earn $6,000.00 they would have to work full time on a 60-hour week.

From time to time, and all too frequently one hears statements about labourers and mechanics getting higher pay than engineers. I assure you and the other students at McGill that this is not the case. It may be possible to find a specific instance which at a specific time shows such relationship between the incomes, but if one takes into consideration the length of time that the artisan has been working at his job as compared to the period worked by the engineer it will be found that the artisan is at the top of his earning capacity where the engineer is at the bottom of his.

Further consideration shows that the engineer continues to get an increasing rate of remuneration, whereas the artisan will receive more only as the cost of living goes up and justifies it. The rate of remuneration for an engineer even though in many instances it is not adequate for the services rendered, is substantially greater than that obtained by almost any artisan in any classification.

It is an unfortunate thing when a publication disseminates an erroneous statement of this kind. I would be grateful if in some way or other you would bring to the attention of your readers the fact that the figure used in your article is far from accurate, and that engineers are paid better than artisans.

L. Austin Wright,
General Secretary.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, January the 16th, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

H. R. Blair-Leighton, *Hull.*
M. J. Brimberg, *Montreal.*
M. H. Broadbent, *Brockville.*
L. W. Bulmer, *Kitchener.*
C. G. Campbell, *Orillia.*
G. Cavadias, *Montreal.*
G. W. Chorley, *Montreal.*
P. Cichy, *Arvida.*
W. F. Correll, *Toronto.*
O. C. L. Cundall, *Sault Ste. Marie.*
M. D. H. Dickson, *Wainwright.*
J. A. Drain, *Galt.*
A. H. R. Elliott, *Hamilton.*
D. H. Fitzwilliam, *Toronto.*
H. Graham, *Victoria.*
D. G. Huber, *Toronto.*
J. F. Irwin, *Edmonton.*
R. H. King, *Montreal.*
E. Klug-Andersen, *Sault Ste. Marie.*
K. Korsak, *Malton.*
A. Legiec, *Montreal.*
L. P. Lemelin, *Quebec.*
A. Madeyski, *Toronto.*
L. G. Mathys, *Montreal.*
J. G. Mihulowicz, *Toronto.*
L. Pallas, *Toronto.*
E. T. Paton, *Toronto.*
F. W. Roberts, *Essex, Eng.*
W. Sefton, *Montreal.*
R. S. Sproule, *Montreal.*
C. Strzelecki, *Toronto.*
A. W. Tobber, *Toronto.*
J. G. Todds, *Belleville.*
M. B. Vegh, *Toronto.*
C. H. Watson, *Welland.*
A. T. Wilson, *Montreal.*
E. J. Wilson, *Montreal.*
A. I. Wotherspoon, *Montreal.*

Juniors:

O. Almoslino, *Montreal.*
B. C. Aylward, *Toronto.*
C. H. Baker, *Belleville.*
P. W. Douglas-Tourner, *Arvida.*
B. L. Farrand, *Toronto.*
H. Fealdman, *Toronto.*
T. Fell, *Marine City, Mich.*
L. Glowacki, *Montreal.*
W. A. Grobicki, *Montreal.*
T. P. Hiramatsu, *Toronto.*
W. J. Howell, *Windsor.*
H. O. McCullough, *Windsor.*
J. J. Noonan, *Peterboro.*
O. L. Oakes, *Montreal.*
R. L. Pellatt, *Toronto.*
K. Piekarski, *Toronto.*
C. F. Reardon, *Moncton.*
A. G. Turton, *Falconbridge.*
J. T. Wieckowski, *Toronto.*
G. W. Wilders, *Melcroft, Pa.*

Transferred from the class of Junior to that of Member:

G. D. Adams, *Sarnia.*
G. C. Adams, *Mont Joli.*
C. G. Anderson, *Hamilton.*
J. D. Anderson, *Winnipeg.*
S. H. Asselstine, *Edmonton.*
W. H. Beaton, *Montreal.*
W. R. Birks, *Shawinigan Falls.*
L. A. Bourgault, *Montreal.*
G. L. Brown, *Sault Ste. Marie.*
P. J. G. Carrothers, *Vancouver.*
E. F. Charlesworth, *Edmonton.*
G. Choy, *Marathon.*
M. D'Amours, *Quebec.*
J. F. Deniger, *Montreal.*
R. M. Freeman, *Montreal.*
H. N. Gawley, *Winnipeg.*
A. H. Gerrish, *S. Salvador.*
V. A. Graham, *Sault Ste. Marie.*
W. B. Hall, *Iroquois Falls.*
R. J. Harvey, *Montreal.*
I. L. Johnston, *Vancouver.*
G. D. Keary, *Guelph.*
P. C. Kupa, *Sarnia.*
L. W. Locke, *Winnipeg.*
A. A. Lorrain, *La Sarre.*
J. E. D. McCord, *London, Eng.*
D. H. MacDonald, *London, Eng.*
D. E. A. MacKay, *Edmonton.*
W. J. McKinnon, *Montreal.*
F. J. Manherz, *Toronto.*
J. C. Martin, *Seven Isles.*
R. Milot, *Montreal.*
A. D. Moore, *Vancouver.*
D. D. Munro, *Pine Falls.*
P. T. Nash, *Windsor.*
S. W. Pappius, *Montreal.*
H. F. Phillips, *Windsor.*
D. K. Plummer, *Fredericton.*
E. C. Reid, *Kingston.*
W. P. Ritchie, *Edmundston.*
W. R. Roberts, *Kitchener.*
J. A. Robson, *Toronto.*
H. G. Roy, *Ste. Therese.*
L. E. Salkeld, *Gleichen.*
R. St. Pierre, *Montreal.*
W. Shelson, *Toronto.*
A. E. Swystun, *Chapman Camp.*
R. H. Teskey, *Devon, Alta.*
D. M. Venton, *Woodstock.*
W. M. Walker, *Vancouver.*
A. A. Ward, *Montreal.*
T. E. Weber, *Winnipeg.*
B. F. Webster, *Winnipeg.*
T. B. Webster, *Cornwall.*
E. O. Wood, *Kenora.*
A. M. Yuile, *Montreal.*

Transferred from Student to Member:

R. C. Harris, *Vancouver.*

The following Students were admitted:

Laval University

Paul Alain	A. Lachance
Marcel Beaudoin	J. Lacroix
Chas. E. Beaulieu	R. Lagace
R. Begin	A. P. Langlois
G. Belanger	G. Laprise
P. Belanger	A. Latulippe
B. Bergeron	C. Leclerc
J. P. Bergeron	M. Leclerc
J. P. H. Bergeron	L. Lefrancois
Z. Bergeron	M. Le Houillier
P. Bergeron	R. Lemieux
J. G. Bernier	C. Lortie
G. Blouin	N. W. Lower
J. Boily	Y. Magnan
G. J. H. Boisseau	J. B. Marchand
L. Boudreau	G. Massicotte
J. Bourassa	R. Mercier
J. P. Brassard	G. Michaud
M. M. Caron	J. G. Moore
G. Castonguay	P. Morin
R. Cayer	M. Noel
J. Charest	J. P. A. Nolet
J. M. Charron	R. Page
Y. Chartier	J. Parent
P. Chollet	G. H. Pelletier
B. R. F. Cloutier	A. Perron
C. Desgagne	N. Plante
M. Desjardins	J. Y. Poliquin
G. M. Dionne	E. Pomerleau
P. Dionne	P. Prout
D. Donovan	F. Rainville
P. H. Doyon	J. L. Rene
R. Dumas	J. P. Ricard
J. L. G. Dupont	A. Risi
A. Dussault	J. M. Roberge
J. Y. Fortier	C. Rousseau
G. Fortin	J. Y. Roy
G. M. Fournier	B. Roy
C. Gagne	S. Samson
G. Gagnon	A. Savard
R. Gagnon	G. Talbot
Y. Gagnon	J. Tessier

J. Gaudreault
A. Genest
R. Giguere
G. Gingras
P. Grenon
J. Guenette
R. M. Guerin
M. P. Heitshu
M. Huard
R. Thibault
J. Thivierge
O. Tremblay
L. Trotier
R. Trudel
J. F. Turpin
H. P. Valliere
P. Veilleux
J. Villeneuve

UNIVERSITY OF MANITOBA

P. M. Abel
G. H. Agnew
A. B. Bjornsson
S. Bobey
H. C. Brown
L. D. Brown
I. H. Chester
T. B. Davey
M. W. Diakiw
S. S. Dolhun
F. W. Donaldson
W. F. Dragaloski
R. B. Gair
M. A. Gange
J. W. A. Godfrey
R. B. Handler
J. A. Harding
L. K. Harvey
J. Horosko
W. A. Jackson
A. Janisch
H. D. Janzen
A. King
J. Klassen
A. W. Knight
H. R. Kootz
C. A. Leech
G. Lexier
F. J. Lindenschmidt
R. A. McDougald
E. F. MacKenzie
G. J. McKenzie
R. P. Malis
D. Margolese
B. A. Martz
F. M. Mathie
H. E. Metelnick
S. Mikoliew
R. A. Newey
R. G. Nicholls
R. R. Packer
I. M. Parker
D. J. Prodan
E. P. Rimmer
C. A. Rowley
E. Sawchuk
R. Schwartzman
J. L. Seychuk
D. A. Shearer
W. E. Stewart
C. Stieda
C. H. Strilkiwski
G. R. Thompson
D. W. Treble
R. G. Turenne
R. D. Vopni
W. W. Wayne
D. D. Young

UNIVERSITY OF TORONTO

K. E. Buchanan
R. S. Bailie
R. A. Collins
J. P. Conforzi
D. J. Corbett
P. J. Dalton
D. N. Dastur
T. L. Douglas
J. A. Foster
G. W. Glass
L. V. Gray
D. S. Harper
H. W. Hotchkiss
B. Jackson
C. W. Kirkpatrick
N. Leipziger
D. C. Lowe
D. W. McLeod
R. G. Naden
J. C. Reiffenstein
R. B. Riley
R. Ross
K. J. G. Sewrey
J. Sheinin
H. Tanenbaum
M. R. Thompson
D. W. Tutt
R. L. Waddell
B. P. Wallace
B. F. Williams
G. F. Wisener

QUEEN'S UNIVERSITY

J. C. Best
A. G. Green
K. E. Ludwig
W. N. Shean
H. W. Thompson

MCGILL UNIVERSITY

E. A. Daoust
G. Richer
G. M. Ross
H. K. Tanaka

UNIVERSITY OF NEW BRUNSWICK

C. G. Gallant
B. W. Kelly
D. M. Rankin
R. P. Whalen

UNIVERSITY OF ALBERTA

L. D. Allen
R. R. Jackson
D. W. Lawrie

ROYAL MILITARY COLLEGE

C. Casson
E. Dunalo

J. A. Brown, *Victoria, B.C.*
J. D. E. Cooke, *Port Credit, Ont.*
J. D. Little, *Kapuskasing, Ont.*
G. T. Rees, *Toronto, Ont.*

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Association of Profession Engineers, the following elections and transfers have become effective:

ALBERTA

Junior to Member:

H. D. Archibald
O. T. Linton
L. O. Olsen
W. J. C. Sissons

SASKATCHEWAN

Student to Junior:

R. C. Hovdebo

MANITOBA

Member:

J. D. A. Adam

NOVA SCOTIA

Member:

M. D. McLean

QUEBEC

Members:

A. C. Attendu
E. J. Warlow-Davies
W. D. Veinot

News of Other Societies

The 1953 convention of the **Canadian Section of the American Waterworks Association** (Secretary-Treasurer, Albert E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont.) will take place from April 6 to 8. Convention hotel will be the Statler, at Buffalo, N.Y.

The Montreal Chapter of the Society for Advancement of Management reports that at the fourth annual industrial engineering conference to be held in the Sheraton-Mount Royal Hotel on Friday, March 20, 1953, views on "Productivity" will be presented by government, labour and management representatives. The theme of the conference is "Progress through Productivity".

Further information on this industrial engineering event may be obtained from D. R. MacLennan, S.A.M. Conference Co-ordinator, Northern Electric Company Limited, 1261 Shearer Street, Montreal 22, Quebec.

The Chemical Institute of Canada (18 Rideau Street, Ottawa 2, Ont.) has announced a program of meetings.

Two regional conferences of the Protective Coatings Division of C.I.C. will be held in March. A new approach is being tried, in order to allow the largest possible attendance. One day conferences in Montreal and Toronto, having identical programs, will take place at the Ritz Carlton Hotel, Montreal, on March 12, and at the Royal York Hotel, Toronto, on March 13.

A joint meeting of the chemical engineering division of the Chemical Institute of Canada and the American Institute of Chemical Engineers will be held in Toronto, April 27-29, 1953. The joint conference will include a symposium on communications, as well as a series of technical papers and plant tours.

The 36th annual meeting of the Chemical Institute will be held in Windsor, Ont., on July 4, 5, 6, 1953.

William T. Nichols, director, General Engineering Department, Monsanto Chemical Co., St. Louis, Mo., was elected president of the **American Institute of Chemical Engineers** for 1953, at the 45th annual meeting, at Cleveland in December.

A conference of the **National Association of Corrosion Engineers** (1061 M & M Building, Houston, Texas) will take place in Chicago, March 16-20, 1953.

The American Association of Spectrographers is planning a symposium on "Emission Spectroscopic Determination of Metals in Non-Metallic Samples". The symposium will be held in Chicago on May 1, 1953. Contributed papers in the fields of petroleum, geology, agriculture, pharmacy, biology, ceramics, etc., are welcome.

All inquiries should be addressed to J. P. Pagliassotti, chairman symposium committee, c/o Standard Oil Company (Indiana), Box 431, Whiting, Indiana.

Charles J. McCarthy, vice-president of United Aircraft Corporation, has been elected president of the **Institute of the Aeronautical Sciences** for 1953. Mr. McCarthy is a fellow and founder member of I.A.S.

Information about the **Materials Handling Exposition** being held at Convention Hall, Philadelphia, May 18 to 22, can be obtained from Clapp & Poliak, Inc., the exposition management.

The Institute of Engineers, Australia, has announced that the 23rd Engineering Conference will be held in Melbourne from Monday, 16th March, to Saturday, 21st March, 1953. (See Correspondence section.)

Personals

News of the Personal Activities of Members of the Institute

J. B. Carswell, O.B.E., M.E.I.C., chairman of Kitimat Constructors, has been named as one of the provisional directors of the Mercantile Bank of Canada, which is seeking a charter to operate in Canada with Dutch banking. It was stated some months ago that the bank planned to establish its head office in Montreal and open its first branch in Vancouver.

Mr. Carswell, a consulting civil engineer, represented the Canadian Minister of Munitions and Supply in Washington, during World War II.

After the war he was the first president of War Assets Corporation and became chairman of the Fraser Valley Dyking Board in 1948 and of the Greater Winnipeg Dyking Board in 1950.

D. C. MacCallum, M.E.I.C., has been elected president of Racey, MacCallum and Associates Limited. He was previously vice-president and managing director of Charles Warnock and Company Limited, and secretary and a director of Construction Borings Limited.

Mr. MacCallum is a 1938 graduate in mechanical engineering from McGill University. He worked with Canadian Ingersoll-Rand until 1940, after which he spent five years with the Canadian Army Overseas. On the staff of the Engineering Institute he was the director of rehabilitation and employment in 1945-46. Later he was an administrative engineer for Canadair Limited, and a consultant on a salary survey for the Corporation of Professional Engineers of Quebec.

H. J. Racey, M.E.I.C., has been appointed vice-president of Racey, MacCallum and Associates Limited, Montreal. He was until recently chief engineer and a director of Charles Warnock and Company Limited, president and a director of Construction Borings Limited; and president of Strathcona Equipment Company.

A graduate in civil engineering, Queens University, 1928, Mr. Racey first became associated with Shawinigan Engineering Company Ltd. Since 1933 he has worked successively with Laurentian Wood Products Ltd., Crane Limited, Shawinigan Water and Power Company, Brown Corporation, and Cresswell Pomeroy Limited. From 1946-1948 he was president and managing-director of Cresswell Roll Forming Co. Ltd.

R. H. Quintal, M.E.I.C., has joined the firm of Racey, MacCallum and Associates Limited as an associate. Mr. Quintal was previously chief engineer of Construction Borings Limited. He joined that firm in 1952, after serving with the Quebec Department of Roads as chief soils engineer, with the Public Works Department of Montreal as a specialist in foundation engineering, and in the Montreal Transportation Commission as chief soils engineer and structural engineer, in the subway design division.

He received his B.A.Sc. degree in civil engineering from Ecole Polytechnique in 1943 and his M.A.Sc. degree from the same University in 1944.

J. S. Lochhead, M.E.I.C., has joined the firm of Racey, MacCallum and Associates Limited as an associate. Mr. Lochhead was previously sales manager and special projects engineer of Charles Warnock and Company Limited.

Mr. Lochhead is a graduate in civil engineering from McGill University, class of 1937. He was a shop supervisor in structural and mechanical work for Dominion Bridge Company for five years; going later to Defence Industries Ltd., and to Canadair Limited, where he was supervisor of production planning. For five years he was an independent consultant and manufacturers' agent.

A. Robert Edis, M.E.I.C., newly-appointed associate professor of mechanical engineering at McGill University, will make instruction in nuclear engineering available to graduate students and it is hoped that eventually research in the field will develop at McGill.

D. C. MacCallum, M.E.I.C.

H. J. Racey, M.E.I.C.

J. S. Lochhead, M.E.I.C.

R. H. Quintal, M.E.I.C.

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Professor Edis went from Rolls Royce and Handley-Page in England to the National Research Council at Chalk River, where he was a research officer. He has observed that the main engineering problems in the nuclear reactor are metallurgical—basically that of utilizing the enormous quantity of heat generated by atomic reactions. An experimental reactor is in operation at Chalk River, but it works at very low temperatures.

Professor Edis hopes to spread interest among mechanical engineers in these problems and it is expected that a course will be instituted at McGill for undergraduates before long.

Andrew G. Watt, M.E.I.C., assistant chief engineer of St. John Drydock & Shipbuilding Company Ltd., of Saint John, N.B., has been appointed chairman of the Saint John Branch of the Engineering Institute.

Born in Glasgow, Scotland, Mr. Watt came to Canada in 1927 and entered Canadian Vickers Limited in Montreal as structural draughtsman and checker. Two years later he joined the St. John Drydock & Shipbuilding Company Ltd., in Saint John where he served as chief draughtsman for eleven years. During the following two years he was employed as the Company's personnel manager.

In 1942 Mr. Watt became personnel manager of the Foundation Maritime Limited in Pictou, N.S.; and he was industrial relations and personnel director of Ferguson Industries of Pictou, N.S., from 1943 until 1945 when he returned to St. John Drydock & Shipbuilding Company Ltd., as chief draughtsman of the structural steel division. Mr. Watt was appointed to his present position in 1950. He has been active in the Saint John Branch of the Institute, having served as general chairman of the Maritime Professional Meeting in 1952, at St. Andrews-by-the-Sea, N.B.

A. G. Watt, M.E.I.C.

L. E. Mitchell, M.E.I.C., has been appointed special projects engineer for the Canadian National Railways with assignment to duties relating to the St. Lawrence Seaway Project and other special undertakings, it was announced recently by S. F. Dingle, vice-president of operation for the system. He will have his headquarters at Montreal.

Mr. Mitchell comes to the Railway from Sarnia, Ont., where he was with the engineering division of the Imperial Oil Limited and with which he has been associated since he joined the Company at its Halifax refinery in 1932. Between 1935 and 1941 he was engaged on construction and maintenance work for the oil company in Peru and Columbia in South America. He returned to the Halifax refinery in 1941 and transferred to Sarnia in 1951.

L. E. Mitchell, M.E.I.C.

Mr. Mitchell received his B.A. degree and engineering certificate from Mount Allison University, Sackville, N.B., and his B.Sc. degree in mechanical engineering from the Nova Scotia Technical College in Halifax, graduating from the latter in 1932.

Mr. Mitchell has been active in the

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work of the Engineering Institute. A past chairman of the Halifax Branch, he represented Halifax Branch on the Council in 1947-48. He was chairman of the Maritime Professional meeting on two occasions, 1946 and 1950.

E. E. Orlando, M.E.I.C., formerly eastern regional manager of the Canadian Westinghouse Company Limited, has been appointed general manager of the District Apparatus Division, one of the three new operating divisions recently formed by the Company.

Mr. Orlando's division will be responsible for all district operations throughout Canada involving the products of

E. E. Orlando, M.E.I.C.

the other two new divisions known as Industrial Products Division and the Power Products Division, as well as normal regional and district operations such as service, industry application, agency and resale functions and sales services.

Mr. Orlando joined Canadian Westinghouse in 1927 upon graduation from the Nova Scotia Technical College in electrical engineering and following a few years in the engineering department, became a sales engineer in Montreal. He was later appointed manager of the Apparatus Division in Hamilton and returned to Montreal in 1948 to become Quebec district manager. He was appointed eastern regional manager in 1951.

J. W. Kerr, M.E.I.C.

J. W. Kerr, M.E.I.C., has been appointed general manager of the Power Products Division of the Canadian Westinghouse Company Limited. He was previously manager of the Company's apparatus sales department. This division will handle such equipment as generating apparatus, ignition rectifiers, power transformers and switchgear.

Mr. Kerr has been with the Company since 1937 when he graduated in electrical engineering from the University of Toronto. Following various positions in the sales department, he became manager of the central station and transportation sales department in 1948. A company-wide reorganization a year and a half ago delegated new sales responsibilities to Mr. Kerr.

Gilles E. Sarault, M.E.I.C., director of the department of electrical engineering at Laval University, and partner in the consulting engineering firm of Tasse, Sarault and Associates of Quebec and Montreal, was recently awarded the diocesan medal of merit by Monsigneur Maurice Roy, Archbishop of Quebec. The award was made in recognition of his outstanding contribution to the centennial celebrations of the University.

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G. W. Titus, M.E.I.C., was recently appointed to the office of chief highway engineer for the Province of New Brunswick.

The appointment, recently announced by Premier Hugh John Flemming, confirms Mr. Titus' occupancy of a post he has held in an acting capacity for some time past.

New Brunswick's new chief highway engineer was born at Norton and received his education at Norton Adademy and Acadia University. He has served the Department of Public Works for 29 years, his introduction to construction work coming as a student worker on road crews in the summer months. For 20 years he held the position of district highway engineer at Edmundston.

R. B. Jones, M.E.I.C., has been appointed chairman of the board and general manager of Charles Warnock and Company Limited, and also president of the firm's associated company, Construction Borings Limited.

R. B. Jones, M.E.I.C.

Mr. Jones was, until recently, assistant chief engineer of the Canadian Pacific Railway Company.

Charles Hawke, M.E.I.C., is now chief engineer of the Charles Warnock and Company Limited and its associated company, Construction Borings Limited.

Previous to this appointment, Mr. Hawke was engineer of the Macnamara Construction Company. He is a civil engineering graduate of the University of Toronto, class of 1934.

Arthur L. Patterson, M.E.I.C.

Arthur L. Patterson, M.E.I.C., chief engineer of the Shawinigan Engineering Company Limited of Montreal, has been appointed vice-president of the company, and is being succeeded as chief engineer by **Guy Rinfret,** M.E.I.C., supervising engineer, it was announced by President **R. E. Heartz,** M.E.I.C.

Both men have been with the Company since it was organized in 1919 as a subsidiary of the Shawinigan Water and Power Company.

Mr. Patterson was born in Montreal and received his mechanical engineering degree from McGill University in 1914. He went overseas with the Canadian Artillery and returned in 1919 as an acting captain after temporary service with the Imperial Forces.

Mr. Rinfret was born in Dawson City, Yukon, and was educated at Loyola College, Shawinigan Technical Institute and McGill University where he received his degree in civil engineering. He joined the Shawinigan Water and Power Company before the engineering subsidiary was formed. Mr. Rinfret was resident engineer on the construction of the Shawinigan hydro-electric plant at Rapide Blanc and the St. Maurice Power Corporation plant at La Tuque on the St. Maurice River. After World War II he spent several months in China when the Company took part in a study of hydro-electric sites for the Nationalist government.

Guy Rinfret, M.E.I.C.

J. E. Leo Roy, M.E.I.C., formerly head of the Quebec Hydro Electric Commission's Transmission and Distribution Section, has been appointed chief engineer of Auxiliary Services, while **Dale M. Farnham** has become chief engineer of the Engineering Design Division, succeeding **George C. Read** who has retired. **James H. Wheatley,** M.E.I.C., has been named chief engineer of the Commission's Shops and Transportation Department with general supervision of activities directed from the Commission's recently inaugurated service centre.

Other promotions in the Quebec Hydro Electric Commission are **Herbert W. Haberl,** M.E.I.C., assistant chief engineer of the Engineering Design Division; **J. Raymond Hango,** M.E.I.C., system planning engineer; **Archie Benjamin,** M.E.I.C., distribution engineer; **Merle P. Gunning,** M.E.I.C., assistant distribution engineer; **Fernand Dugal,** M.E.I.C., assistant chief engineer of the Shops and Transportation Department; **Rene Gauthier,** superintending engineer of the Transmission and Distribution Section, and **Maurice St. Jacques,** his assistant.

J. E. Leo Roy, M.E.I.C.

James H. Wheatley, M.E.I.C.

M. R. Campbell, M.E.I.C., has been appointed assistant general superintendent of Dominion Iron and Steel Limited in Sydney, N.S., it was recently announced by C. M. Anson, M.E.I.C., vice-president and general manager.

Mr. Campbell received his B.A. degree from St. Francis Xavier University and his M.Sc. degree in chemical engineering from the Massachusetts Institute of Technology in 1927.

While attending university he worked during his vacations at the steel plant in various capacities and early in 1927 he became a permanent employee of the Company. Later that year he was appointed assistant superintendent of the Open Hearth Department, becoming superintendent of that department in February, 1946.

Mr. Campbell has served on the executive of the Engineering Institute. He is a member of the Mining Society of Nova Scotia and the British Iron and Steel Institute, and has contributed a number of technical papers to some of

these organizations. He is active in community affairs and is a past president of the Home and School Association in Sydney.

A. A. Moline, M.E.I.C., has been appointed manager of the engineering department of the Power Products Division of the Canadian Westinghouse Company Limited.

Mr. Moline came to Canada from the Westinghouse Electric Corporation which he joined following graduation from the University of Colorado as a mechanical engineer in 1925. He entered the Canadian Westinghouse Company in 1937 and was engaged in the mechanical design of heavy apparatus before organizing the Mechanical Division during the war and contributing much to the Company's materials conservation program. In 1936 Mr. Moline was appointed chief engineer and last year became manager of apparatus engineering.

J. E. Cranswick, M.E.I.C., has been appointed manager of sales in the Industrial Products Division of Canadian Westinghouse Company Limited.

He is a 1929 graduate in electrical engineering from the University of Manitoba, and he entered the Canadian Westinghouse organization in 1931.

Mr. Cranswick is known throughout western Canada where he spent several years engaged in both apparatus and appliance operations. He was appointed manager of the Edmonton office in 1944 and last year became regional manager of the Company's central region.

N. S. Bubbis, M.E.I.C., general manager of Greater Winnipeg Water District, was in October, 1952, elected chairman of the Minnesota section of American Water Works Association, the next convention of which will be held in Winnipeg.

A. W. Crawford, M.E.I.C., director of training for the Department of Veterans Affairs, has been transferred to the Department of Labour in the same capacity.

W. I. McFarland, M.E.I.C., has become a member of the firm of Haddin, Davis and Brown Limited in Calgary. Mr. McFarland was previously superintendent of the power plant for the City of Edmonton.

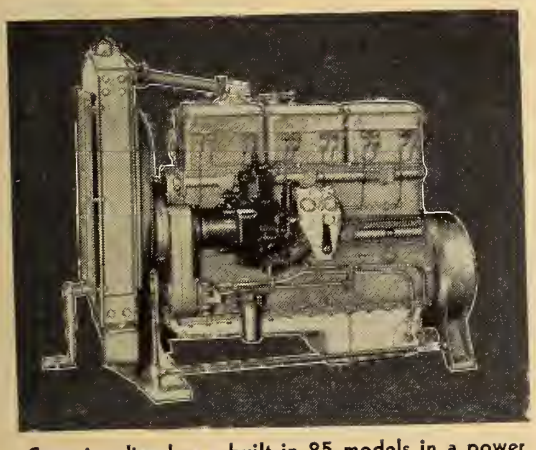
Mr. McFarland graduated from the University of Alberta in electrical engineering in 1929. For six years he was with the Beauharnois Construction Company as assistant to the electrical engineer in the construction of a large hydro-electric development. He then joined the engineering department of the City of Edmonton to work on the design of the electrical work for their power plant and to supervise the maintenance and electrical installations.

While with the City of Edmonton, Mr. McFarland prepared plans for their trolley coach overhead system, and advised on the trolley coach garage layout. He also supervised the last stages of the design and the construction of the city water treatment plant. As superintendent of the city power plant department, Mr. McFarland was responsible for the operation and maintenance of the power plant, the pumping plant and the water treatment plant.

Wm. R. Geddes, C.B.E., M.E.I.C., was recently elected vice-president of North American Cyanamid Limited. He was assistant to the president until his recent advancement. He is also president of Chemical Construction (Inter-American) Limited. Both firms are Canadian associates of American Cyanamid Company.

Prior to joining NACL in January, 1948, Mr. Geddes was connected with Milton Hersey, Ltd., of Montreal for many years. At the outbreak of World War II he served the Canadian Government as a member of the Foreign Exchange Control Board and Price and Trade Board in Ottawa. He was deputy chairman of the latter, in charge of war-time civilian supplies.

Mr. Geddes was also the Canadian member of the civilian section of the combined Production and Resources Board. After the war he was the economic advisor in Berlin, for the Canadian Military Mission to the Allied Control Council for Germany. For his war-time



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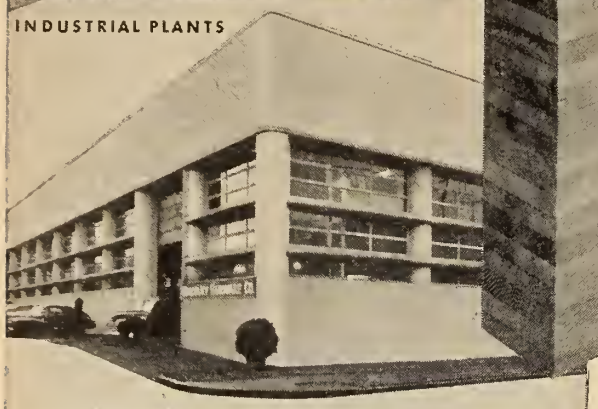
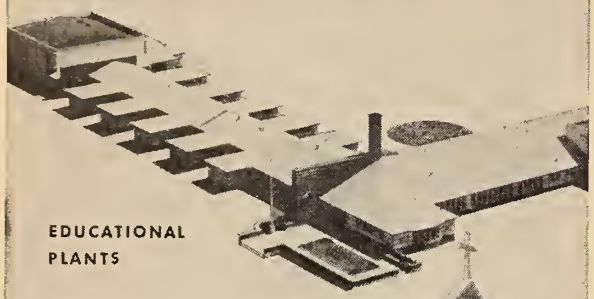


WAREHOUSES



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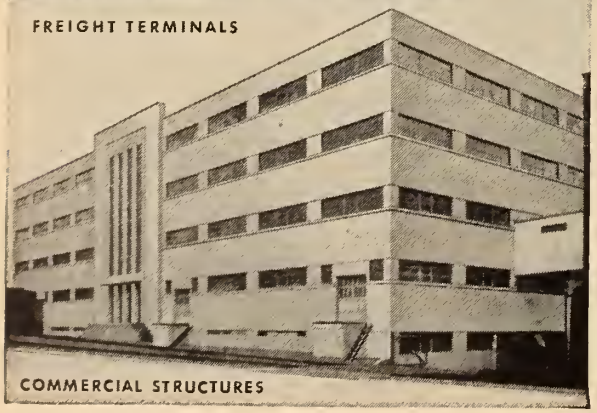

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service he was decorated with the Commander of the Order of the British Empire.

Dr. Lyle G. Trorey, M.B.E., M.E.I.C., consulting engineer of Vancouver, has been retained by New Zealand interests in connection with the proposed extensive surveys in that country. He left Vancouver on January 8, expecting to be away about two months.

Dr. Trorey is associated with T. & H. Engineering & Forestry Limited, and is president and chief engineer of Photographic Surveys (Western) Limited. He is well known outside of British Columbia for his work in engineering and forestry applications of air survey. He has recently been retained by the United States Government upon classified research and development work in his field.

A. L. Stevinson, M.E.I.C., has been transferred to Montreal as sales engineer of electric utilities of the Apparatus Division of the Canadian General Electric Company Limited. He was formerly apparatus sales engineer in Calgary.

Major A. L. Maclean, M.E.I.C., has been posted to Army Headquarters in Ottawa from the Canadian Army Staff College at Kingston, Ont. He will be in the Directorate of Quartermaster Operations and Plans.

Major Maclean is a past chairman of the Kingston Branch of the Engineering Institute.

R. A. Park, M.E.I.C., structural engineer with the Atlantic Region of the Canadian National Railways, has been transferred to the chief architect's office at headquarters in Montreal.

Mr. Park graduated in civil engineering from the University of New Brunswick in 1950. During the war years he served in the Royal Canadian Navy. He has been very active in the branch affairs of the Engineering Institute and was a member of the Moncton executive, and news editor for the Branch.

R. A. Park, M.E.I.C.

Charles A. Auclair, M.E.I.C., is now on the staff of Associated Management Consultants Limited in Montreal as consulting management engineer. He was previously employed in the Quebec district engineer's office of the federal Department of Public Works, and with the Steel Structure and Services Limited.

Mr. Auclair is a chemical engineering graduate of Ecole Polytechnique, class of 1941. Among his engineering experience has been work for the Inspection Board of the United Kingdom and Canada, 1943-1946; for Surveyer, Nenniger & Chenevert, 1946-1948; Quebec Construction Company 1948-49; and for the Department of Finance.

Group Captain A. O. Adams, M.E.I.C., has now retired as deputy controller general of inspection services of the Royal Canadian Air Force after many years in this service.

D. J. S. Irvine, M.E.I.C., has joined the staff of the industrial sales division of Exide Batteries of Canada Limited in Toronto. He was formerly superintendent of the phenol plant of the Dominion Tar & Chemical Company Ltd. in Toronto.

Mr. Irvine received his B.A. degree in chemistry and economics in 1937 from the University of Saskatchewan and his B.Sc. degree in chemical engineering in 1941. He was for 4 years with Consolidated Mining & Smelting Company at Trail, B.C., after his return from service in the R.C.N.V.R.

V. T. B. Williams, M.E.I.C., is plant engineer of the Canadian Cellulose Company, Prince Rupert, B.C. He was previously with the Irvine Pulp & Paper Company, Ltd., at Fairville, N.B.

John M. Woods, M.E.I.C., is supervisor of the miniature plant section of the Pulp and Paper Research Institute of Canada in Montreal. Mr. Woods had been for several years associated with the Restigouche Co. Ltd., Campbellton, N.B.

Edgar Hogg, M.E.I.C., is assistant technical director of the Arvida works of the Aluminum Company of Canada Limited, where he was formerly chairman of the metal purity committee of the Company in Arvida.

Major A. H. Lewis, M.E.I.C., is now with the Dalhousie and King's Universities Contingent of the Canadian Officers Training Corps in Halifax.

Major Lewis has been in the R.C.E.M.E. since graduation from Queen's University in chemical engineering, class of 1941. He was a senior instructor at Barriefield before being posted to Petawawa, Vancouver and Toronto.

J. H. E. Doyle, M.E.I.C., is manager of distributor and apparatus sales of the Dominion Oxygen Company Limited in Toronto. He has been with the Company since 1939, beginning in the engineering sales and process service departments in Montreal. In 1945 he was appointed sales representative for the Winnipeg district and he comes to his present position from that of district manager in St. Boniface, Man.

C. A. O. Dell, M.E.I.C., of H. G. Acres Company, is resident electrical engineer for the Company at the J. Clark Keith Generating Station in Windsor, Ont. Mr. Dell has been with the H. G. Acres Company since 1940. Recently he was on a project at Pine Falls, Man.

W. J. Gall, JR.E.I.C., has resigned from his post as scientific officer with the U.N.E.S.C.O. Science Co-operation Office for South East Asia, Djakarta (Java) Indonesia, having completed

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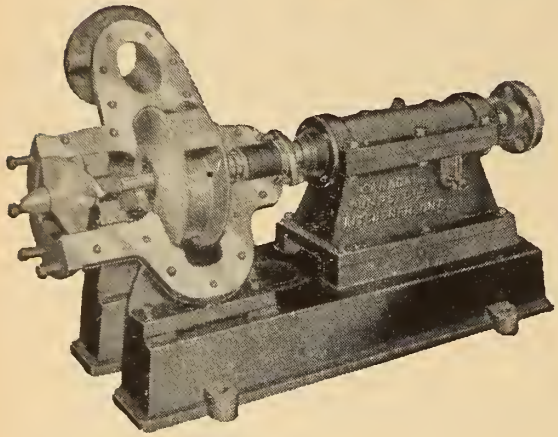

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three years with this specialized agency of the United Nations in Paris and Djakarta.

Mr. Gall left Indonesia on December 31, 1952, travelling via the Middle East and Europe with several stopovers, particularly to make contact with the Science Co-operation Offices in Delhi and Cairo and its branch office in Istanbul.

He expects to arrive in Canada in March after six years abroad.

George Durnin, JR.E.I.C., has been appointed to the position of assistant to the superintendent of Public Works in Brandon, Man. He was formerly assistant district engineer of the highways branch for the Manitoba Department of Public Works, at Dauphin.

Mr. Durnin is a 1948 civil engineering graduate of the University of Manitoba.

William Shelson, JR.E.I.C., who is now employed in the Research Division of the Hydro-Electric Power Commission of Ontario, was granted the degree of doctor of philosophy at the last convocation of the University of Toronto.

Mr. Shelson gained his B.A.Sc. degree from the University of Toronto in 1944 and his M.Sc. degree from Pennsylvania State College in 1947.

F. S. Miller, JR.E.I.C., has accepted the position as master of chemistry at St. Andrew's College, Aurora, Ont. He was previously with the Aluminum Company of Canada Limited in Arvida.

Mr. Miller is a 1949 graduate of McGill University in chemical engineering.

Lieutenant (L) W. B. Christie, R.C.N., JR.E.I.C., has recently taken up his new appointment in Bath, England, as electrical representative on the staff of the principal R.C.N. technical representative overseeing construction of the new aircraft carrier being completed in the United Kingdom for the Royal Canadian Navy.

Lieutenant Christie has served during the past year as assistant command electrical officer on the staff of the Flag Officer Atlantic Coast at Halifax.

He is a 1950 electrical engineering graduate of the Nova Scotia Technical College.

D. C. Floyer, JR.E.I.C., is employed by Richard Costain Limited in London, England, and is at the same time reading for the bar.

Mr. Floyer is a 1951 civil engineering graduate of McGill University.

R. C. Bezanson, JR.E.I.C., has been employed by Dominion Steel and Coal Corporation in Sydney, N.S., since December 1951. He is at present working as construction engineer in the new extension to Seaboard Power Plant.

Mr. Bezanson received his B.Sc. degree from Dalhousie University in 1948 and his civil engineering degree from the Nova Scotia Technical College in 1951.

J. A. Spinney, JR.E.I.C., has been transferred to Shawinigan Falls, Que., from Copper Cliff, Ont., by Canadian Industries Limited.

Mr. Spinney graduated in 1949 as a civil engineer from the University of New Brunswick.

G. M. Irving, JR.E.I.C., is on the staff of Standard Chemical Company Limited of Montreal, and is sales representative in the Industrial Chemicals Division. He was previously with Price Brothers and Company Limited.

Mr. Irving is a chemical engineering graduate of McGill University, class of 1950.

R. E. LeSueur, JR.E.I.C., has returned from Houston, Texas, where he has been employed by Brown and Root, Inc., to the Canadian Chemical Company Limited, Edmonton.

Mr. LeSueur is a graduate in chemical engineering of the University of Toronto, class of 1948.

H. W. Robinson, JR.E.I.C., is now a lecturer in the department of agricultural engineering at the Ontario Agricultural College, Guelph, Ont. He was previously with the University of British Columbia agricultural engineering department.

Mr. Robinson received his B.A.Sc. degree in agricultural engineering in 1950 from the University of British Columbia.

Ronald C. Getty, JR.E.I.C., has been employed as field engineer with Margison Babcock & Associates of Toronto, since March 1952.

Mr. Getty is a 1950 civil engineering graduate of the University of Toronto.

Walter Edward Webb, JR.E.I.C., is now employed with the Department of Transport (St. Lawrence Seaway). He was previously junior assistant engineer with the Canadian National Railways in Montreal.

Mr. Webb is a graduate of McGill University in civil engineering, class of 1950.

J. W. Thomas, JR.E.I.C., is now assistant technical supervisor at the Elk Falls Company, Campbell River, B.C. He was previously employed as control chemist, Reighhold Chemicals (Canada) Ltd., Port Moody, B.C.

Mr. Thomas is a 1951 graduate of the University of British Columbia in chemical engineering.

Sigurdur G. Petursson, JR.E.I.C., is on the staff of the John Inglis Company, Limited, Toronto.

Mr. Petursson graduated in mechanical engineering from the University of Manitoba in 1951.

R. S. Green, JR.E.I.C., has been appointed the Maritimes division engineer of the marketing department of Imperial Oil Company. He was previously in the Company's Toronto office.

Mr. Green graduated from McGill University in 1948.

G. J. Melanson, JR.E.I.C., has joined the staff of the B.C. International Paper Company at Dalhousie, N.B. He was previously in the mechanical department of Building Products Limited in Montreal.

Mr. Melanson is a 1951 graduate in mechanical engineering from the Nova Scotia Technical College.

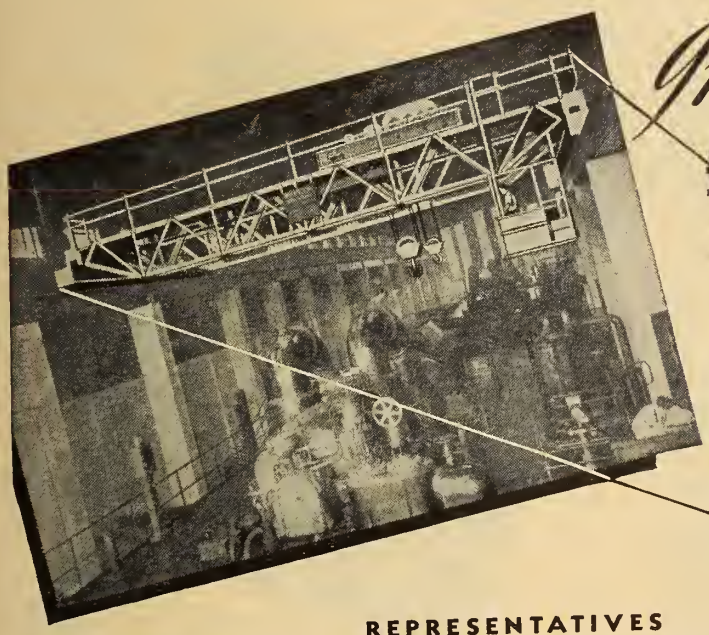
Paul Lepinay, JR.E.I.C., is in the employ of consulting engineer, Guy Piette in Quebec City. After graduating from L'Ecole Polytechnique in civil engineering in 1950, Mr. Lepinay worked for the Public Works Department as a project engineer.

B. W. Henkin, JR.E.I.C., is now on the staff of the Montreal Engineering Co. Ltd., of Montreal as a structural engineer in the hydro-electric power engineering department. He was formerly with T. Pringle & Son Limited in Montreal.

Mr. Henkin is a 1948 engineering graduate of Imperial College of Science and Technology, London, England.

E. A. Godfrey, JR.E.I.C., is assistant engineer in the electrical maintenance department of the Ontario Hydro-Electric Power Commission, in Toronto.

Mr. Godfrey received his B.A.Sc. degree in electrical engineering from the University of Toronto in 1951.



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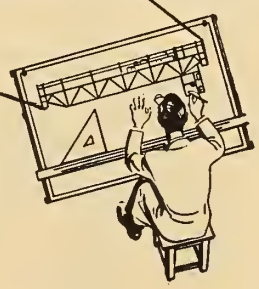

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Frank Meier, JR.E.I.C., is on the staff of McColl-Frontenac Oil Company Limited. He is presently engaged in structural design and architectural planning of warehouses for the Company.

Mr. Meier is a civil engineering graduate of McGill University, class of 1951.

J. B. Woods, JR.E.I.C., is sales engineer in the employ of Gartshore-Thomson Pipe & Foundry Company Limited in Hamilton, Ont.

Mr. Woods is a 1951 civil engineering graduate of Queen's University.

Donald G. Kitson, JR.E.I.C., has recently accepted the position of chief operator in the new hydro-electric plant of Manicouagan Power Company at Baie Comeau, Que.

Formerly he worked with the Canadian General Electric Company as an apparatus service engineer at the Montreal office.

Mr. Kitson graduated in electrical engineering from McGill University in 1950.

H. A. B. Small, JR.E.I.C., has joined the firm of Leeds & Northrup Company in Cleveland, Ohio.

He was formerly sales engineer with the Electric Materials Company, North East, Penn.

Mr. Small is a 1950 electrical engineering graduate of the University of New Brunswick.

John P. Miller, JR.E.I.C., is second assistant city engineer of Belleville, Ont. He was formerly municipal engineer for Atikokan, Ont.

Mr. Miller is a 1951 graduate in civil engineering from the University of Manitoba.

S. R. Price, JR.E.I.C., is assistant city engineer of Niagara Falls, Ont. He was previously assistant city engineer of Belleville, Ont.

Mr. Price graduated in civil engineering from Queen's University in 1948.

Claude D. Quenneville, JR.E.I.C., is employed as sales engineer in the Ross & Grieg Division of Upton Bradeen & James Limited of Montreal.

Mr. Quenneville is a 1951 civil engineering graduate of Ecole Polytechnique.

R. H. Scott, JR.E.I.C., is now employed by the Hufford Machine Works in El Segundo, California, engaged in the design and manufacture of stretch-wrap forming machines.

Mr. Scott was formerly a research engineer in the fusion and joining department of the research and development laboratories of the Kaiser Aluminum and Chemical Corporation at Trentwood, Wash.

After graduating in 1951 in mechanical engineering from the University of British Columbia he completed the Canadian Westinghouse Company Limited graduate training course in Hamilton, Ont.

R. H. Scott, S.E.I.C.

G. P. Berthin, S.E.I.C., has enrolled in the graduate training course of Canadian General Electric Company in Peterborough, Ont.

Mr. Berthin is a mechanical engineering graduate of the University of Manitoba, class of 1952.

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W. A. MacKay, S.E.I.C., is superintendent engineer with the Construction Equipment Company, Ltd., in Halifax.

Mr. MacKay is a 1952 mechanical engineering graduate of the Nova Scotia Technical College.

R. W. Heine, S.E.I.C., has joined the staff of the Department of Transport in Winnipeg, and is engaged in the development of additional airfields in that region.

Mr. Heine is a recent graduate of the Nova Scotia Technical College.

Gerald G. Monkman, S.E.I.C., of Peterborough, Ont., is in the British Isles where he will spend some time working with a firm of structural consultants near London.

He is a 1952 civil engineering graduate of Queen's University.

J. A. Gordon Moore, S.E.I.C., is on the engineering staff of the Foundation Company of Canada at Chalk River, Ont.

S. A. MacNaughton, S.E.I.C., has been since December 1950 working as assistant technician in charge of the Kjeldahl Laboratory of the Department of Agriculture experimental station at Kentville, N.S.

D. J. McLennan, S.E.I.C., is presently employed by the B.C. Power Commission as district manager at Alert Bay, B.C.

Sverre Mollo-Christensen, S.E.I.C., is employed by the Northern Electric Company Limited in Belleville, Ont., in the department of manufacturing methods. He was previously with the Dominion Tar and Chemical Company Limited.

Mr. Mollo-Christensen is a 1951 graduate of the Norwegian Institute of Technology.

W. W. Serrick, S.E.I.C., is assistant engineer with the Water and Sewerage Corporation of Greater Corner Brook, Corner Brook, Nfld. He was formerly with the Aluminum Company of Canada Limited.

Mr. Serrick is a 1952 graduate of McGill University in civil engineering.

F. K. Burgar, S.E.I.C., is administrative engineer to the project engineer of Defence Construction Limited, Barriefield, Ont.

Visitors to Headquarters

Ralph Kendall, M.E.I.C., Halifax, Nova Scotia, December 15, 1952.

Gerard L. Jolicoeur, JR.E.I.C., Ottawa, Ontario, December 17, 1952.

Paul B. Dilworth, M.E.I.C., Toronto, Ontario, December 17, 1952.

Major-General G. R. Turner, M.E.I.C., Ottawa, Ontario, December 27, 1952.

James A. Vance, M.E.I.C., Woodstock, Ontario, January 8, 1953.

A. D. Fisken, M.E.I.C., Toronto, Ontario, January 8, 1953.

G. R. Henderson, M.E.I.C., Sarnia, Ontario, January 8, 1953.

F. P. Shearwood, M.E.I.C., Montreal, Quebec, January 15, 1953.

Harry H. Angus, M.E.I.C., Toronto, Ontario, January 19, 1953.

Edgar A. Cross, M.E.I.C., Toronto, Ontario, January 19, 1953.

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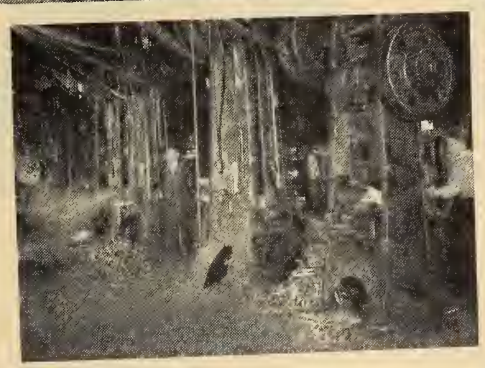

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MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Homer Morton Jaquays, M.E.I.C., prominent Montreal engineer and industrialist, passed away suddenly on January 9, 1953.

Mr. Jaquays was born in Frelighsburg, Quebec, in 1870. He was educated at McGill University where he received his M.A. and his M.Sc. degree in electrical engineering in 1896.

He began his engineering career with the New York consulting engineer Charles H. Davis, and later joined Wm. Sellers Incorporated of Philadelphia. In 1900 he went to England where he was employed in the designing department of S. Z. Ferranti.

Mr. Jaquays was invited by McGill University in 1901 to become lecturer and assistant professor in the mechanical engineering department, a position he held until 1906 when he was appointed chief engineer of the Montreal Rolling Mills. This Company was later absorbed by the Steel Company of Canada. At the time of his death, Mr. Jaquays was a director of the Steel Company of Canada.

He became a director of Ontario Steel Products Company Limited in 1923, its vice-president in 1943, and president in 1945. He was also president and a director of Gould Cold Storage Company and a director of Montreal, London and General Investors Limited. In addition, Mr. Jaquays was a director and vice-president of the Occidental Fire Insurance Company.

In 1936 he was a chairman of the $350,000 campaign for the erection of the Sir Arthur Currie Memorial Gymnasium and Armory of McGill University.

He joined the Engineering Institute as a Student in March, 1898, transferring to Associate Member in December of the same year, and to Member in 1909. Mr. Jaquays was granted Life Membership in 1947.

Geoffrey Johnstone Dodd, M.E.I.C., professor of civil engineering of McGill University for many years, died on December 20, 1952, at his home in Jamaica, B.W.I.

Professor Dodd was born at Port Antonio, Jamaica, in 1888. He received his preliminary education at Potsdam School, now the Monroe School, at Malvern, Jamaica. In 1907 he entered the faculty of engineering at McGill University on a scholarship from the Jamaican government and in 1911 he graduated with a B.Sc. degree in civil engineering.

In 1908 he assisted Professor MacLeod at the McGill Observatory in meteorological and time observations. During the summer months of his university terms he was employed successively by the Crown Reserve Mining Company in Cobalt, Ont., the Canadian Pacific Railway Company at North Bay, Ont., and by the Grand Trunk Railway. After graduation he continued with the Grand Trunk Railway for two years.

In 1913 he was invited by McGill University to lecture in mathematics and demonstrate in civil engineering. In the summer months of 1914 he was engineer in charge of the construction of a

G. J. Dodd, M.E.I.C.

fishway for the Labrador Company of Canada.

At the outbreak of war Professor Dodd enlisted with the Canadian Engineers. He proceeded overseas in 1915 and received his commission in the Royal Engineers of the British Army the following year. He served in England, France and Belgium. He was seriously injured while playing in a soccer game in France in 1917. Upon leaving hospital he was given an appointment at Aldershot. He assisted in organizing the Khaki University of Canada for officers and men in the armed forces.

In 1919 Professor Dodd returned to Canada to rejoin the staff of McGill University. While carrying on full time teaching duties he also completed the requirements for his master's degree in civil engineering which he received in 1921. He specialized in structural and hydraulic engineering. One of the foremost structural engineers in Canada, he was a consultant on many important projects and was especially well versed in strength of materials, foundations and soil mechanics.

Professor Dodd continued on the staff of the University for 31 years, retiring because of ill health in May, 1950.

He joined the Engineering Institute as a Student in 1910, transferring to Junior in 1913, to Associate Member in 1920, and to Member in 1940. On January 1, 1953, Professor Dodd would have attained Life Membership.

Frederick Stevens, M.E.I.C., draughting supervisor of the Canadian Bridge Company in Walkerville, Ont., died on May 20, 1952, at the age of 67 years.

Mr. Stevens was born in Watford, England, and came to Canada as a boy. He received his education at Peterborough, Ont., and studied structural engineering privately and by correspondence.

In 1900 he entered the Hamilton Bridge Works Company in Hamilton, Ont., where he served two years. He then joined the Canada Foundry Company in Toronto and was employed for seven years in general shop work on structural steel, bridge, steam shovel and locomotive construction.

Mr. Stevens then entered the Cana-

Frederick Stevens, M.E.I.C.

dian Bridge Company in Hamilton, Ont., with which he remained associated for 43 years. He played a large part in numerous projects. Some of the earlier of these included the construction of the C.P.R. elevators at Port McNicol, Ont., the designing of the Quebec Bridge, the construction of the Grand Trunk Central Train Shed in Ottawa, the Canada Cement Company building in Hull, Que., and the organization of the template department of the St. Lawrence Bridge Company in Montreal.

In June, 1915, Mr. Stevens enlisted with the Canadian Overseas Railway Construction Corps and was corporal in charge of the steel bridge section. He landed in France in August of the same year and served in that country until the end of the war. He was awarded the Military Medal in the field and was discharged in Canada in 1919 with the rank of company sergeant major.

Mr. Stevens afterwards returned to the Canadian Bridge Company Limited.

He joined the Engineering Institute as an Associate Member in 1923, transferring to Member in 1940.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMIST OR CHEMICAL ENGINEER experienced in compounding and laboratory testing of rubber goods, particularly along mechanical lines. Location Province of Quebec. File No. 4470-V.

CHEMICAL ENGINEER required in province of Quebec for designing process services, plant layout and supervising equipment installations. Accommodation available. File No. 4471-V.

CIVIL

CONSTRUCTION ENGINEER required as department manager for expanding construction firm in Alberta. Must have field experience in concrete work. Unlimited opportunity. Give all qualifications and remuneration expected. File No. 4467-V.

ENGINEER REQUIRED by city located in Western Canada to perform traffic studies and to design highway parking systems. Qualifications: degree in Civil engineering with considerable experience. Preferably experience in highway and traffic problems or the equivalent. Salary $357.00 to $428.00 per month. File No. 4468-V.

CIVIL ENGINEER required by organization in P.Q. Experience in reinforced concrete, building and structural steel design, age about 30, housing available. File No. 4471-V.

ELECTRICAL

A LEADING ELECTRONICS manufacturing firm, located in Montreal has an exceptional opportunity for an electrical engineer (or equivalent training) who has had several years of practical experience in the design and manufacture of small transformers and other radio receiver components. This position has unusual immediate and long-term prospects. Only fully-qualified engineers will be considered. File No. 4460-V.

ELECTRICAL SALES ENGINEER required by manufacturer located in Hamilton, Ontario, of electric motors to cover Province of Quebec. Applicant must be bilingual. File No. 4472-V.

ASSOCIATE PROFESSOR electrical engineering; duties: to instruct undergraduate students and develop post-graduate work. Time and facilities for research. Qualifications: University graduate, preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Location Halifax, N.S. File No. 4475-V.

JUNIOR ELECTRICAL ENGINEERS required in the signalling department of Canadian Railway. Work is related to the entire field of railway signalling including design, installation, maintenance, repair and inspection. File No. 4485-V.

ELECTRICAL ENGINEER required by firm of architects in Edmonton. Applicant should be qualified to handle all electrical design. Good salary offered. File No. 4481-V.

MECHANICAL

MECHANICAL ENGINEER required by organization manufacturing small automotive pistons and aircraft components located near Montreal. Duties include production and design. File No. 4465-V.

JUNIOR TOOL AND DIE designer required by pulp and paper industry in Province of Quebec. Applicant must also be able to do construction drawings, also entails maintenance of plant engineering records and various detailed reports. Job also covered by group insurance and pension plan. File No. 4469-V.

MECHANICAL ENGINEER to be personal assistant to the chief engineer of a large multi-plant organization with headquarters in Toronto. Graduate mechanical engineer with 5 to 10 years experience in industry (or consulting engineering) on the layout, installation, operation and maintenance of heating, air conditioning and other mechanical services. File No. 4476-V.

MECHANICAL ENGINEER required by firm of architects in Edmonton. Applicant must be able to handle all heating and plumbing design. Good salary offered to applicant with experience. File No. 4481-V.

STEAM PLANT ENGINEER required for large Newfoundland paper mill. Essential requirements: 1st class British Board of Trade Marine engineers certificate, sound mechanical training, preferably with experience in paper or pulp mill, experience with high pressure boilers and turbines. Age limit 45 years. Attractive salary and good working conditions. Other detailed information available on application. File No. 4483-V.

MECHANICAL ENGINEER required in Province of Quebec by firm of contractors specializing in heating, plumbing, air conditioning, sheet metal works and machine shop works. Applicant must be bilingual with 5 to 6 years experience. File No. 4486-V.

SALES ENGINEER preferably mechanical to work in Montreal district for manufacturer of compressed gases, equipment and supplies for welding operations. Bilingual preferred but not essential. Age 25 to 40 years. File No. 4487-V.

MISCELLANEOUS

ESTIMATOR REQUIRED for all types of construction in the commercial institutional and industrial field. Location, Hamilton area, medium size construction company. Applicant must have had experience in these fields. File No. 4461-V.

GRADUATE ENGINEER member of association of Provincial engineers of P.Q. required to act as field engineer. Applicant should be bilingual 25 to 35 years of age, of direct sales contact type with good personality and personal background and owner of serviceable car. Experience of one year minimum selling technical products to industry. To be sole contact for technical sales of premium quality industrial power transmission V belting and drives, full range of specialized industrial hose and other mechanical rubber goods. Territory Montreal and other main trading areas of the Province of Quebec. File No. 4462-V.

MECHANICAL OR CIVIL ENGINEER required by large automotive industry in Ontario to act as process engineer. Duties include the preparation of packaging specifications, including materials for rust and damage protection for unit and immediate packs of vehicle components to be shipped to overseas territories, to investigate complaints from overseas territories, recommend corrective action, institute experimental packs, request out-turn reports. File No. 4464-V.

MECHANICAL AND CIVIL ENGINEERS wanted for a large pulp and paper organization located in Quebec city. Applicants should have one to three years experience in pulp and paper mills or allied industry. File No. 4466-V.

ENGINEER REQUIRED by large departmental store in Montreal to act as maintenance engineer. Applicant should be graduate mechanical or electrical engineer with about 5 years experience. He

should also be capable of designing and supervising any alterations necessary. File No. 4473-V.

MINING OR METALLURGICAL ENGINEER required by Montreal sales office. Applicant should be 25 to 30 years with preferably milling experience to act as assistant manager of the department. File No. 4474-V.

CIVIL SERVICE (FEDERAL) requires civil engineer (construction) and an electrical engineer (power and lighting) at salaries depending upon qualifications of applicants, for the department of National Defence at Ottawa. Many years of experience in related fields required. File No. 4477-V.

SALES ENGINEER required in Toronto. Applicant must be personable engineer with about 10 years paper mill experience to take charge of paper machinery sales. In addition to administration of sales office routine, duties would include maintaining contact with Canadian mills in promoting sales of paper machines manufactured to designs of Pusey and Jones, and acting as liaison between customer and company's engineering department. Please supply photograph and full details of personal, educational and experience background. File No. 4478-V.

GRADUATE MECHANICAL OR ELECTRICAL ENGINEER required in Montreal to act as sales engineer for manufacturer of industrial commercial and domestic space heating systems. Sales experience not necessary but preferable. Excellent opportunity for young engineer to train for executive position. File No. 4479-V.

SALES POSITION AVAILABLE at Head Office, Hamilton. Machinery tools and supplies of British and Canadian manufacture in metal and woodworking. Salary, overall commission, in exclusive territory including expenses. File No. 4482-V.

SUPERINTENDENT REQUIRED for natural gas department by Western Canadian Power Corporation to assist in setting up a provincial gas utility. Experience in actual operation of collection, transmission and distribution systems, with particular reference to rates and customer acquisition and relations important. Excellent superannuation plan, sick leave with pay and other fringe benefits. Salary $5,000 to $8,000 per year commensurate with experience and responsibility. File No. 4484-V.

SALES ENGINEER WANTED preferably with some experience in structural steel and tank and plate work, for organization located in Montreal. File No. 4488-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

GRADUATE CHEMIST or chemical engineer with thorough grounding in physical chemistry, postgraduate training and relevent experience desirable. Duties to conduct both research and investigation of practical problems in the combustion of gas turbine and jet engine fuels, to assume responsibility in the guidance and supervision of this work. Salary dependent on qualifications and experience. File No. 4410-V.

SALES ENGINEER required to establish an Edmonton Branch Office for a well-known Canadian industrial company handling boiler water treatment, combustion controls and industrial instruments. Applicant should have sound knowledge of chemistry, so as to be capable of being trained in its application to boiler water conditioning and should preferably be acquainted with boiler instruments and controls. Territory to be covered is Alberta, Saskatchewan, and N.W.T. This position will be permanent, and on a salary basis. State sales experience and qualifications. File No. 4442-V.

CIVIL

YOUNG GRADUATE CIVIL ENGINEER for position of transitman on a railway division in P.Q. Commencement salary $306.00. Increases according to service and experience. File No. 4366-V.

GRADUATE CIVIL ENGINEERS required with a minimum of five years experience in the heavy construction industry, some with field experience. Work consists of the following, project liaison, progress scheduling, quantity take-off or requisitioning. Salary ranges from $400.00 to $600.00 per month. File No. 4443-V.

CIVIL ENGINEERS required, field engineers of all types, construction superintendents, assistant superintendents and engineering administrative personnel on all levels. File No. 4443-V.

APPLICATIONS, closing February 21, 1953, are requested for the position of civil engineer. Applicants must be graduate engineers. Application forms for this position may be obtained at the office of the City Engineer, City Hall, Duckworth Street, St. John's, Newfoundland. File No. 4489-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER wanted for Toronto area with experience in commercial and industrial lighting equipment to contact electrical jobbers, architects, consulting engineers. Good salary and commission, plus car allowance and expenses. Excellent opportunity for intelligent and aggressive man. File No. 4415-V.

ELECTRICAL ENGINEER required to act as assistant to the manager of special contract department for manufacturer located in Ontario. Applicants should be only of high calibre and have some commercial or retailing background. File No. 4415-V.

ELECTRICAL ENGINEER required for the design and layout of specialized equipment in a pulp and paper mill. Applicant should have majored in power preferably test course graduate. Desirable experience in test course or short design experience with an electrical manufacturer or period of service as an electrician in an industrial plant or work as a designer in a consultant's office. Salary $325 per month. File No. 4419-V.

SALES AND SERVICE ENGINEERS for large X-Ray equipment manufacturers. Graduate electrical engineers or men with good background in electricity and electronics. Training programme and car provided with good starting salary and advance later to commission arrangement. File No. 4423-V.

TWO ELECTRICAL ENGINEERS required, one a recent graduate interested in designing electrical conductors, the other experienced in plant electrical maintenance. Southern Ontario Town. File No. 4440-V.

ELECTRICAL ENGINEERING graduate for established manufacturer of electrical signalling equipment located in Ontario. Sickness and accident insurance plan, pension plan, five day week, pleasant surroundings. This man should be capable of engineering work involving design and manufacturing problems, engineering correspondence, and preparation of instruction manuals. File No. 4444-V.

ELECTRICAL ENGINEERS with experience in communications and television system engineering required by a large organization in Montreal. Salary commensurate with ability and experience. File No. 4447-V.

RECENT MECHANICAL ENGINEERING graduate required in Toronto. Applicant should have preferably paper mill experience. Salary range $350. per month. File No. 4413-V.

MECHANICAL ENGINEER required by Montreal district office of the civil service commission to supervise the inspecting and testing of armament components. Salaries depend upon qualifications. File No. 4416-V.

MECHANICAL

MECHANICAL ENGINEER required for old established concern in South East Ontario within 70 miles of Toronto. Applicants must be interested in design work as applied to materials handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance profit sharing and pension plan available. Apply stating experience, education and remuneration. File No. 4418-V.

MECHANICAL ENGINEER with some practical shop experience for estimating department by Montreal light sheet metal work plant. Salary commensurate with experience. File No. 4420-V.

MECHANICAL ENGINEER required in Montreal well versed in various types of textile machinery and capable of designing new equipment and remodeling old equipment. File No. 4422-V.

INDUSTRIAL ENGINEER preferably mechanical with 3 or more years of industrial engineering experience in industry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment materials handling, plant layout, and other aspects of factory operation. He will also learn to make time studies to establish production standards for wage incentive installation. The starting salary range is $4,000. to $4,500. There are good opportunities for advancement. File No. 4424-V.

JUNIOR MECHANICAL ENGINEER required by world wide organization with head office in Ontario. Applicants must be under 30 years of age and interested in tool and product design. Those successful will be given extensive training in the overall operation of the company for a period of at least 12 months. Age experience, marital status and salary expected should accompany letters of application. File No. 4426-V.

SALES ENGINEER on machine tools required by well known Canadian manufacturing concern with branches from coast to coast. Preference shown to mechanical engineer 25 to 35 years of age with sales experience and proven ability. Unusual opportunity for man with executive ability. File No. 4426V.

MECHANICAL ENGINEER required by larger organization with head offices in Montreal. Candidates should be recent graduates with approximately two years experience. They should have a knowledge of general mechanical design and installation of plant equipment. Training as project engineer to eventually be responsible for major installations. File No. 4432-V.

MECHANICAL ENGINEER for plant located in Southern Ontario. Candidates

SUPERINTENDENT

Natural Gas Department

AN OPPORTUNITY TO START ON THE GROUND FLOOR

The Saskatchewan Power Corporation, a provincial Crown Corporation distributing electric power to over 600 cities, towns, villages and hamlets in Saskatchewan, requires a Superintendent for its Natural Gas Department to assist in setting up a provincial gas utility. Experience in actual operation of collection, transmission and distribution systems, with particular reference to rates and customer acquisition and relations important.

Excellent Superannuation Plan, sick leave with pay and other fringe benefits. Salary $5,000 to $8,000 per year commensurate with experience and responsibility.

Apply to J. W. Tomlinson, General Manager, Saskatchewan Power Corporation, 1739 Cornwall Street, Regina, Saskatchewan.

MECHANICAL

AND

CIVIL ENGINEERS

Wanted for a large pulp and paper organization located in Quebec City. Applicants should have one to three years experience in pulp and paper mills or allied industries. File No. 4466-V.

should be recent graduates with preferably some manufacturing experience and knowledge of rubber. Initiative and mature judgment are, of course, requisites. Duties would include co-ordination and supervision of engineering details in connection with an expanding programme. File No. 4432-V.

MECHANICAL ENGINEER required for plant engineering department of medium size manufacturer. Duties include design and installation of new equipment, improvement and modification of existing equipment, constructional engineering and project cost estimates. Southern Ontario town. File No. 4440-V.

MECHANICAL ENGINEER required by large organization in Montreal. Duties include supervision of construction and building facilities with general mechanical problems involved. Age range 30 years. File No. 4449-V.

REFRIGERATION ENGINEER required by large manufacturer of home appliances in Montreal to do design and development work on refrigerator units. Applicant should have at least three years experience in domestic refrigerator unit engineering, and be able to carry out the work with a minimum of supervision. Graduate in Mechanical engineering preferred, age 25 to 40 years, salary according to qualifications. File No. 4454-V.

MISCELLANEOUS

SALES ENGINEER REQUIRED by manufacturer of metal working compounds, chemicals for drawing, grinding, derusting, rust prevention, metal rolling, cutting and point stripping. Territory Montreal and district. Salary and profit sharing. Experience required. Our employees have been advised of this advertisement. File No. 4148-V.

CITY IN WESTERN Canada requires an assistant planner. Duties under the planning director and in collaboration with specialist colleagues, to conduct a variety of planning studies and surveys in developing a general plan for the area and to present findings in concise reports appropriately supplemented with maps and statistical data, to perform related design including subdivision and administration as assigned. Graduate in architecture or civil engineering. File No. 4409-V.

SALES ENGINEER (Graduate), required by Montreal district office of nationally-known company. Preferably with general experience in power engineering with utility. Some knowledge of underground cable practice desirable. File No. 4414-V.

SALES ENGINEER bilingual required by leading tank and truck tank manufacturer. Sales office in Montreal and Toronto. Should have at least two years experience on the road. Salary, commission, expenses and good bonus. File No. 4420-V.

ENGINEERS required for military projects and commercial products, in the communications and radar field, to organize and co-ordinate all engineering aspects. Work will include the technical supervision of manufacturing and testing of such electronic equipment. Previous manufacturing experience required. Technical wartime experience a definite asset. Salary to be commensurate with experience. Willing to consider Canadian citizens only or those capable of being cleared for work on defence contracts. File No. 4421-V.

ENGINEER REQUIRED for the electronic design of specific circuits used in communications and radar equipment both for commercial and military applications. Experience required: one to 5 years. Technical wartime experience a definite asset. Salary to be commensurate with experience. Willing to consider Canadian citizens only or those capable of being cleared for work on defence contracts. File No. 4421-V.

ASSISTANT TO COMMISSIONER of works and buildings required by Western School District. General duties will include assessment of buildings to determine repairs, supervision of the repair programme, and responsibility for caretaking and maintenance of schools, all under the direction of the commissioner of works and buildings. Applicants should have preferably training and experience in the maintenance of building, knowledge of mechanical and structural engineering and successful experience in dealing with personnel.

Here is what one of these positions offers you

to the

E. E. or PHYSICIST

with an interest or experience in

RADAR or ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operations.

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to Canadian government agencies and Canadian companies purchasing Hughes equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories in Southern California for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this helpful in your new work.

WHERE YOU WORK

After your period of training—at full pay—you may (1) become the Hughes representative at a Canadian company where our equipment is being installed, or (2) be the Hughes representative at a Canadian military base. Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply

If you are under thirty-five years of age, a Canadian citizen, and if you have an E.E. or Physics degree, write to the Laboratories giving résumé of your experience.

HUGHES

Research and Development Laboratories
Scientific and Engineering Staff
Culver City, Los Angeles County, California, U.S.A.

Civil Service

(Federal)

A Civil Engineer

(Construction)

and

An Electrical Engineer

(Power and Lighting)

At salaries depending upon qualifications of applicants — for the Department of National Defence at Ottawa.

Many years of experience in related fields required.

Details and application forms at your nearest Civil Service Commission Office.

File No. 4477-V.

Salary range $5,250.-$6,250. Letters of application should give full details of education, training, age and include references. File No. 4428-V.

CHIEF ENGINEER with proven record of extensive experience in structural design required by well established organization located in large community about 100 miles from Montreal. Responsibilities will include supervision of drafting department. Good salary offered to right man. File No. 4430-V.

COMPETENT ENGINEERING DRAFTSMEN are required for a newly formed plant engineering group in a large pulp and paper mill in Newfoundland. Excellent opportunity for acquiring all-round engineering experience with good salary under good conditions. Single men preferred. Please submit detail of training and experience, with recent photograph preparatory to an interview during the last week in January, 1953. Employment to start February 1, 1953 or as soon thereafter as possible. File No. 4435-V.

DESIGN AND FIELD ENGINEERS required by a firm of engineers and builders specializing in prestressed and precast concrete throughout Canada. Several years experience in reinforced concrete is required. Position offers salary, participation in company hospitalization and pension plans and eventual bonus. Applicants should give full details including age, education, experience, marital status, salary requirement. Personnel interview will be arranged with selected applicants. File No. 4436-V.

ENGINEERING SALES POSITION available in promotion of original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and North Western Ontario and North Western Quebec. Progressive training for suitable applicant. Mechanical maintenance or mill experience desirable. Submit record of education, experience with reference and photograph. File No. 4437-V.

SALES ENGINEER required to sell rust preventatives, cutting oils and drawing compounds for Canadian manufacturer to large industrial accounts. Chemical or mechanical engineer preferred with some industrial experience, but this is not essential. Guaranteed salary and expenses with profit sharing arrangement. File No. 4439-V.

IRON MINE MANAGER required. Open pit iron mine in production requires competent manager capable of increasing production, improving mill operations and shipments. Reply stating qualifications, record of employment and starting salary. Outstanding opportunity. File No. 4441-V.

DESIGN ENGINEER OR senior mechanical draughtsman required by manufacturer in Ontario of pipe and bolt threading machinery. File No. 4445-V.

APPLICATIONS ARE INVITED for the position of Town Engineer for a rapidly expanding town in Ontario. Present population approximately 3,500. Applicants must have practical experience in the supervision of construction and maintenance of waterworks, sewers, roads and sidewalks. Age, experience, references and salary expected must be included in applications. File No. 4446-V.

SENIOR ESTIMATOR required to join a growing concern that offers excellent opportunity. Applicant should be able to take off quantities accurately and have pricing and general contractor's office routine experience. Salary commensurate with experience and ability. File No. 4448-V.

TWO METALLURGISTS recent graduates, to undergo training in production methods of large organization. Location, short distance from Montreal. File No. 4451-V.

TECHNICAL REPRESENTATIVE required. Applicant must be Canadian by birth or of British origin and familiar with Canada as the result of 5 or 6 years residence with University degree in engineering. Good general engineering experience; experience of diesel engines and/or heavy earth moving desirable but not essential. Age 30 to 35 years. Personality is of great importance. Future prospects in view of the stability of the company are excellent. File No. 4453-V.

INDUSTRIAL ENGINEER required by large container manufacturing firm in Montreal. Applicant should have experience in development overhead and operating labour standards, time study, job evaluation, cost reduction, etc. Personality and ability to deal with people important. This company is expanding in Canada and the opening holds definite future opportunity. Man under 30 preferred. File No. 4455-V.

PETROLEUM ENGINEER for the Saskatchewan petroleum industry. Salary $273.00 to $348.00 per month. A variable cost of living bonus is paid in addition to the above stated basic salary. Current cost of living bonus is $9.60 per month. To perform research work, involving field activities on gas and oil reserves. Require university graduate in a related field such as geologist, petroleum chemical or mechanical engineer. Position will be filled as soon as a suitable applicant is obtained. File No. 4456-V..

TWO SALES ENGINEERS civil or mechanical to sell road machinery in Northern and Eastern Ontario. Preferably married. Age 30 to 35 years. Apply by letter with full particulars as to education, military service, sales experience, etc. File No. 4457-V.

INDUSTRIAL ENGINEER, preferably bilingual, with good knowledge of accounting. File No. 4458-V.

Situations Wanted

GRADUATE MECHANICAL ENGINEER, age 40, 15 years in industry, hydraulics, internal combustion, maintenance, production control, management, now employed looking for opportunities in foreign assignment. File No. 140-W.

CIVIL AND SANITARY ENGINEER, Jr. E.I.C., P.Eng., B.Sc., Queen's 1948, M.A.Sc., Toronto 1949. Age 28, single. Presently employed as municipal engineer with 5 years experience on design and construction of waterworks systems, sewer systems, reinforced concrete structures, road construction and pavements. Have extensive experience in planning and estimating and also on administration. Seeking a more progressive position as design engineer or on construction where opportunity exists to apply past advanced technical training and experience to the job. Prefer to locate in Vancouver, Montreal or Toronto, but not governing if suitable position is offered elsewhere. Available on reasonable notice to present employer. File No. 250-W.

CIVIL ENGINEER, P.E.Q., Queen's 1936, desires spare time design work. Montreal district File No. 1532-W.

PROFESSIONAL ENGINEER, qualifications grade VI. Experience heavy machine shop manufacturing, field erection of machinery and general industrial construction. Available immediately, on full time, part-time or job basis. File No. 2526-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1947 graduate with additional university training in psychology, guidance and counselling; also short factory courses in foremanship, methods and human relations. Age 26, married. Over two years in chemical industry on process development and plant engineering. One summer as temporary assistant engineer on oil refinery expansion. Presently employed as a technical instructor. Available in July. Location preference Western Canada or Ontario. File No. 1014-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., B.A., B.Sc., age 37, married, two children, veteran, R.C.E., bilingual. Experience in concrete and steel design, supervision of construction. Sales ability. Looking for an opening on fee plus percentage basis in the sale of structural steel, reinforcing steel, structural steel products or products related to cement. Location central or eastern preferred. File No. 2140-W.

PROFESSIONAL ENGINEER and land surveyor, M.E.I.C. available. Experience includes steel plant layout and construction, power houses, large office buildings, mine surveying, land surveying with considerable office experience in draughting and estimating. File No. 2153-W.

ENGINEERING REPRESENTATIVE for Canadian territory available. Interested in sales, installation and maintenance in the fields of instrumentation and electronic control equipment. Graduate in electrical engineering from large Canadian university, diversified experience, multilingual. Considerable travel experience. Member of Engineering Institute of Canada, Institute of Radio engineer, age 39, married. Willing to undergo short company training program. File No. 2635-W.

MECHANICAL ENGINEER, M.E.I.C., since graduation from Queen's University in 1936 have had the following experience: 10 years diversified engineering in plants of primary metal producers, embracing instrumentation, design, production, maintenance, and administration; 3 years work in applied and fundamental engineering research; currently employed in petroleum industry on design of refinery utilities, but am

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Position Available

The Research Council of Alberta requires an Industrial Engineer, preferably with mechanical or metallurgical experience, to assist in making industrial surveys, to prepare reports on processes and developments, and to provide liaison between science and industry. Position available immediately. The salary will depend on academic attainments and experience.

Apply with all particulars, recent photo, and addresses for references, to Secretary, Research Council of Alberta, University of Alberta, Edmonton.

interested in capitalizing on previous experience in work at administrative level. File No. 2966-W.

CIVIL ENGINEER, Jr.E.I.C., married, presently employed, with 5 years experience in all types of structural design, field work and sales desires first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to future partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

CIVIL ENGINEER, M.E.I.C., professional engineer, age 48. 10 years experience railway and highway construction, 10 years as sales and service manager large eastern electric, gas and transportation utility. 5 years experience ship construction. Presently employed but available on two weeks notice. Seeking permanent position where technical skill, knowledge of handling men and public relations experience would be of value. File No. 3057-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., (McGill, 1949) B.Sc., 1947, age 25, married. 3 years experience as a structural designer, mostly on bridges. Experienced in re-inforced concrete, steel, and timber design. Desires position with future anywhere in Canada where design experience will be an asset. Presently employed in the Maritimes. Available on approximately one month's notice. File No. 3097-W.

PRODUCTION EXECUTIVE, P.Eng., M.E.I.C., B.A.Sc., age 43, family. Extensive production and manufacturing experience in Canada and United Kingdom in variety of industries in senior management positions. Proven administrator and organizer with outstanding drive and energy. Interested in establishing connection with medium to large sized concern in which ability to organize and produce can be utilized. Montreal area preferred but will locate anywhere depending upon proposition. File No. 3138-W.

MECHANICAL ENGINEER, McGill, 1949, desires position as plant engineer, or assistant plant engineer in any field of manufacturing. Experience consists of two years with pulp and paper industry on design, installation and maintenance, and one and one half years as project engineer on oil refinery construction. Age 26, married. File No. 3219-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 29, married, without children, desires position with advancement possibilities in Montreal area. Would also consider offer leading to future partnership. One year with large paper company on design and construction of electrical installations. Also some experience on instrumentation and control. At present with leading electrical manufacturer as junior project engineer. Available on reasonable notice. File No. 3310-W.

CIVIL ENGINEER, Jr.E.I.C., age 28, married, 1 child, with 5 years varied structural experience with architects, contractors, and concrete and steel fabricators, in design, estimating, detail, field supervision and liaison desires position with responsibility leading to future partnership in progressive concern. Or would consider sales development and/or administrative position with a firm that can offer the right incentive and advancement to an ambitious engineer. File No. 3340-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc., 1949, twenty-four years old, married, two years service with the Canadian Hydrographic Service and 1½ years construction work in Labrador. Position in construction work preferred, but will consider others. File No. 3429-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field, or in instrumentation and control. File No. 3460-W.

CIVIL ENGINEER, M.Eng., Jr.E.I.C., P.Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement. Montreal area preferred. File No. 3466-W.

COMBUSTION ENGINEER and fuel technologist, M.E.I.C., M.Inst. fuel, (Eng.) twenty years experience construction, operation and maintenance coke ovens, manufactured and synthetic gas plants, industrial refractory settings, kilns, furnaces, boiler settings, waste heat recovery units, etc., can assume complete charge for all phases of works from foundations to performance tests and reports. Married, free to travel, locate anywhere. File No. 3505-W.

ELECTRICAL ENGINEER, S.E.I.C., University of Manitoba, 1951, age 32, and a veteran of World War II. Experience as hydro plant operator and plant engineer, also some experience in electrical draughting, design and installations. Desire job pertaining to the field of electrical design and draughting. Would also consider good maintenance position. Western Canada location preferred. File No. 3562-W.

1949 GRADUATE, Jr.E.I.C., P.Eng., desires part-time work in Montreal and vicinity doing design work, drafting, checking, etc. File No. 3699-W.

CIVIL ENGINEER, M.E.I.C., B.Eng., 1942 graduate, age 34, small family. Eight years' experience in plant engineering in pulp and paper industry, experience covers maintenance, construction, plant design. Desires position in Ontario or Western Canada — preferably in pulp and paper industry. File No. 3817-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I. Mech.E., (G.B.) M.E.I.C., P.Eng. 20 years experience in development various types high speed I.C. engines, (carburetor, diesel, petrol-injection, supercharged, etc., from 20-1,000 H.P.) At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. File No. 3863-W.

CHEMICAL ENGINEER, M.E.I.C., M.A.I. Ch.E., P.Eng. (Ont.), (Chem. and Met.) B.A.Sc., (Toronto), M.Sc. (Queen's), wishes responsible position in development work in chemical or allied fields. Four years directing staff of 25-30 in commercial research in inorganic and metallurgical technology (unit operations, ion exchange, solvent extraction, analytical), four years in less responsible positions. Experienced in economic studies and estimating, plant design, statistical techniques and pilot plant operations. Age 31, married. File No. 3994-W.

ELECTRICAL ENGINEER, 27 years of age, veteran, graduate of Manitoba 1950, completed Canadian Westinghouse Test Course. Desires job of technical aspect in Western Ontario or Western Canada. File No. 4021-W.

ELECTRICAL ENGINEER, Jr.E.I.C., (Man. 51), age 32, married, one child. Foreman journeyman electrician on large building construction. Electrical superintendent large water power project. Well experienced in design of wiring for industrial and office building. Three years Radar Officer RCAF. Desirable responsible position with contractor or consulting engineers. File No. 4055-W.

STATISTICAL ENGINEER, university graduate, specialist in mathematical statistics, familiar with sequential analysis (new technique reducing the number of observations required) seeks a job in this capacity. File No. 4065-W.

MECHANICAL ENGINEER, S.E.I.C., U.B.C., 1952, age 22, single, desires position with a firm in Eastern Canada. Interested in design or production of railroad and highway equipment and air conditioning design. File No. 4068-W.

CONSTRUCTION SUPERINTENDENT of an electrothermic zinc plant and chief of maintenance of the same plant; with over 15 years of mechanical engineering and field construction experience in the army and in civilian capacity. Veteran of World War II, British army, British subject. Seeks opportunity along allied lines in Canada. File No. 4069-W.

CIVIL ENGINEER, B.Eng., Nova Scotia Technical College, 1952, S.E.I.C., age 27, married. Seeking employment in Eastern Canada (preferably Maritimes). Some construction experience. File No. 4070-W.

EXECUTIVE AVAILABLE, P.Eng., M.E.I.C., B.A.Sc., age 38, family. Offers direct administration experience at a high level of responsibility in a large chain-retail merchandising operation, combined with teaching experience, university administration, and background of electrical engineering followed up by technical experience in the electronic-instrument field. Present location southern Ontario but willing to move. Interested in management of a medium-sized industry with growth possibilities dependent on capable administration and promotion; or employee relations and personnel administration, production-sales liaison, or cost control in a large organization which also provides opportunity for advancement. File No. 4075-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., McGill 1950, desires part time work in Sherbrooke, P.Q., evening and weekends, detailing concrete reinforcing including bar lists, quantity take-offs also structural steel detailing. File No. 4076-W.

CHEMICAL ENGINEER, 29, B.Sc. (Eng.), 2nd class honours, University of London, England (1952), desires a junior position. Has no industrial experience, willing to learn. Most interested in chemical engineering design work or plant production control. Location Ontario preferred. File No. 4077-W.

MECHANICAL ENGINEER, B.Sc. (M.E.), Jr.E.I.C., P.Eng., 28 years old, two years experience in oil piping, site drainage and plumbing design, also two years general machine shop experience seeks employment in Western Canada in any of the above fields which offer a good opportunity for advancement. Presently employed in Ontario but must move west for reasons of wife's health. File No. 4081-W.

CIVIL ENGINEER, B.Sc., B.A. (Mathematics), M.E.I.C., 36, married. Two years with army (R.C.E. officer). Three years experience in reinforced concrete and structural steel design of factories, schools, hospitals and bridges. Four years in charge of a general design office involving structural, mechanical, heating, ventilating and architectural design; sewer and water services; road construction; preparing estimates, writing specifications, drawing up of contracts and general supervision of construction inspection. File No. 4082-W.

GRADUATE ENGINEER, M.E.I.C., age 55, bilingual, married, residing in Quebec City, seeks additional accounts for technical representation on a reasonable fee basis, would sell strictly on commission or buy on his own. Ex-R.M.C. professor and Quebec Department of Mines Engineer. File No. 4083-W.

ELECTRICAL ENGINEER, U. of Man. 1949, Jr.E.I.C., age 26, married with no children, desires position with Canadian Railroad in mechanical or locomotive maintenance staff. At present employed by Canadian railroad as diesel supervisor. Previously employed by major locomotive manufacturer as service engineer. Thoroughly experienced in all phases of electrical and mechanical maintenance of General Motors, Montreal Locomotive and General Electric diesel electric locomotives. Desires

Rubber Chemist

Progressive manufacturer of rubber footwear has an opening for a rubber chemist experienced in compounding development and process control.

Must have complete knowledge of formulating compounds, factory processing and laboratory control.

Should be able to express himself in French.

Salary commensurate with experience.

File Number 4494-V.

position of responsibility where theory and practical experience will be an asset. Available on approximately one month's notice. File No. 4084-W.

QUALIFIED ENGINEER desires part-time detail or design work in Montreal evenings and week-ends. Experienced in medium and heavy machine design also refinery and boiler house piping layouts. 10 years experience. Satisfaction guaranteed, hourly rates. File No. 4085-W.

CIVIL ENGINEER, S.E.I.C., Manitoba 1952, age 31, 2 children; 6 months in maintenance dept., 5 months as instrumentman, 4 years radar mechanic in R.C.A.F., 19 months training as machinist apprentice. Would like job in design office or with any concern where out of town travel is at a minimum. Any phase of engineering including manufacturing and service work where hard work and competence are rewarded. File No. 4086-W.

ELECTRICAL AND MECHANICAL ENGINEER, Jr.E.I.C., graduate, 4 years in electronics as project engineer on broadcasting installations. Seeking position in industrial research and development. File No. 4087-W.

EXPERIENCED PLANT MANAGER available M.E.I.C., P.Eng., desires a position where administrative ability to organize and manage a plant can be put to full use. A qualified electrical, electronic engineer used to design and manufacture all types of precision equipment, electric motors to radio remote and gyro controlled equipment for ships and aircraft. Experience in building new plant recently, starting up production, labour relations and all phases of plant management and control. Prefer Montreal location, second, Toronto. Married, age 41, perfect health, highest references will prove business ability. File No. 4088-W.

CIVIL ENGINEER, S.E.I.C. (McGill 1952), seeks employment in design of reinforced concrete and steel structures for consultant firm. Location, Montreal preferred but not governing. Sound knowledge of field practices and methods. Presently employed. Available on reasonable notice to present employer. File No. 4089-W.

ENGLISH ENGINEER (33), member of Inst. Mech. Eng., engineering diploma, 14 years experience chemical, civil and mechanical engineering. Emigrating early 1953, seeks appointment as industrial or mechanical engineer; preferably B.C., Ontario or Quebec. Fluent knowledge technical and commercial French and Italian. File No. 4091-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., P.Eng., Grad. I.C.E., Queen's, Northern Ireland 1948, married, aged 28. Experienced in general contracting in Northern Ireland, tunneling and water works engineering in the Far East, and heavy building construction in Canada. Desires work, preferably in connection with hydraulic engineering, anywhere outside Canada. File No. 4097-W.

CHEMICAL ENGINEER, B.Sc., Laval 1953, age 24, married, available at the end of April 1953. File No. 4098-W.

1951 U.B.C. graduate electrical engineer S.E.I.C., requires employment in western Canada preferably. Two years manufacturing experience in carrier telephone, 2 years maintenance and installation of radio communication equipment. 6 months telephone installation, 6 months commercial wiring. Age 30, married. File No. 4100-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., B.E., 1949, M.Sc., 1951, University of Saskatchewan, married, age 25. Experience includes two years conducting research on heat and moisture transfer through building materials, and two years design work on heating, piping, air conditioning, steam plant and paper mill equipment. Desire responsible position in plant engineering, design or development work where initiative is required. Would prefer to be located in small city or town. File No. 4107-W.

POST-GRADUATE CIVIL engineering, McGill student, who is also honours graduate in mathematics, seeks part-time work. Available for full time work from June 1st. File No. 4108-W.

MECHANICAL ENGINEER, Jr.E.I.C., married, age 28. Nearly three years experience in pulp and paper industry. Desires position with control or production department of paper company which will eventually lead to a position of responsibility. File No. 4109-W.

METALLURGICAL PHYSICIST AND physico-chemist, graduate, 16 years experience, married, desires position with initiative and responsibility. Experience consists mainly in the development for technique of procedures, especially in thermo-chemistry and measuring technique. File No. 4110-W.

CIVIL AND STRUCTURAL ENGINEER arriving in Canada April, seeks responsible position. Age 26, B.Sc. (Eng.), A.M.I. Struct.E., graduate I.C.E. Experience includes field survey; site investigation; design of general and reinforced concrete structures, sewerage and sewage dispcsal schemes and water supply; supervision of construction. Presently employed as resident engineer on the construction of new sewerage schemes. Will consider any location in Canada. File No. 4111-V.

CIVIL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.A.Sc., Tor. 1951, M.Sc., Illinois, 1952, age 24, married, one child. Presently employed, one year's experience in soil mechanics. Desires work in structural engineering or with consulting engineer engaged in such or in construction. Available on one month's notice to work anywhere in Canada. File No. 4112-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age 28, married, graduated 1949. Experience includes design, specifications, and field work in ground services, some reinforced concrete design; past 2½ years as resident engineer on multi-million dollar townsite project. Desire responsible position with real opportunity for advancement. Available upon month's notice to present employer. File No. 4119-W.

FIELD ENGINEER, S.E.I.C., 28, married, family. Presently employed as administrative engineer on general building. Studying civil engineering and road design under C.I.S.T. Wishes position with responsibility under contractor or consultant. Future promotion on ability. Administrative abilities proven. 1 year on N.H.A. housing; 2½ years on highway location surveys, draughtsman, instrument, etc.; 2½ years on subway underpinning, instrumentman, yard layouts, assistant project engineer. Familiar with office procedure and field take-offs for quantities. References. Prefer Ontario to start. Working Brockville area now. Available on reasonable notice to present employer. Open for interviews. File No. 4121-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.), 1949 graduate, age 31, married, one child. 4 years varied experience in electronics, inspection of steam and hydro power plant machinery, hydro power plant layout and design. 3 years wartime aviation electronics experience. Desire change of location preferably Ontario or Western Canada. File No. 4124-W.

ELECTRICAL ENGINEER, S.E.I.C., power option, grad. McGill 1952, age 31, married, R.C.A.F. veteran with overseas service, presently employed in Montreal, desirous of improving present position with greater scope of responsibility. Would accept position in industry or sales engineering in Quebec City or Chicoutimi district. File No. 4125-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.A.Sc. (Toronto 1950), master's degree in Business Administration, age 24, single. 2 years' experience in electrical manufacturing company. Desires position in production supervision with medium-sized company anywhere in Canada where recognition is given for ability and initiative. File No. 4126-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A.Sc. (Chemical, Toronto 1946), Dr. Sc.nat. (Swiss Federal Institute of Technology, Zurich 1950). Canadian, married, age 28, abroad last six years, residing in Switzerland, France, Indonesia. Just completed three years with a United Nations Specialized agency in scientific liaison work. Travelled extensively. Desirous of organization and management work—policy formulation, planning and administration, leading to increased responsibility and independent action; definite possibilities for advancement dependent on competence in a situation where initiative, imagination and resourcefulness are assets. An organization with foreign interests would be of most interest. File No. 4129-W.

CIVIL ENGINEER, S.E.I.C., Nova Scotia Technical College, 1953. Age 29, married. Overseas with R.C.A.F. Summer experience includes assistant resident engineer, department of highways. Seeking employment in structural engineering and steel erection. File No. 4130-W.

1951 GRADUATE IN CIVIL ENGINEERING National University of Ireland, with one year's experience as designer with consultant and at present engaged on construction with railway company, desires employment with consulting engineers in Montreal or Toronto. File No. 4131-W.

ELECTRICAL ENGINEER, M.E.I.C., age 43, married, no children, desires responsible position, 17 years experience in design and construction of electrical lighting and power installation, and electric hydro and thermo electric power stations. At present with leading consulting engineering firm. Available on reasonable notice to present employer. File No. 4132-W.

News of the Branches

Activities of the Forty-one Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. Lusk, Jr.E.I.C.,
Secretary-Treasurer

December Meeting

The Belleville Branch held its regular monthly meeting at the Masonic Temple on December 8 with 54 members and guests present.

G. A. Bradford, chairman of the Branch, presided. Mr. Bradford advised the meeting that the chairman, secretary-treasurer, and H. T. Floyd visited the Peterborough Branch in October on the occasion of the President's visit to that Branch. Mr. Bradford also advised that the committee for the Junior Engineers' Training Course had issued a general invitation to the Branch membership to attend its meeting on February 2, when the subject of International Affairs would be presented by members of the Staff College at Kingston.

E. L. Littlejohn introduced the guests of the evening. After the chairman welcomed these guests, he called upon S. Sillitoe to introduce the guest speakers, H. C. Rickaby, deputy minister of mines, and Dr. M. E. Hurst, provincial geologist. After their most interesting addresses, A. O. Drysdale expressed the appreciation of the Branch.

January Meeting

At the regular monthly meeting at the Masonic Temple on January 12, 36 members and guests were present.

G. A. Bradford, chairman of the Branch, presided. Mr. Bradford explained that the program for this meeting had been scheduled for February. However, as it had been impossible to complete the original arrangements for January, the program had been changed accordingly.

The chairman also advised the members that the Committee of junior members had issued a general invitation to the Branch members to attend its meeting on February 2, when a talk on International Affairs would be presented by a member of the Staff College at Kingston.

Mr. Bradford then introduced the two speakers of the evening, A. O. Drysdale, M.E.I.C., and J. C. R. Punchard, M.E.I.C. Both Mr. Drysdale and Mr. Punchard are members of the Branch and presented papers on the activities carried out by their respective companies, and Canada Cement Co. Ltd. and the Northern Electric Co. Ltd.

Mr. Drysdale's paper dealt with three phases of the manufacture of cement in general and at the Canada Cement Co. Plant No. 5 at Belleville. This plant has an annual production capacity of 4,000,000 barrels which makes it the second largest cement plant in Canada accounting for 23 per cent of Canada Cement's total production.

The raw products used in the manufacture of cement are limestone and clay, obtained near the plant, gypsum shipped from Nova Scotia, and Pennsylvania coal shipped across the lake from New York State. During this year this plant will quarry 900,000 tons of limestone, use 300,000 tons of clay and burn 160,000 tons of coal. The power load at the plant approximates 10,000 kilowatts, about equal to that of the City of Belleville.

Three types of cement are produced at this plant, namely normal portland cement, air entraining portland cement and masonry cement.

The manufacture of cement can be simplified by saying that the quarried limestone is crushed, screened and pulverized with the addition of clay and water forming a fluid slurry which is pumped to the kiln for burning. The product after burning is pulverized with a small percentage of gypsum to form portland cement.

Mr. Drysdale presented a film entitled "The Drama of Portland Cement". This film depicted the manufacture and uses of cement in a most interesting and entertaining manner.

J. C. R. Punchard in his address briefly outlined the organization and products of the Northern Electric Co. Ltd. with special reference to some of its activities at Belleville.

Throughout Canada the Northern Electric Co. has approximately 11,000 employees with 900 located in Belleville. The manufacture of high fidelity sound systems, the excellent quality of which is recognized throughout the continent is carried out at Belleville.

Mr. Punchard also showed slides and described in some detail the design and installation of the C.B.C.'s 50,000 watt transmitter, C.B.L., at Hornby near Toronto. The installation was made by the Northern Electric Co. The problems which were encountered when the C.B.C. wished to install a second 50,000 watt transmitter to use the same antenna at Hornby were also described by Mr. Punchard. The filter circuits which were designed are unique in the radio industry.

At the conclusion of the meeting the appreciation of the Branch was expressed by C. R. Whittemore to the speakers.

Calgary

C. E. McNevin, M.E.I.C.,
Secretary-Treasurer
J. W. Thomas, M.E.I.C.,
Branch News Editor

December Meeting

A regular branch meeting was held at the Palliser Hotel, December 4, 1952. The guest speaker of the evening was G. E. Mayne, general superintendent, Alberta District, Canadian Pacific Railway. He gave a very interesting and enlightening discussion on the background of the dieselization of the Canadian Pacific Railroad.

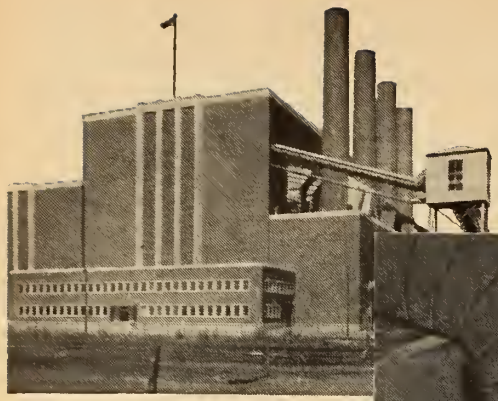
He outlined the development and trials carried out before diesel-electric type locomotives were accepted. The trials were carried out on Vancouver Island so as not to interrupt any mainline operations and their results were far more beneficial than had originally been expected.

With these results, the railroad then decided to forego any glamorization of its trains and apply dieselization to the areas where the most benefit could be obtained both economically and efficiently. A great deal of planning was necessary in establishing maintenance depots, stores handling and servicing. The diesel electric locomotive has an operating range of 400 miles without service, compared to the steam locomotive's 70 miles.

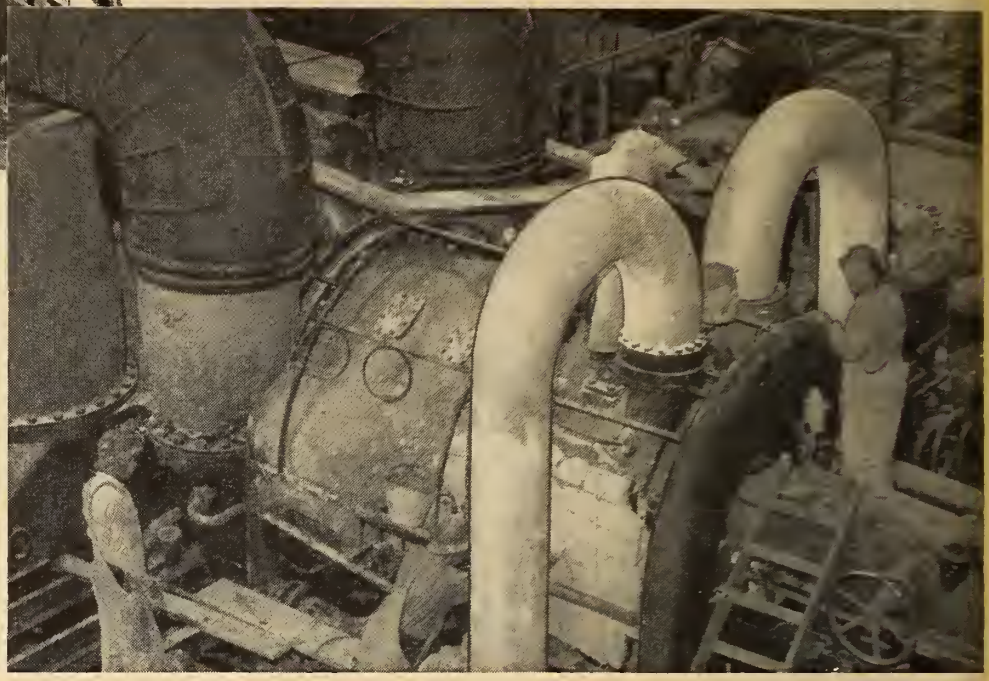
There are four sizes of diesel locomotives in service; approximately 800 hp., 1000 hp., 1600 hp. and 2200 hp., each having its specific job to do.

As this was an Alberta group, he enlarged on the utilization of diesel power on the Calgary to Revelstoke run, giving some very significant comparisons on the operation of steam versus diesel electric. The talk was completed with a very scenic colour picture of our own Canadian Rockies which had the odd diesel electric powered passenger train passing through it.

After a very intense question period, the speaker was thanked by Mr. T. D. Stanley, Branch chairman, and the meeting adjourned.



To effectively reduce heat losses . . .



(ABOVE) View of the recently completed Richard L. Hearn Steam Generating Station, part of Ontario Hydro's multi-million-dollar expansion program.

(RIGHT) Close-up of workmen applying J-M 85% Magnesia and Superex Combination Insulation to the pipes and casing of a giant turbine-generator.

Johns-Manville 85% Magnesia Insulation was used in Ontario Hydro's new steam generating station

• For temperatures up to 600° F., rugged J-M 85% Magnesia Insulation will not distort regardless of length of time it stays in service. It is bonded with asbestos fibers, fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600° F., J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900° F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem . . . remember that Johns-Manville is "Insulation Headquarters." Consult your nearby J-M Insulation Contractor . . . or write direct to Canadian Johns-Manville, Dept. 3305, 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

*Trade Mark Reg'd.

SKILLED APPLICATORS, trained in Johns-Manville methods and well aware of the high installation standards set by J-M, applying J-M 85% Magnesia to pipelines. Located in key cities throughout Canada, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as quality products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

1-791

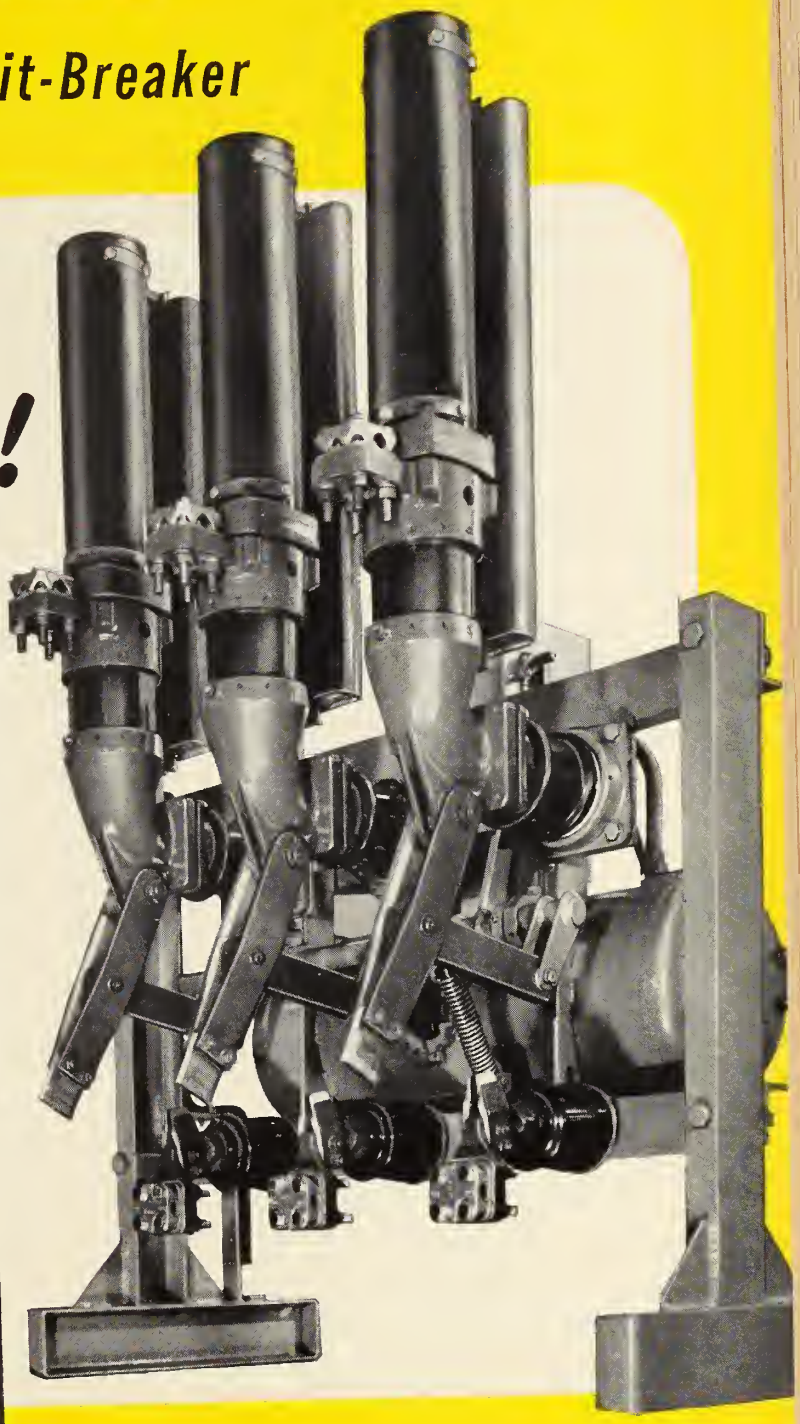
Johns-Manville FIRST IN INSULATION

MATERIALS • ENGINEERING • APPLICATION

BROWN BOVERI

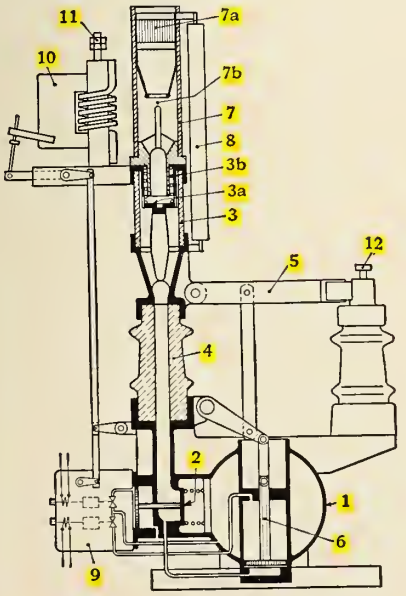
Air-blast

High-Speed Indoor Circuit-Breaker



built to be 12 ways better!

1. Compressed air receiver
2. Main valve
3. Arc extinguishing chamber
   - 3a. Extinguishing contact spring
   - 3b. Compression spring
4. Hollow insulator
5. Isolating contact
6. Isolator operating machanism
7. Exhaust cooler
   - 7a. Damping baffles
   - 7b. Spark for switching resistor 8
8. Damping resistor
9. Control unit
10. Built-on relay
11. Line terminal
12. Load terminal



Here's how it's Built

and...

...here's how it's BETTER!

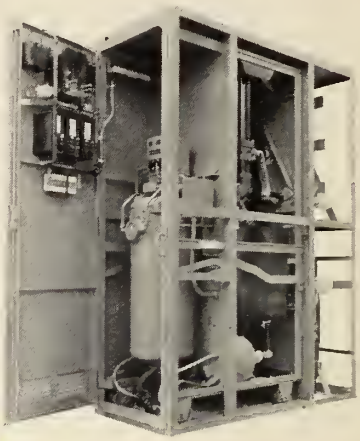
1. Explosion, sooting, and fire hazard free
2. Clean in operation
3. Has short switching times
4. Operates with maximum mechanical safety due to greater number of mechanical switching operations which can be executed.
5. Easy and quick to overhaul
6. Gives trouble-free operation under low and high temperature conditions
7. Doesn't cause dangerous over-voltages — maximum electrical reliability obtained
8. Individual parts do not oscillate or rebound. Main valve and isolating contacts are pneumatically damped.
9. Employs spring-loaded power storage devices for "positive" transmission of all short control orders
10. Equally suitable for frequent or infrequent switching
11. When equipped with additional air receiver, Brown Boveri's Air-blast High-speed Circuit Breaker, Type DB, is the most suitable type for high-speed reclosing. High-speed reclosing, as an effective means of dealing with faults, is of special importance for the protection of medium-voltage networks — eliminating as much as three-quarters of all faults. The entire equipment for this feature can be located in a relay box

Type DB circuit-breakers can be supplied in:—

Voltage Ratings — 10, 20, 30, 45, and 60 kV
Current Ratings — 1000, 1500, 2500, and 4000 amps
Interrupting Capacity — 200, 400, 600, 1000, 1500, and 2000 MVA

You are invited to discuss your circuit breaker requirements with Brown Boveri specialists. Type DB is made in Canada and available for immediate delivery.

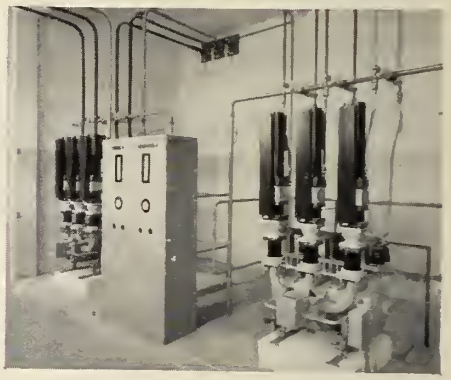
Adaptable to conditions on site: floor or wall mounting, with mounting plate or truck, or enclosed cubicle. Illustrated are two typical installations:—



STEEL CUBICLE:

This draw-out type steel-enclosed panel for Type DB is particularly suited to new installations. A real space saver, this unit can be installed rapidly and with low cost.

12



FLOOR MOUNTING:

Suitable in the event of modernization as was the case in the above power station. Built before the first world war its oil circuit breakers were replaced recently by the modern air-blast circuit breakers, Type DB

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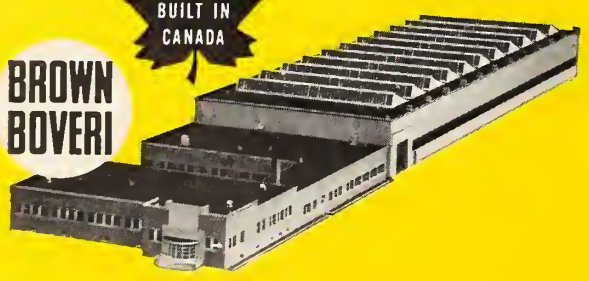

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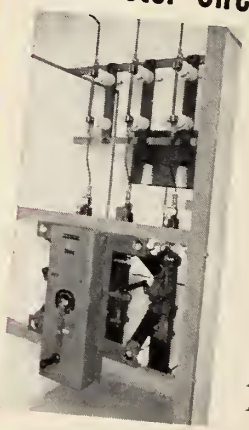
Convector Circuit-breaker • TYPE S



A low-oil-content high-speed circuit breaker of exceptional simplicity and reliability. Particularly suitable for small distribution stations in local or industrial systems, where only a small number of circuit-breakers are required and the cost of the air-blast type is too high, because of the need for a compressed-air plant.

Rated Voltage:
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Rated Current: 600 amps.
Interrupting Capacity:
75, 150, 250, 400 MVA

CB 1-3

Central British Columbia

H. L. Topham, Jr.E.I.C.,
Secretary-Treasurer

resident Stirling Visits Kamloops

A dinner meeting of engineers and heir wives and friends was held in honour of the visit of the president of the Engineering Institute, Dr. J. B. Stirling, nd Mrs. Stirling. Mr. and Mrs. Jubien f the Montreal Branch were also present. Chairman H. Hatfield was in the hair.

There were 52 persons in attendance.

Mimeographed copies of the branch annual report were distributed by the secretary-treasurer to all members and uniors present at the meeting.

Mr. Hatfield explained the postponement of any discussion of the annual report until the next meeting, scheduled to be held in January, so that more time would be available for the president's address.

Mr. McCallum and Mr. Ramsay were scrutineers for the election, which resulted in the following Branch executive: chairman, R. Bigg, by acclamation; vice-chairman, M. Zirul, by acclamation; committeemen, F. Dembiske, F. Joplin and A. Kerr.

Dr. Stirling was introduced by the chairman. President Stirling, in his address, told of his activities in the Institute since June, and of the tremendous travelling schedule which must be undertaken to visit all the branches from coast to coast. He stressed the necessity for Engineers to enter public service for the future welfare of our country.

Mr. Wade very appropriately expressed the appreciation of the meeting for the president's excellent address.

The presidential party left for Vancouver by C.P.R. at 11.30 p.m.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.,
Branch News Editor

Annual Meeting

The annual meeting and election of officers of the Hamilton Branch took place Thursday, January 15. E. T. W. Bailey, who had taken over the chairmanship from W. L. Hutchison when the latter was stationed overseas by his firm in mid-term, turned over the gavel to Mr. W. A. Dawson, the chairman for 1953. Balance of the executive, either elected or continuing in office, included W. A. Wheten, vice-chairman; J. A. Reid, secretary-treasurer; D. J. Hains, F. E. Milne, W. S. Macnamara, and J. H. Mitchell, executive committee.

The feature of the evening was an address on Canada's vast and far-flung paper industry from a man well qualified to discuss it: Mr. R. J. Askin, M.E.I.C., vice-president of the Abitibi Power and Paper Company, whose talk was well supported by a colour film, "Wealth of the Nation".

The meeting also had opportunity to express its congratulations to Mr. Fred J. Veale, a Branch member, who enjoys the well-earned distinction of having been selected Hamilton's Citizen of the Year by the Advertising and Sales Club of this city.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

D. R. Graham, Jr.E.I.C.,
Assistant Secretary

Buffet Supper, January

The monthly meeting of the Kingston Branch was held on January 21, at the LaSalle Hotel. The meeting took the form of a buffet supper.

The speaker for the evening was Professor A. V. Corlett of Queen's University, who spoke on a recent trip through Canada's oil fields and iron ore developments. Professor Corlett graphically showed how our oil and ore production and demand has increased over the first half of the century, and what probable future demands and production might be anticipated. He illustrated his talk with slides that he had taken of the Western Oil Fields and of the Steep Rock, Labrador, and Belle Isle iron ore developments.

After Professor Corlett's very interesting talk, a discussion was held regarding the relationship between the E.I.C. and the Ontario Association of Professional Engineers. A motion was passed that our councillor should write a letter to the Ontario Council of the E.I.C. proposing that a mutual agreement be drawn up between the Professional Engineers and the E.I.C., similar to ones that are in force in other provinces.

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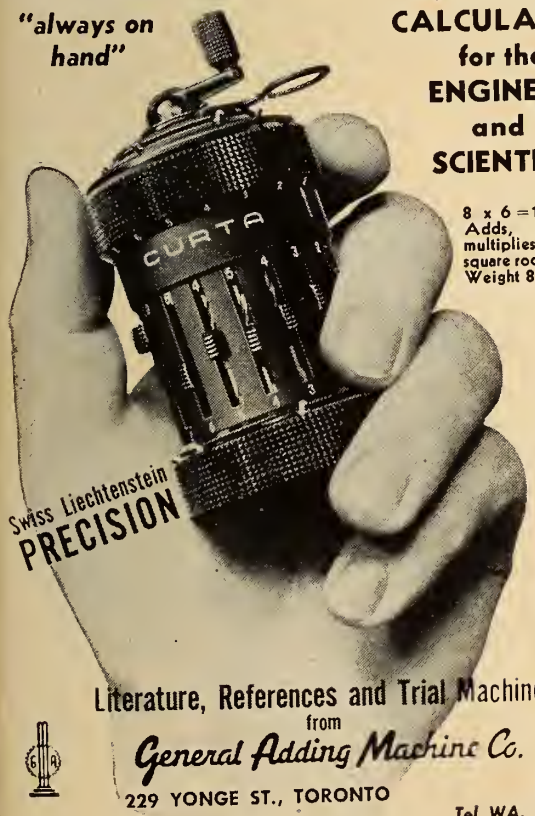

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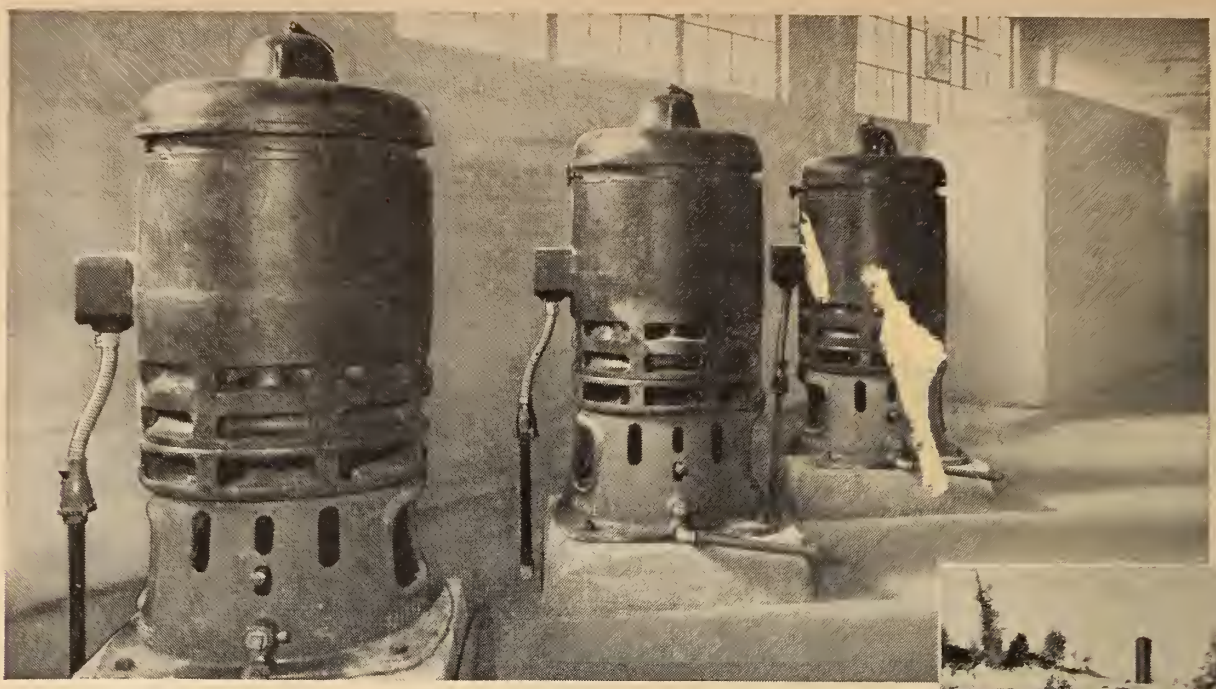

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AT WORK AT ELK FALLS

Located in the pump house on the Campbell River approximately 3¼ miles away from the mill site, three two-stage Fairbanks-Morse vertical Pomona pumps supply all of the water required in the production of pulp and paper at the Elk Falls plant in British Columbia. Each pump is complete with a 250 HP 1750 RPM Fairbanks-Morse Vertical hollow shaft motor and has a capacity of 4,000 GPM against a total operating head of 200′.

Two pumps are in operation all the time with the third unit as a standby. The pumps discharge into a common header which in turn delivers the water through 3¼ miles of 36″ Wood Stave Pipe to an elevated storage tank of 355,000 Gallons capacity. And in addition to the storage tank for mill use, the same pumps deliver water to a storage tank of 112,000 Gallons capacity, used for fire protection.

Indicative of the vital and important function which this pumping equipment performs in keeping the mill in operation, is the fact that the combined hourly pumping capacity of the two units on the line is 480,000 Gallons and the storage capacity of 355,000 Gallons is only sufficient to run the mill for approximately forty minutes.

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Annual Business Meeting and Smoker, Kingston Branch

Through the kind permission of Colonel Jones the meeting was held in the Officers' Mess of the R.C.E.M.E., Barriefield on December 10, 1952. Professor J. S. Campbell was in the chair. The Branch's financial statement was read by Secretary H. D. Forbes.

After the business meeting the group was shown the International Nickel Company of Canada's sound and colour film entitled "Corrosion in Action".

The film was outstanding in regard to both its colour photography and its technical content. The film explains such factors as the electro-chemical theory, galvanic action, and passivity with amazing clarity, using animation and stop motion photography.

A short history of the development of the electro-chemical theory of corrosion and the contributions made to it by certain investigators during the past 125 years was presented. The basic reactivity of metals was explained with reference to the standard electromotive series in relation to the importance of potentials, polarization, current density, and area effects. The film was concluded with a discussion of passivity and protective films. The passivation of iron by exposure to concentrated nitric acid was demonstrated by bench experiments. These also show the frailty of this kind of passivity in comparison to the more stable passivity shown by stainless alloys containing chromium and nickel.

Dr. H. P. Godard of Aluminium Laboratories Limited answered any questions that came up regarding corrosion.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

Wm. J. Ray, Jr.E.I.C.,
Branch News Editor

December Meeting

The Lethbridge Branch of the Institute held its third dinner meeting of the season on December 13 in the Marquis Hotel banquet hall. Thirty-five members, affiliates and guests were present, and chairman J. C. Neufeld presided over the meeting.

P. M. Sauder gave a comprehensive summary of the more important decisions reached at the council meeting.

A program of Community singing under the leadership of E. A. "Ted" Lawrence was enjoyed by all. Guest artist Wm. Gordon sang two very fine solo numbers. He was accompanied by Mr. Jack Stead.

The guest speaker M. S. Mitchell, M.E.I.C., of the local architectural firm of Meech Mitchell and Associates, was introduced by A. G. Donaldson. Mr. Mitchell titled his address "Structural Form, Past and Present".

The speaker started his talk with a discussion of structural forms found through the ages in nature. Such things as spider webs, sea life, dead trees either upright as columns, or spanning gaps as beams, are all examples of nature's structural form. Other examples are the structural arch found in badlands, and jungle vines acting as catinaries. However, the materials forming nature's structures are mostly wood and masonry. The same was true of the first structures erected by man.

During the Roman Era the structural arch became more prominent. Stone masonry was used exclusively, since there was no method of joining wood. The architects of that day were master builders as well as designers.

During the 18th century the structural arch was still the predominant means of carrying loads, the only difference being that an attempt was made to conceal, or mask, the arches supporting the structures.

The Social Revolution brought an upsurge of education and hence more knowledge and study of structure and design. Designers began to analyse the materials of construction and to look for new materials to use. These factors brought about radical changes in structures. Relatively small beams of steel or reinforced concrete span great distances. Laminated timber beams and arches are now fabricated by means of new electronically dried glues. Flat roofs and walls of glass are commonplace in building construction. Sphere and dome structures, offshoots of the arch, are becoming more prominent.

Mr. Mitchell then went on to describe the present and future trends in building design. Architects are endeavouring to create buildings which would possess startling new beauty through their structural form. He noted that nature did not conceal structural form, but used it in a fully revealed form to create beauty. The main problem now facing architects and structural

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23-2

engineers is that of educating the public to appreciate this revolutionary form of structure. Owners, building codes, and municipal commissions still place outdated restrictions on designers. However, despite these obstacles the new type of structure is almost certain to predominate in the near future.

Mr. Mitchell concluded his talk by showing a series of slides on many of the world's outstanding structures.

E. A. Lawrence thanked Mr. Mitchell for his interesting and informative address.

London

R. G. Newall, Jr.E.I.C.,
Secretary-Treasurer

I. D. Patterson, M.E.I.C.,
Branch News Editor

November Meeting

The regular November meeting was held at Wolseley Barracks Reserve Force Officers' Mess on Tuesday, November 4. The Branch was very fortunate in securing for their speaker Mr. Bob Corbett of Minnesota Mining & Manufacturing Co. Ltd. Mr. Corbett spoke briefly on the various new types of electrical insulating tapes which M.M.M. is now marketing and demonstrated the great time-saving which can be effected by using them. He also spoke on their new pipe line coverings which provide most excellent corrosion protection for underground pipe lines.

I. D. Patterson, thanked Mr. Corbett for the thirty-five members who were present.

President's Visit

The annual president's visit took the form of a dinner-dance on October 21. President Stirling, who was introduced by Past-President Jim Vance, outlined his visits to branches of the Institute across Canada. He also said that Canadian engineers are doing a job and gaining recognition, and warned student engineers to forget that awful security complex.

He went further to say that at a recent reunion of his own classmates in Kingston, only 50 per cent of them were actively engaged in engineering, and neither group was happier than the other.

Chairman D. D. C. McGeachy conducted the very successful meeting, and Mr. R. Allison thanked Dr. Stirling for his inspiring address.

A dance followed the business session. Approximately fifty members and their wives were present.

Mr. Erle Steiss is Speaker

The October meeting of the London Branch was held at Wolseley Barracks Reserve Force Officers' Mess on Wednesday, October 8. The Branch was most fortunate in securing as their guest speaker Erle Steiss, manager, investment department of the Canada Trust Company.

Mr. Steiss said that the old methods of forecasting business outlook based on the natural laws of supply and demand no longer applied due to direct and indirect government influence; that a new formula for forecasting has not yet been discovered; that rather than trying to discover one, he would explain some of the simple and fundamental truths and facts of our Canadian economy and let the individual judge for himself what the future held.

Some of the major influences on the trend of our economy mentioned were consumer spending, capital investment expenditures, government expenditures, organized labour policies, government "full" employment policies, export markets, and productivity.

Mr. Steiss noted that Canada is becoming increasingly dependent on the U.S.A. for export; that in 1951 we had a trade deficit of $524,000,000, but that the trade deficits have been more than offset by the inflow of $1,600,000,000 of foreign capital in the last two years.

Mr. Steiss was thanked by Mr. George Humphries and the meeting was adjourned.

Nipissing and Upper Ottawa

D. K. Campbell, Jr.E.I.C.,
Secretary-Treasurer

Stewart Bramah, Jr.E.I.C.,
Branch News Editor

Dinner Meeting

For the dinner meeting held on January 7 at the Marine Room in North Bay, the guest speaker of the evening was Mr. John F. Hayward, sales engineer of C.G.E. in Toronto, who spoke on "Deaeration and Dealkalization of Boiler Feeder Water".

The meeting was ably directed by the Chairman, G. L. Hood, of North Bay. The speaker was introduced by Mr. John Hayes, of New Liskeard, and thanked by Mr. J. Rose, Temiskaming.

Mr. A. K. Grimmer read a precis of the discussion that took place at the council meeting of the E.I.C. in Temiskaming on November 8, 1952.

Mr. K. Campbell read the minutes of the previous meeting and they were approved as read.

Fourteen members from Temiskaming braved the bitter cold to attend the meeting. Fourteen members from North Bay and three visitors were also in attendance.

Col. L. F. Grant, field secretary of the E.I.C. was scheduled to be guest speaker at the meeting to be held in February in Temiskaming.

Ottawa

M. L. Narraway, Jr.E.I.C.,
Secretary-Treasurer

Junior Section

Gordon Bird, Jr.E.I.C.,
Chairman

Annual Meeting

The annual meeting of the Junior Section of the Ottawa Branch took place on January 20, 1953, in the Officers' Mess of the Royal Canadian Electrical and Mechanical Engineers.

The meeting was presided over by M. L. Narraway, retiring chairman and reports were read by Peter Tansy, secretary-treasurer, and Carl Crawford, proceedings committee.

The scrutineers for the elections were Tom Tomson, Peter Strutynski and Moe Anderson. The new executive elected at the meeting is as follows: Chairman, Gordon Bird; vice-chairman, Peter Tansy; Committee, Herb Gladdish, A. H. Graves, Don S. Cummings, Arthur J. Shama, and Carl Crawford.

At the conclusion of the business meeting, Lt. Don Alexander of the R.C.E.M.E. gave a talk on the opportunities for engineers in the Army. The "Grey Cup Film" in technicolour was shown, through the courtesy of Bradings Brewery, with a special commentary.

Saskatchewan

Reginald Bing-Wo, M.E.I.C.,
Secretary-Treasurer

Saskatoon Section

J. A. Wedgwood, M.E.I.C.,
Secretary-Treasurer

The Saskatoon sections of the Engineering Institute and the Association of Professional Engineers of Saskatchewan are now presenting a course in professional development. The course of nine weekly meetings commenced on January 13, with registration at $5.00 for members, and $2.50 for student members.

Meetings consist of a 60-minute lecture, a 10-minute break, and a 50-minute discussion period. The special projects committee is composed of J. B. Mantle, chairman, S. J. Hartridge and A. S. Ringheim. Allan Tubby is the local chairman, and J. A. Wedgwood the secretary.

The program of meetings is as follows:

Jan. 13, Public Speaking for Engineers, Dr. D. L. Gibson, Department of Dairying, University of Sask.

Jan. 20, Cost Estimating, Mr. Verne E. Thierman, superintendent, Wells Construction Co.

Jan. 27, Contracts and Agreements, Mr. Arthur Moxon, Q.C., Moxon, Schmitt & Estey.

Feb. 3, Labour Relations, Mr. R. W. Allen, personnel manager, Saskatchewan Federated Co-operatives, Limited.

Feb. 10, Office Organization and Equipment, Mr. Charles Hazen, Hazen-Twiss Limited.

Feb. 17, Managerial Controls, Mr. Herb. C. Pinder, Pinder's Drug Stores.

Feb. 24, Engineering Salesmanship, Mr. M. A. Montgomery, sales manager, Canadian Blower & Forge Company, Kitchener, Ontario.

Mar. 3, Professional Status, Dr. Neil B. Hutcheon, Department of Mechanical Engineering, University of Sask.

Mar. 10, Mixed dinner meeting, Interior Decorating, Mr. Harry Day, J. O. Day Limited.

Sudbury

G. W. Fleming, Jr.E.I.C.,
Secretary-Treasurer

H. M. Whittles, Jr.E.I.C.,
Branch News Editor

Dinner Meeting

The Sudbury Branch held a dinner meeting at the Sudbury Granite Club on Thursday, January 8, with Mr. R. J. Berkol, sales development engineer for the Atlas Steel Company, as guest speaker.

Mr. Berkol, who graduated in chemical engineering from John Hopkins University, was with the American Smelting and Refining Co. and the Armco Steel Corporation prior to joining Atlas Steel Co.

After the dinner and general business meeting Mr. Berkol, who was introduced by Mr. Frank Orange, showed a most interesting coloured film which outlined the steel processing industry and many of its various applications.

The film was followed by a very informative address on "The Application of Stainless Steel to Modern Industry". Mr. Berkol praised the present and future industrial potential of Canada,

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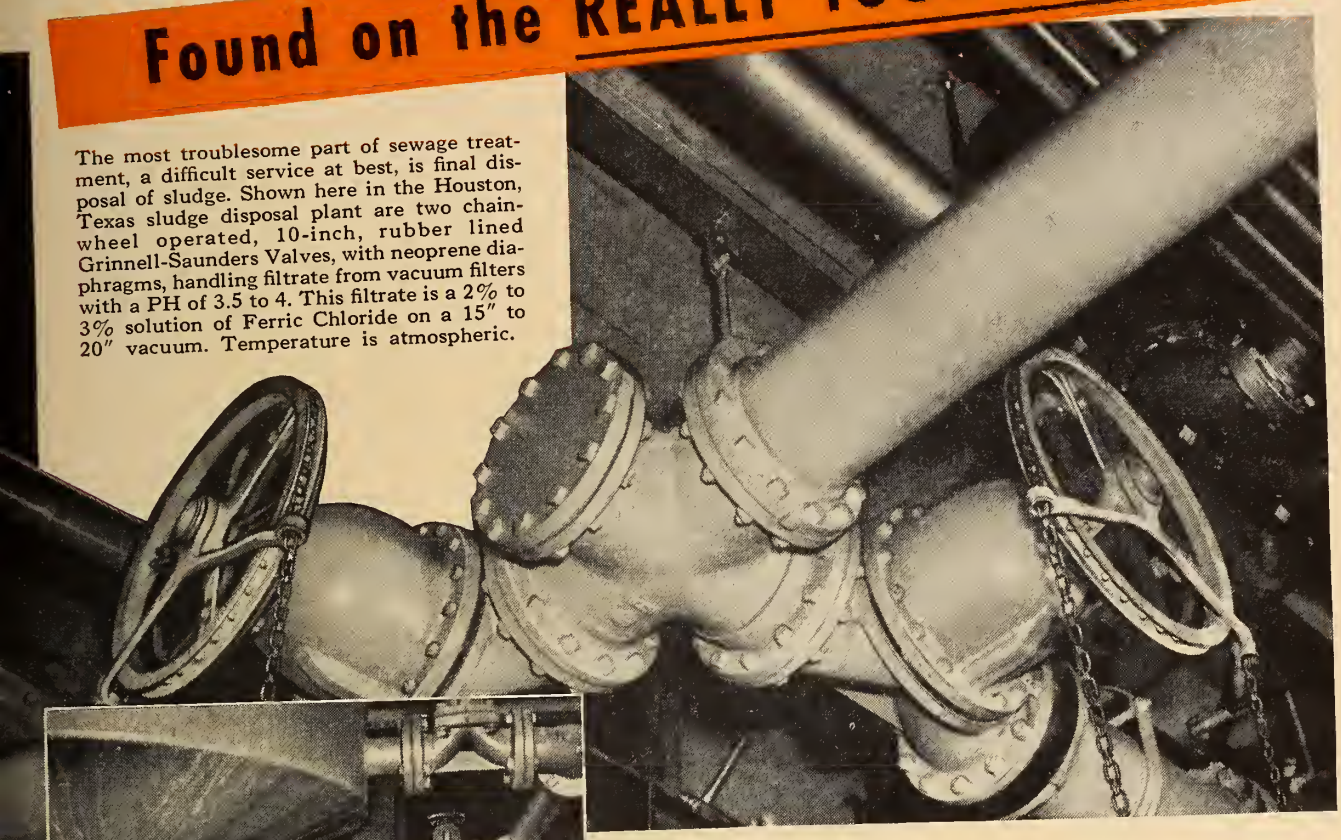
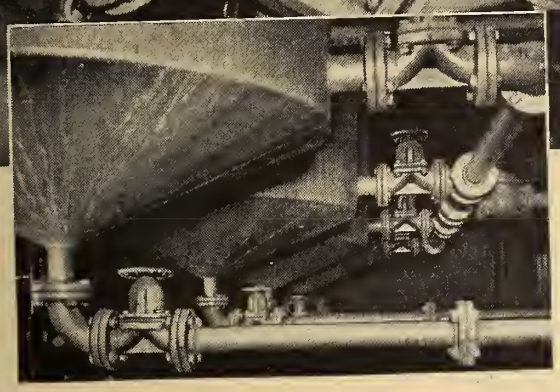
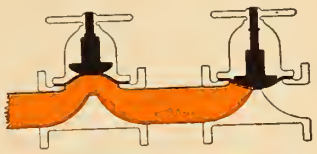




◀ In same plant. Eight 3-inch rubber lined Grinnell-Saunders Diaphragm Valves, handling 8% to 10% Ferric Chloride, at atmospheric temperature



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Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate fluids.

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which he considers outstanding when compared with almost all other countries. The speaker said that the stainless steel industry, which had its beginning during World War I, was introduced to Canada in 1929. It has expanded rapidly until today Canada has an annual per capita consumption of 2½ pounds. The development of stainless steel alloys has had a highly beneficial effect on the Sudbury district because of the large percentage of nickel which these alloys contain as a necessary component. Today stainless steels have over 100,000 uses in such industrial fields as pulp and paper, chemicals, aircraft and automobile, household fixtures and utensils, surgical instruments, canning, food processing, dairying and other miscellaneous fields.

During the discussion period which followed his address Mr. Berkol answered a wide range of questions pertaining to his topic.

E. R. Eaton thanked the speaker for a most interesting and informative film and address on a topic which is, and will be, so important to Canada in future years.

Toronto

HARVEY M. KOLESAR, JR.E.I.C.,
Secretary-Treasurer

The Professional Development Course, now in progress under the sponsorship of the Toronto Branch is a series of 30 interesting lectures.

Oct. 2, Registration and Introductory Lecture, Lt.-Col. L. F. Grant, Chairman of The Engineers' Council for Professional Development and Field Secretary of The Engineering Institute of Canada.

Oct. 7 and Oct. 9, Public Speaking, Mrs. W. D. Tucker, University of Toronto.

Oct. 14, The Economic Climate, W. F. Lougheed, chief economist, Canadian Bank of Commerce.

Oct. 16, Business Letter Writing, R. C. Charles, Ryerson Institute of Technology.

Oct. 21, Canada—What Ails Us, J. W. Johnston, Financial Post.

Oct. 28, Labour Relations (from Labour's Point of View), C. H. Millard, national director, United Steelworkers of America.

Oct. 30, Labour Relations (from Management's Point of View), K. Hallsworth, executive assistant, Industrial Relations Division, Ford Motor Co. of Can. Ltd.

Nov. 6, Labour Relations (from Public's Point of View), V. W. Bladen, director, Institute of Business Administration, University of Toronto.

Nov. 13, Responsibilities of Citizenship, Donald Fleming, Q.C., M.P.

Nov. 25, Marketing (including Public Relations), C. A. Morrison, vice-president in charge of marketing service division, Can. Gen. Elec. Co. Ltd.

Nov. 27, Preparation of Engineering Reports, E. L. Pugsley, supervisor of plant accounting, Bell Telephone Co.

Dec. 2, Professional Development of the Engineer, G. Ross Lord, University of Toronto.

Dec. 9, Your Rights Under the Law, Alderman F. J. Cornish.

Jan. 13, Public Speaking (Parliamentary Procedure), Mrs. W. D. Tucker, University of Toronto.

Jan. 14, Toronto Branch E.I.C. Annual Meeting, Northgate Hotel.

Jan. 15, International Situation (especially as it affects Canada), Major E. T. Salmon, Department of Classics, McMaster University.

Jan. 22, Industrial Management, J. W. Seymour, resident manager, Urwick, Orr, and Partners Ltd.

Jan. 27, Industrial Management, L. J. Powell, manager, organization research, Mfg. Eng. & Relations Services Div., Can. Gen. Elec. Co.

Jan. 29, Real Estate, J. V. Laffey, res. sales manager, W. H. Bosley & Co.

Feb. 3, General Accounting Principles (Setting up a Balance Sheet), J. R. Barker, Millar, Macdonald and Downie.

Feb. 10, Corporate Finance, Colonel M. C. G. Meighen, Canadian General Securities Ltd.

Feb. 12, Personal Investment Policies, Colonel M. C. G. Meighen, Canadian General Securities Ltd.

Feb. 17, Personal Investment Policies, George C. Armstrong, Canadian Business Service.

Feb. 24, Public Ownership vs. Private Enterprise, J. W. Johnston, Financial Post.

Feb. 26, Visit to the Lighting Institute, Canadian General Electric Co. Ltd., Toronto.

Mar. 3, to be announced.

Mar. 10, Engineering Reports, L. L. Youell, M.E.I.C. vice-president, Stone and Webster.

Mar. 12, The Engineer and Society,

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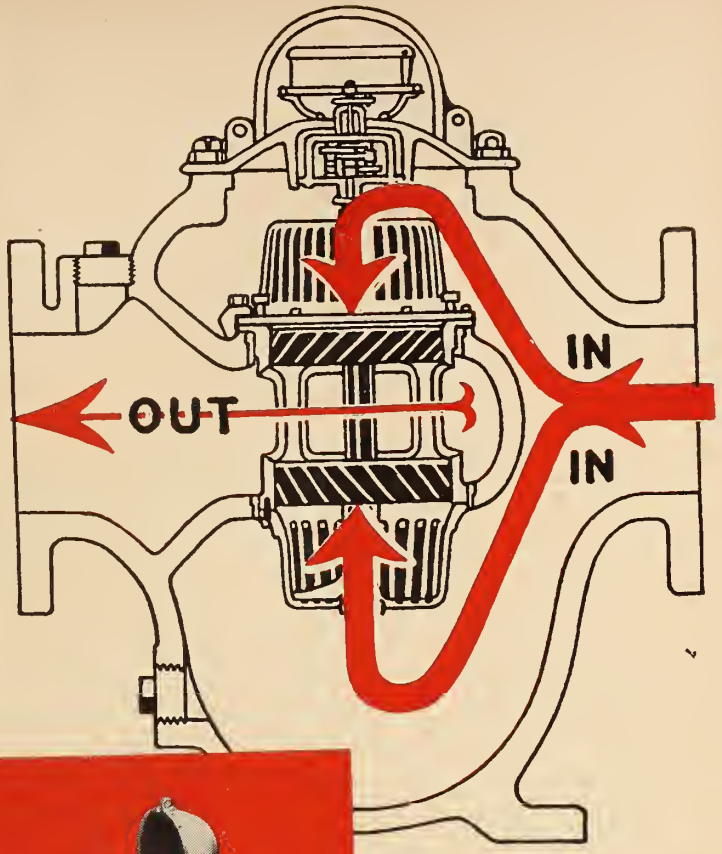
SO LITTLE WEAR
AND SUCH
LOW LOSS
OF HEAD



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Use the Crest Meter for bulk water deliveries — i.e. where mains deliver water to adjacent townships; hydraulic elevators, cranes, pile-jetting apparatus, etc.

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Dr. Marcus Long, University College, University of Toronto.

Mar. 17, Post Graduate Studies for Engineers.

Mar. 24, to be announced.

Annual Meeting, January

The Toronto Branch held its annual meeting on January 14, 1953, at the Northgate Hotel, Toronto, and the meeting was very well attended.

The guest speaker was Mr. Frank Clair, coach of the Toronto Argonauts Football Club. Mr. Clair gave a very interesting talk on football in general and concluded by showing a film of the 1952 Grey Cup final, and while this was not a sound film Mr. Clair followed through with explanation of the various features of the game.

At the conclusion of the meeting the chairman, Mr. W. H. Paterson, handed over his duties to Mr. John G. Hall, the new chairman of the Branch. Mr. Hall is assistant to the vice-president of the Combustion Engineering Corporation Ltd. Other officers elected are as follows: vice-chairman, M. McMurray, Dominion Bridge Co. Ltd.; secretary, H. Kolesar, Bell Telephone Co. of Canada. The executive is made up of John H. Ross, consulting engineer, Charles E. Potter, Angus Robertson Co. Ltd., R. Harvey Self, H.E.P.C. of Ontario, Robert W. Teagle, contractor, Frank E. Wellwood, City of Toronto Building Dept. Mr. Paterson thanked the 1952 executive for the support they had given him.

Mr. Hall, when taking over the chairmanship, pointed out that the Toronto Branch of the E.I.C. belonged to the members of the branch, and that its success would depend on their continued support. He promised the best efforts of the new executive and expressed the hope that each member would enthusiastically do everything in his power to advance the services and uphold the integrity of the profession that he represents.

Mr. Hall also outlined the program of speakers for the balance of the season. The variety of subjects chosen will cover a large proportion of the profession.

In summing the meeting up, it was interesting to note the enthusiasm shown by all the members present.

Vancouver

S. S. LEFEAUX, M.E.I.C.,
Secretary-Treasurer

W. L. INGLIS, M.E.I.C.,
Branch News Editor

Joint Meeting with B.C. Society, January

A joint meeting of the Vancouver Branch of the E.I.C. and the Vancouver Section of the B.C. Engineering Society was held on Wednesday, January 21, at 8 p.m., in the New Engineering Building at the University of B.C.

The meeting was under the chairmanship of the E.I.C. branch chairman, H. T. Libby, and about 200 were in attendance.

On this occasion the speaker was E. C. Cooley, resident engineer of the Elk Falls Co. Ltd. at Campbell River, B.C., who presented a paper on "Engineering Features of the Elk Falls Project". He was introduced by W. Thornber, M.E.I.C.

Mr. Cooley first explained that the Elk Falls Company was formed by Canadian Western Lumber Company and Pacific Mills Limited to build and operate a newsprint mill at Campbell River, B.C. Here they found all the necessary requirements for such an operation viz., timber supply, adequate electric power, plenty of water, sheltered area for log booms, good means of disposing of effluent and excellent facilities for shipping the product.

The company has obtained a forest management license from the B.C. Government covering 183,000 acres of timberland. Under this license no timber can be cut until 1974 and in the meantime logs will be supplied by the Canadian Western Lumber Company.

Power is obtained from the B.C. Power Commission's John Hart Hydro-electric Plant at Campbell River.

The speaker traced the plant process through the various stages from the log pond, grinding of wood to pulp, screening, paper making, wrapping, storage and shipping. Some of the problems encountered in the construction were mentioned and a colour film of the plant was shown.

This plant, completed last fall, is the first of its kind to be built in Canada during the past 35 years and incorporates many new features in equipment and controls.

Following a question period, Jack Miller, M.E.I.C., thanked the speaker on behalf of those present.

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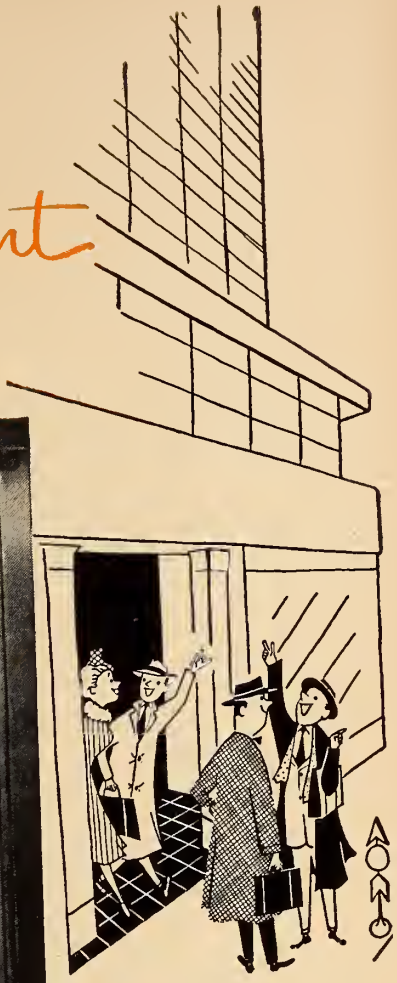

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Vancouver Island

CMDR. P. F. FAIRFULL, M.E.I.C.,
Secretary-Treasurer

R. E. DYSON, JR.E.I.C.,
Branch News Editor

Annual Meeting

A joint dinner meeting of the Vancouver Island Branches of the E.I.C. and B.C. Engineering Society was held at the Oak Bay Beach Hotel on Friday, January 23. Some 60 people attended. J. A. Izard was in the chair.

Unfortunately, due to business commitments the guest speaker, Mr. J. G. McKeachie, public relations director, B.C. Power Commission, could not attend. Instead of the scheduled talk, the members were shown a very illuminating film on the Bridge River Power Development.

At the conclusion of the film the E.I.C. members held their annual business meeting. J. A. Izard was elected president, A. Bowman, vice-president, and P. F. Fairfull was re-elected secretary-treasurer.

Winnipeg

C. S. LANDON, M.E.I.C.,
Secretary-Treasurer

L. E. MARRIN, JR.E.I.C.,
Branch News Editor

Progress of TV Discussed

Mr. E. M. Scott, chairman of the Electrical Section, Winnipeg Branch, presided over a joint meeting of the E.I.C. Electrical Section, and the Institute of Radio Engineers, held at the University Broadway Building early in December. Special guests included Mr. Frank Marshall and a number of television and radio students from the Technical Vocational School.

Mr. R. D. Cahoon, regional engineer of the Canadian Broadcasting Corporation, introduced the guest speaker, Mr. J. E. Hayes, assistant to the director-general of engineering, C.B.C.

Mr. Hayes, speaking on the progress made in the field of television in Canada, with special emphasis on its development in Winnipeg, outlined the broad principles by which TV expansion has been guided. Television development has been carefully planned to avoid costly experiments which Canada cannot afford; wherever practical the technical advances made in the United States and other countries have been incorporated into our system.

Licensing of commercial stations has been curtailed until such time as national programs which all stations may carry become available. Since the population is predominately English-speaking, only such programs are produced in the French language as meet the needs and interests of French-speaking Canadians.

"Winnipeg's C.B.C. television station will be the most powerful in Canada", said Mr. Hayes. The 50-kilowatt Winnipeg station will have an effective reception range of about 75 miles. The directional properties of the aerial array are included with the output of the transmitter to give the total strength of the station. This is a new conception of power rating.

The Toronto and Montreal TV stations have an output of 15 to 17 kilowatts with a correspondingly smaller reception area.

Installation of transmission equipment in the new million dollar Winnipeg station, will get under way by the summer of 1953 and it is hoped broadcasting will commence by the end of the year or early in 1954.

Site and details of the tower for the Winnipeg station are still unsettled. One application for construction of a 500-foot tower has already been rejected by the Department of Transport on the grounds that it would be a definite hazard to aircraft. However, it is hoped a suitable location may soon be found that will be acceptable to all concerned.

Reception in Winnipeg should be excellent and very consistent due to the flat contour of the surrounding area.

Due to the high cost, local live productions will be confined largely to commercials and programs of special local interest such as sport events. The bulk of the shows will be brought in from Eastern Canada on kinerecordings and re-broadcast. The excellent quality of these recordings was demonstrated to the members by a fifteen minute showing.

An interesting question period followed Mr. Hayes' address, after which Mr. Howard Body of Siemens of Canada Ltd., thanked the guest speaker and the meeting was concluded by Mr. Scott.

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E. I. C. TECHNICAL PAPERS

•

To supplement the technical data published in *The Engineering Journal* the Institute has established a fund to provide for the separate printing of specialized technical papers. These papers are published in pamphlet form for distribution at cost or less. Announcement of new technical papers appears in *The Engineering Journal.*

These technical papers constitute a record of engineering development in Canada and, in addition to circulation among E.I.C. members, are supplied to technical societies and libraries in all parts of the world.

The Publications Committee of the Institute invites members to submit manuscripts for consideration for *The Engineering Journal* or for separate publication.

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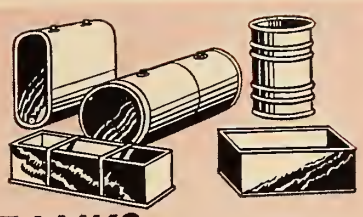
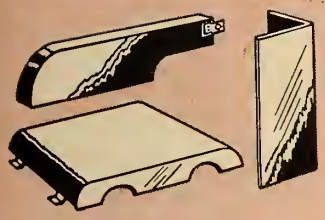
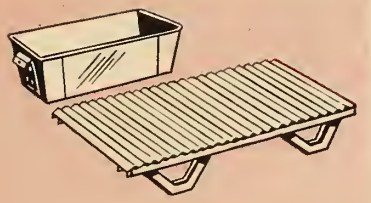


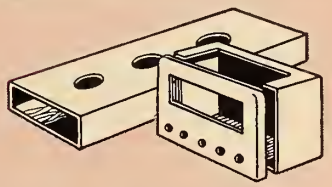
TANKS
BINS
TROUGHS
BOILER BREECHINGS



MACHINERY GUARDS AND COLUMN CORNER GUARDS . . .



TOTE BOXES AND TRUCK LIFT PALLETS . . .



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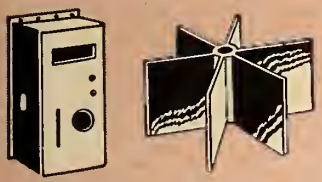

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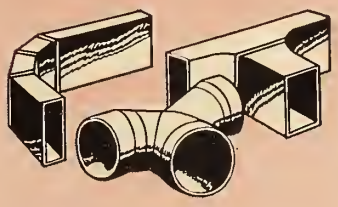

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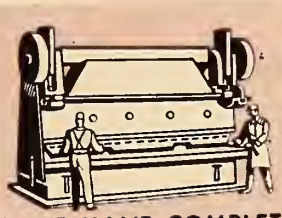

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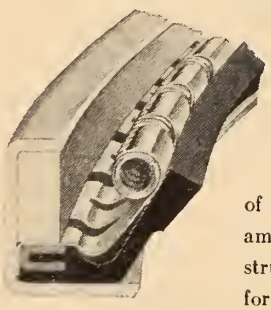

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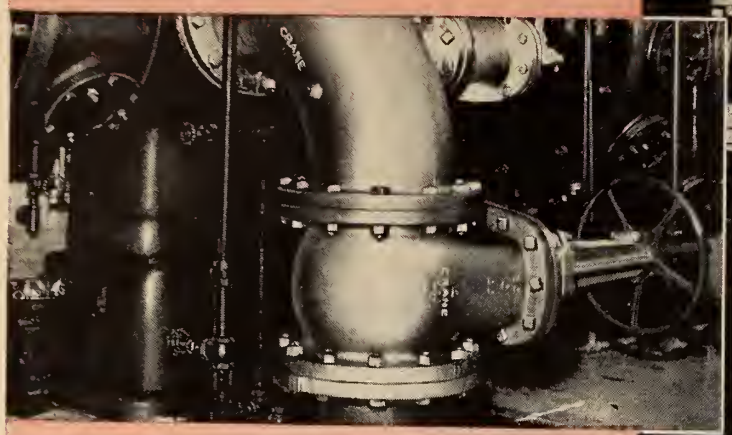
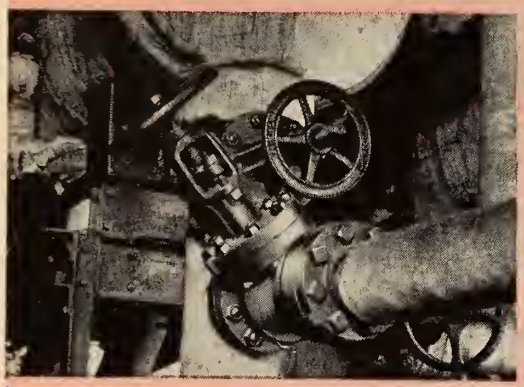
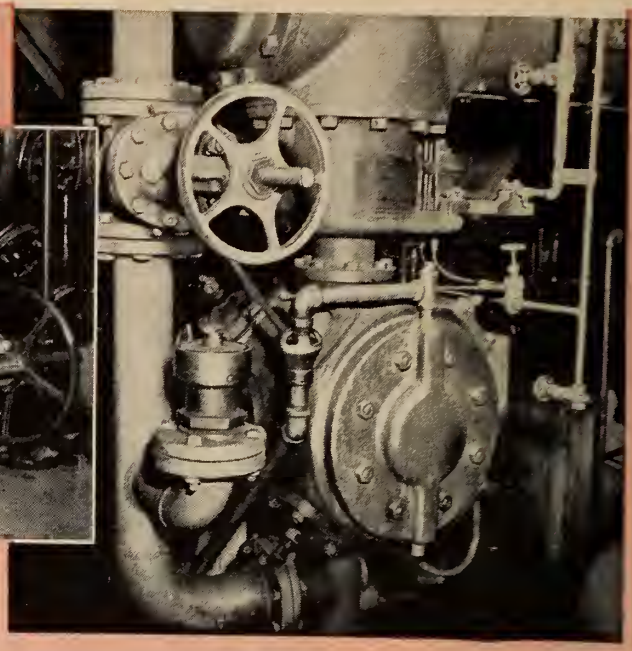


LINES TO CLOSED FEED hot water heater showing Crane 4-in. steel gate valves.





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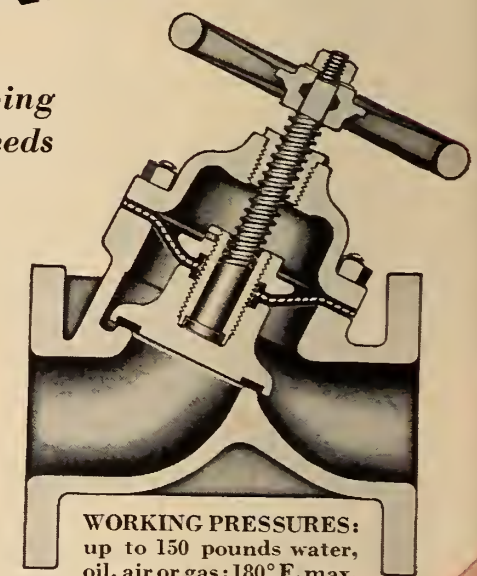

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Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Kingzett's chemical encyclopaedia: a digest of chemistry and its industrial applications: 8th ed., edited R. K. Strong. London, Baillière, Tindall and Cox; Canada, Macmillan, $13.25.

The ideal method of reviewing a book of this type is to place it on the desk of a chemical research worker for a few months, and then ask him how many times it has failed him.

However, it is in the interests both of ourselves and of the publishers to draw this book to your attention sooner than that.

It is a sorry reflection on our society to-day that the first thing to greet one in this eighth edition is the A-bomb.

From there we proceeded to H-bomb, which referred us to Fusion reaction. From this we were referred further to Fission reaction, which heading does not exist in this particular volume. But, since this, our first test, we have been unable to catch the editors out a second time.

The improvement in format of this edition over the seventh of nineteen hundred and forty-five, is immense, both in paper and type face, and the physical side of its use is greatly facilitated. Also, this edition has ninety-six pages more than its predecessor.

But, the chief thing about the new Kingzett is the much greater clarity of the explanations of many of the terms. Three random references were, Penicillin, Osmosis and Nomograms. Although the complete book is not rewritten, all of these entries had been, and there was simply no comparison in the presentation of the information. The non-chemically trained person would leave the nineteen hundred and forty-five edition with a very hazy idea as to the meanings of these terms; but not so with the new edition. It is a difficult improvement to describe except by concrete examples such as the above, and it will only become evident with use.

The increase of ninety-six pages in this volume is partially accounted for by slightly longer explanations in some cases, and of course, by obvious additions to the chemical field over the past seven years, chiefly in the field of nuclear chemistry and radioactivity, which section includes a folded chart of the heavy elements.

We have no hesitation in strongly recommending the new Kingzett to all of you in the chemical field, whether you have a previous edition or not. E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Anger's digest of the mercantile law of Canada: 16th ed. F. R. Hume. Toronto, Cartwright & Sons ltd., c1952. 530 pp., $7.50.

Subtitled "a practical code of mercantile law for the business and professional man embodying the variations of all ten provinces" this volume is a great asset to the desk of any business executive.

Could you provide the answers on a question regarding the intricacies of the foreign rights of Canadian authors? Joint tenancy? Changes on a cheque? Deposits on goods? Bills of exchange and promissory notes? Rights of husband and wife in the different provinces of Canada? As all of these, and similar questions, are asked in all types of libraries, it is a must for practically every business and public library.

Those of you who know the book will simply need to be informed that the new edition is now on the market. During the five years since the publication of the fifteenth edition, complete revision has been done to cover the changes in new income tax and bankruptcy acts. Also all statutory amendments up to the time of publication have been included, and outdated information deleted.

This digest is not intended to substitute for legal advice, but it is an invaluable reference guide to every day legal matters.

Footnote sources are provided with all references, and the book is indexed.

Canadian income tax act, 18th ed. Toronto, CCH Canadian ltd., 1952. 348 pp., $2.50.

This eighteenth edition consolidates the amendments passed in 1949-1952 inclusive. Following each section of the consolidated Act will be found the full text of the analogous provision of the Income War Tax Act and the full text of the section as it read prior to amendment in the period 1949-1952. A thorough topical index makes all provisions readily available by subject and a two-way cross reference

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Mon., Tues., Wed., Fri. . 9 a.m. - 6 p.m.
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(For Montreal branch meetings)
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Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

Please give as much detail as possible when requesting information of either type.

Borrowing and Purchasing

Books, periodicals, photostats, translation, etc. may be borrowed for two weeks at a time. **A fine of 25c. per day will be charged for each day borrowed items are retained beyond this period.**

A library deposit of $5.00 at par in Montreal is required for which two items may be borrowed at one time. Temporary deposits (30 days or less) $10. Books, periodicals, etc. may be ordered by members through the library. All carrying charges are payable by the individual concerned. Except in the case of library deposits, please make **no payments in advance.**

Non-members may consult the library, but may not borrow material.

table provides the analogous provisions of either Act.

Canadian master tax guide, 8th ed. Toronto, CCH Canadian ltd., 1952. 311 pp., $3.00.

This guide is designed as an up-to-date presentation of to-day's tax story. It presents the final conclusions of the Supreme court of Canada, the Exchequer court and the Income tax appeal board without details of the long legal struggles which form the warp and woof of the present tax pattern. The arrangement of the Income tax section follows closely the arrangement of the Income Tax Act itself. A detailed index is included.

Charbons activés (adsorption des gaz et des vapeurs). C. Courty. Paris, Gauthier-Villars, 1952. 534 pp., illus., $13.25.

This publication deals with the adsorption of gases and vapours by activated carbon. It covers the theory of adsorption, adsorption heat, kinetics of adsorption, adsorption by activated carbon of many gases or vapours, and dynamic adsorption or adsorption by gaseous flow. Desorption, along with porousness and surface of activated carbon, physical adsorption and chemical adsorption by activated carbon are included, and properties of activated carbon which make it a good adsorbent of gases and vapours. The scope is not always limited to carbon, theories that are valid for carbon often being valid for other substances. The book is not indexed. It contains a few diagrams and a bibliography of over five hundred references.

Conciliation in action: principles and techniques. Peters, Edward. New London, National Foremen's Institute, c1952. 266 pp., $4.50 (U.S.)

In the case of an impending strike, how much do the workers know about their own demands to management? Do the conciliators know how far the workers, the unions, or the management are prepared to go before a strike is declared?

Is the average employee essentially loyal to his management, or wholly in support of his union?

Considerable discussion is given to these questions, along with much information on the ethics and active role of the conciliator, in finding the real issue, and in timing and conveying the position involved.

A few footnotes provide source references, but most of the information is based on the actual experiences of the author, who is conciliator for the California State Conciliation Service.

Besides being of value to people engaged in conciliation between plant and management, this volume could also be profitably read by many personnel men.

Diesel engine catalog, Vol. 17, 1952. Los Angeles, Diesel engines inc., 1952. 409 pp., illus., $10.00 (U.S.)

This catalogue covers the products of Diesel engine manufacturers, Diesel equipment manufacturers and Diesel transmission manufacturers. It is divided into two parts. In the first, each manufacturer is allotted a few pages in which he gives descriptions, specifications, photographs, three-views, diagrams, drawings, exploded views, charts, power curves, etc. of each of his products. The second part is much shorter and is called "Market place of Diesel engines and accessories". This is a subject index giving, under each type of engine or accessory, the names and addresses of manufacturers.

Education in town planning: an international survey. The Hague, International federation for housing and town planning, 1952. 139 pp., Fl. 5.00.

This booklet contains the answers given by twenty-eight countries to the following questions: "Is instruction and training in town planning given in your country? By what institutions? By what kind of professors? Outline of historical development. Conditions of admission? Course of study? Fees? Examinations? Is degree recognized by bodies appointing town planners? What qualifications are stipulated for appointment as town planner? Does town planning attract many students or professional practitioners? Refresher courses?" The present publication is arranged in alphabetical order of countries and is indexed.

Electrical instruments, meters and electronic control. E. Molloy ed. London, Newnes, Toronto, British book service, c1952. 196 pp., illus., $3.75.

The first half of this book deals with instruments and meters. After a practical survey of switchboard instruments in Section one, the operation, installation, maintenance and applications of electrical recording instruments are dealt with concisely and extensively in Section two. Sections three and four make a complete survey of the electricity supply meter and its testing in accordance with the (British) Electricity supply (Meters) act of 1936. In the concluding section the magnetic amplifier is described and its operation explained. The book is illustrated and indexed. Engineers interested in instruments, meters and control will find it invaluable.

Electronic valves, Book 3A: **Data and circuits of radio receiver and amplifier valves.** N. S. Markus and J. Hotte, comp. and ed. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1952. 487 pp., illus., $6.25 (U.S.)

This book contains descriptions and data of the receiving and amplifying valves brought out by Philips in the post-war years 1945-1950, and is a sequel to Books 2 and 3 of the series covering 1933-1939 and 1940-1941 respectively. Rimlock-valves take a prominent place, together with the miniature battery valves and various Noval types, in which the EQ 80 is an important newcomer for F.M. and A.M./F.M. receivers. Considerable space is devoted to applications of the new valves illustrated with many photographs, drawings and circuit diagrams of receivers. Descriptions of the latest measuring instruments and of auxiliary equipment for use in laboratories, testing stations and factories are also included.

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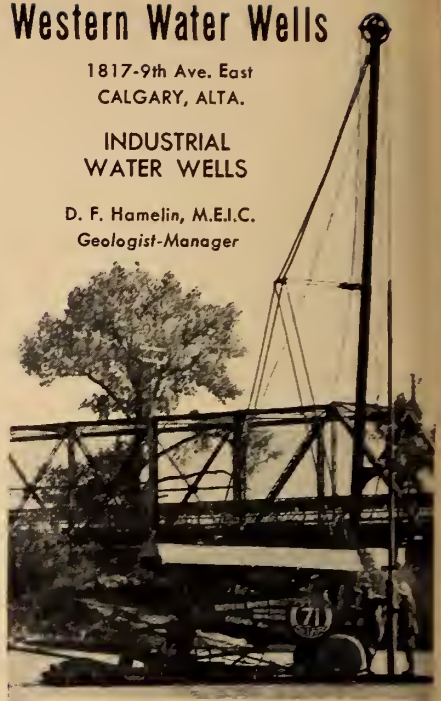

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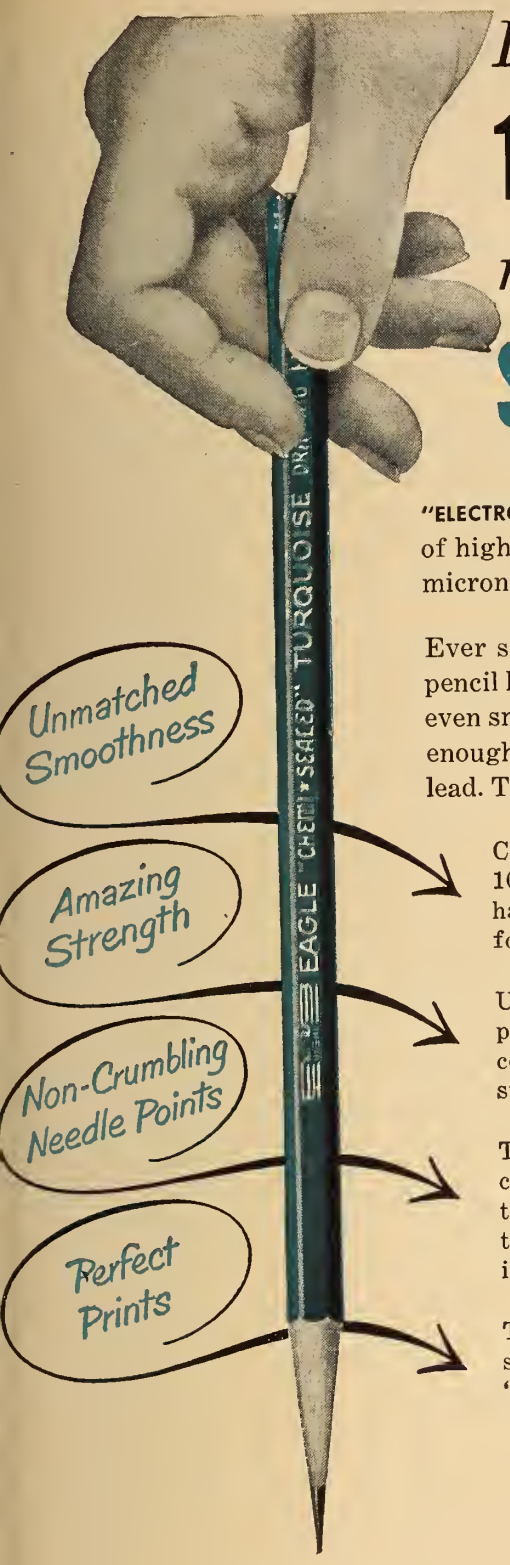

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Frontiers of personnel administration. Columbia university, Department of industrial engineering. New York, the department, c1951. 151 pp., $15.00.

This publication deals with the Conference on industrial personnel held at Columbia university in 1951. After a report on the conference, the reader will find nine papers on executive development in the personnel function, executive and supervisory training and development, communications and personnel, communications programs, flexibility and tolerance in labor relations systems, worker participation on production problems, budgeting of industrial personnel, the place and future of personnel, and personnel and the community. An outstanding twenty-five-page bibliography is included.

German immigration into Canada. W. G. Friedmann. Toronto, Canadian institute of international affairs, c1952. 63 pp., $1.25. (Contemporary affairs Series, No. 23).

While it is mainly concerned with the problem of German immigration, this study deals with many problems which are also common to present-day immigration of other nationalities to Canada. It discusses such problems as population pressures in Western Germany, state of mind of the German immigrant and his social assimilation. Immigration statistics are given.

Hydraulic research in the United States. H. K. Middleton and S. W. Matchett. Washington, Department of commerce, 1952. 20 pp., $1.20. (National bureau of standards, Miscellaneous publication No. 205).

This is a survey of the hundreds of problems related to hydraulics that are being investigated by university, company or government laboratories in the United States. In each case, the following information is given: title of project, who the project is conducted for, nature of project, description, present status, results and publications. The present work also contains lists of publications and films available on the subject. It is indexed.

An international bibliography on atomic energy, Vol. 2: **Scientific aspects,** Supplement No. 1. New York, United Nations, Toronto, Ryerson, 1952. 233 pp., $3.50.

This supplement gives references to more than eight thousand papers dealing with atomic energy and published during the years 1949 and 1950. These papers are arranged in alphabetical order of authors under approximately a hundred divisions and subdivisions of the main subject. The major five divisions are fundamental nuclear science, the physics and engineering of nuclear reactors, the biological and medical effects of high energy radiations, isotopes in biology and medicine and application of radio-active tracers in non-biological sciences and technology. An author index is also included.

Mechanics. Vol. 1, Statics, Vol. 2, Dynamics. J. L. Meriam. New York, Wiley, c1952. 340 pp., 671 pp., illus., $4.00 (U.S.) per volume.

These two volumes are essentially textbooks. They contain over a thousand problems and hundreds of simple drawings and diagrams. The problems are generally presented in order of increasing difficulty and answers are given in the majority of cases. Full use of graphic procedures is made whenever they are of advantage. They have not been isolated from the remainder of the text. The first volume is divided into chapters on principles of mechanics, force systems, equilibrium, structures, distributed forces, beams, friction, virtual work and moments of inertia. The second volume is divided into chapters on principles of mechanics, kinematics, principles of kinetics, force, mass and acceleration, work and energy, impulse and momentum, periodic motion and moments of inertia. Both volumes contain independent indices and an appendix of useful tables.

Mechanics of materials. Alvin Sloane, Toronto, Macmillan, c1952. 468 pp., illus., $5.50.

Written as a textbook for the engineering student, this volume presents the fundamental theorems of mechanics of materials in clear direct language.

The arrangement of the information is clear and definite, and reasonably and logically divided into the various mechanics, i.e. stress, strain, flexure, shear, torsion, column theory, etc., and the last chapter deals with the mathematical properties of areas. Problems accompany some of the chapters, twelve pages of Appendix include a variety of pertinent tables, and the book is indexed.

Ontario tax Acts consolidated, 1952. 4th ed. Toronto, CCH Canadian ltd., 1952. 289 pp., $2.50.

This publication contains the full text of the eleven most important taxing Acts of Ontario and the taxing provisions of other Acts in effect in the province. As in other CCH consolidations of tax Acts, all amendments to date are consolidated and the dates of amendments are given. A feature of the fourth edition is the new, large type and a revised and enlarged topical index.

Quebec tax Acts consolidated 1952. 4th ed. Toronto, CCH Canadian ltd., 1952. 169 pp., $2.50.

The twelve principal taxing Acts of the province of Quebec and the taxing provisions of other Acts in effect in the province are reproduced in full text in this booklet. All amendments to date are consolidated and the dates of amendment appear in historical notes following each section. A subject index is included.

Road test One-MD: effect of controlled truck axle loadings on concrete pavement, final report. Washington, United States highway research board, 1952. 142 pp., illus., $2.25.

The principal object of Road test One-MD, was to determine the relative effects, on a particular concrete pavement, of four different axle loadings on two vehicle types. This report contains a general summary of the project, traffic test procedures and results, an analysis of soil data and an analysis of structural effect of heavy-vehicle loads. An appendix gives many tables and graphs on soil samples and pumping. This publication is illustrated with photographs, diagrams and maps.

Science and hypothesis. Henri Poincaré. New York, Dover, c1952. 244 pp., paper ed., $1.25, cloth ed., $2.50 (U.S.)

This will make interesting reading for everyone concerned with what was advanced scientific thinking, fifty years ago. The author deals with mathematical reasoning, magnitude and experiment, geometry and geometries, mechanics, physics and probabilities. This is one of the new series of paperbound scientific books published by Dover at half the price of the clothbound edition.

Science and method. Henri Poincaré. New York, Dover, c1952. 288 pp., paper ed., $1.25, cloth ed., $2.50 (U.S.)

These are the reflections of a broad and cultivated mind upon the procedures of scientific discovery. In the present work Poincaré covers the following general subjects: the scientist and science, mathematical reasoning, the new mechanics and astronomical science. Although first published in 1908, this book will be of great interest to anybody concerned with scientific methodology. This is also a Dover paperbound edition.

Woods practical guide to fan engineering. W. C. Osborne and C. G. Turner ed. Colchester, Essex, Woods of Colchester ltd., c1952. 227 pp., illus., $3.00.

This is a practical guide to the basic principles of fan engineering. The author has taken into consideration such problems that confront the designer and fan engineer, as high and low altitudes, high and low temperatures, foreign particles, etc. Whole chapters are devoted to such subjects as humidity, air cleaning, air duct design, system resistance, hazardous applications, noise and backdraught. The book contains over sixty tables and charts. It is illustrated with drawings and diagrams and is indexed.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Flux linkages and electromagnetic induction. L. V. Bewley. Toronto, Macmillan, c1952. 100 pp., illus., $4.00.

The purpose of this small monograph is to explain and interpret Faraday's law on electromagnetism, and to demonstrate how this and other basic laws and concepts underlie the many applications of electric theory which have been developed since.

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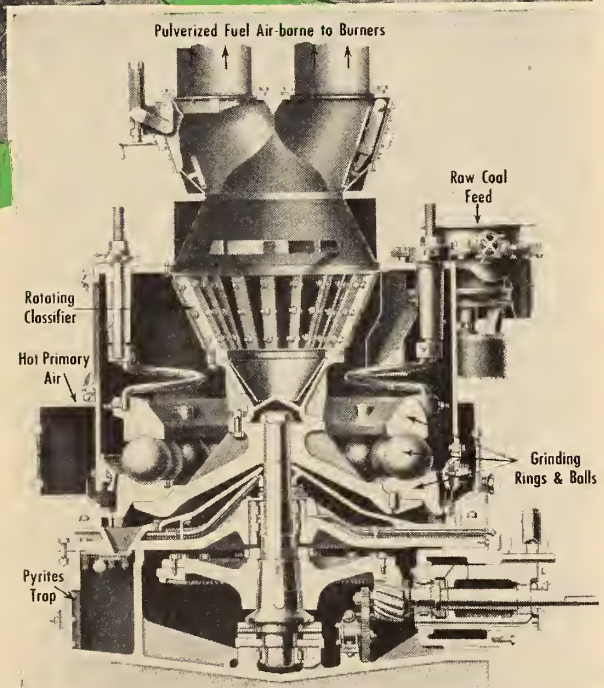

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Fundamentals of engineering electronics. W. G. Dow. New York, Wiley, second edition, 1952. 627 pp., illus., $8.50 (U.S.).

The author's intent is to provide, from the engineer's point of view, a realistic, quantitatively usable conception of the principles that govern the internal behavior of electronic devices and to familiarize the reader with methods of circuit analysis customarily used in connection with the most common engineering applications of these devices. Non-circuit phenomena are covered as well, for semi-conductors, for instance, and within the general revision special attention has been given to uhf and microwave frequency tubes.

Gas turbine power. G. M. Dusinberre. Scranton, Penna., International Textbook, Laurel, 1952. 256 pp., illus., $6.00 (U.S.).

An elementary text written from the viewpoint of the mechanical engineer. In treating the gas turbine as a prime mover the author discusses the basic gas turbine cycle and its variations with emphasis on the thermodynamic and heat balance aspects. There are separate chapters on gas flow, compressors, combustion, heat transfer, and part-load operation. There is a bibliography.

Handbook of chemistry. Compiled and edited by N. A. Lange, Sandusky, Ohio, Handbook Publishers, Inc., eighth edition, 1952. 1,998 pp., $7.00 (U.S.).

This standard handbook is a comprehensive reference volume for all who require ready access to chemical and physical data used in laboratory work and manufacturing. In this eighth edition 26 tables have been extended or completely rewritten, and six new tables have been added on such varied topics as ionization potentials of elements, classification of clay minerals, titrimetric indicators and molar equivalents. In the general revision necessary corrections, changes, and additions have been made, and some tables have been omitted to make room for more useful material. As before, Beilstein references are given in the extensive table of physical constants of organic compounds.

Storage tubes. M. Knoll and B. Kazan. New York, Wiley, c1952. 143 pp., illus., $3.50 (U.S.).

The purpose of this book is to explain in concise form the fundamental operation of the different types of electronic storage tubes for television, computer, and signal-converter applications. Working from the underlying principles through the currently-used writing and reading methods the author concludes with condensed descriptions of a wide range of tube types, referring in each case to one or more references, in the accompanying bibliography, in which fuller treatment will be found.

Television. F. Kerkhof and W. Werner. Eindhoven, Holland, Philips' Gloeilampenfabrieken, 1952. 434 pp., illus., $7.75 (Available in U.S. from Elsevier Press, Inc., Houston, Texas).

Primarily for technicians and engineers with a knowledge of radio theory, this book gives the physical principles upon which television is based and develops the numerous and varied electrical circuits employed in the design of modern receivers and transmitters. It discusses not only the systems used in the U.S. but also those in use or projected in Great Britain and the Continent. A glossary of terms and a bibliography for each chapter are included at the end of the book.

Theory of elasticity and plasticity. (Harvard Monographs in Applied Science, No. 3.) H. M. Westergaard. New York, Wiley, 1952. 176 pp., illus., $5.00 (U.S.).

Suitable for first year graduate students, this book is written from the point of view of the engineer although the treatment is entirely theoretical. Topics covered include the important basic concepts of the states of stress and strain, the basic laws and equations of elasticity and plasticity, and specialized applications to hollow cylinders, spheres, etc., to various force effects, and to thermal stresses.

BOOKS RECEIVED

Advanced mechanics of materials, 2nd ed. F. B. Seeley. New York, Wiley, c1952. 680 pp., illus., $8.50 (U.S.).

The E. B. Eddy handbook of printing production. Hull, E. B. Eddy Co., c1952. Illus.

The electrical engineer's reference book, 6th ed. E. Molloy ed. London, Newnes, Canada, British book service, c1952. 2,196 pp., illus., $12.75.

F.B.I. register of British manufacturers, 25th ed., 1952-1953. London, Iliffe, c1952. 922 pp., illus., 42/–.

Fifty-year index to A.S.T.M. technical papers and reports, 1898-1950. Philadelphia, American society for testing materials, c1952. 207 pp., $1.00 (U.S.).

Handbook of aerial mapping and photogrammetry. L. G. Trorey. Cambridge, University press, Toronto, Macmillan, 1952. 180 pp., illus., $5.75.

National directory of the Canadian pulp and paper industries, 1952. J. N. Stephenson ed. Gardenvale, Pulp and paper magazine of Canada, 1952. 473 pp., illus., $3.50.

Physical metallurgy for engineers. D. S. Clark and W. R. Varney. Toronto, Van Nostrand, c1952. 567 pp., illus., $7.25.

Report of the committee on national policy for the use of fuel and power resources, (Ridley report). London, HMSO, Ottawa, United Kingdom information office, 1952. 242 pp., $1.50.

Soil mechanics for road engineers. Great Britain, Road research laboratory, London, HMSO, 1952. 541 pp., illus., 30/–.

Statistical yearbook of the World power conference, No. 6, Annual statistics for 1948 - 1950. Frederick Brown ed. London, World power conference, Montreal, Engineering Institute of Canada, 1952. 163 pp., 35/–.

Textbook of engineering materials. Melvin Nord. New York, Wiley, c1952. 518 pp., illus., $7.80.

Underpinning and strengthening of structures. L. E. Hunter. London, Contractor's record ltd., 1952. 162 pp., illus., 25/–.

Welded highway bridge design. J. G. Clark ed. Cleveland, James F. Lincoln arc welding foundation, 1952. 240 pp., illus., $2.50 (U.S.).

World airline record 1952. Chicago, Roy R. Roadcap & Assoc., 1952. 400 pp., illus., $12.50 (U.S.).

TECHNICAL BULLETINS RECEIVED

British electrical and allied industries research association. Technical reports:

No. C/T105 — An extension of the momentum theory of wind turbines, by H. H. Rosenbrock. No. J/T151 — Factors influencing the creep resistance of wrought carbon steels, by C. H. M. Jenkins and H. J. Tapsell. No. L/T251 — Dipolar permittivity and structure in ketone-paraffin mixtures, by V. Daniel. No. L/T278 — The electrochemistry of non-aqueous solutions, by I. G. Roe. No. O/T7 — The bond-strength of galvanized-steel angle in concrete, by G. Mole. No. U/T125 — The effect of inductance on the fine transfer between platinum contacts, by J. Warham.

California institute of technology. Industrial relations section. Circulars:

No. 20 — Conducting a wage survey by the conference method, by R. A. Nelson and L. R. Sorensen.

Canada. Department of mines and technical surveys. Surveys and mapping branch. Maps:

New general geographical map of Canada.

Canada. National research council. Canadian government specifications board. Provisional specifications:

No. 1-GP-81P — Paint; priming, alkyd, air drying and baking types (for metals). No. 1-GP-88P — Enamel, alkyd type, air drying and baking, gloss (for motor vehicles). No. 1-GP-104P — Enamel; alkyd type, air drying and baking, semi-gloss (for motor vehicles). No. 1-GP-106P — Ink; stencil, for marking porous surfaces. No. 1-GP-107P — Ink; stencil, for marking non-porous surfaces.

. . . Specifications:

No. 41-GP-2 — Trays; plastic.

Purdue university. Engineering experiment station. Structural engineering reprints:

No. 4 — Stress concentration in built-up structural members, by J. E. Carter. No. 5 — A further study of behavior of floorbeam hangers, by M. B. Scott and J. W. Cox. No. 6 — Rigid frame analysis of variable moment of inertia (five parts).

United States. Highway research board. Bulletins:

No. 53 — Highway sufficiency ratings. No. 54 — Load capacity of roads affected by frost. No. 55 — Land acquisition and control of adjacent area.

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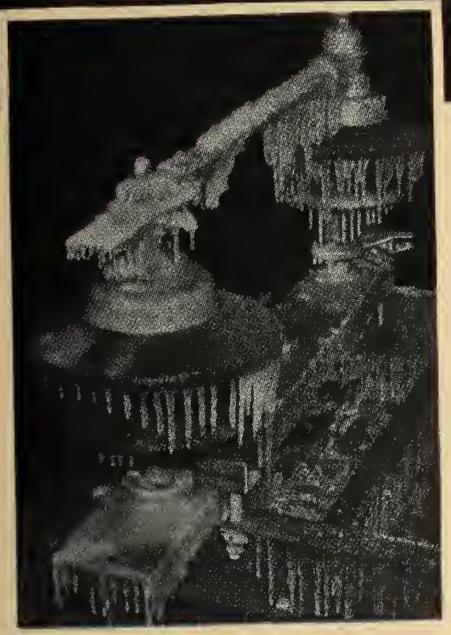

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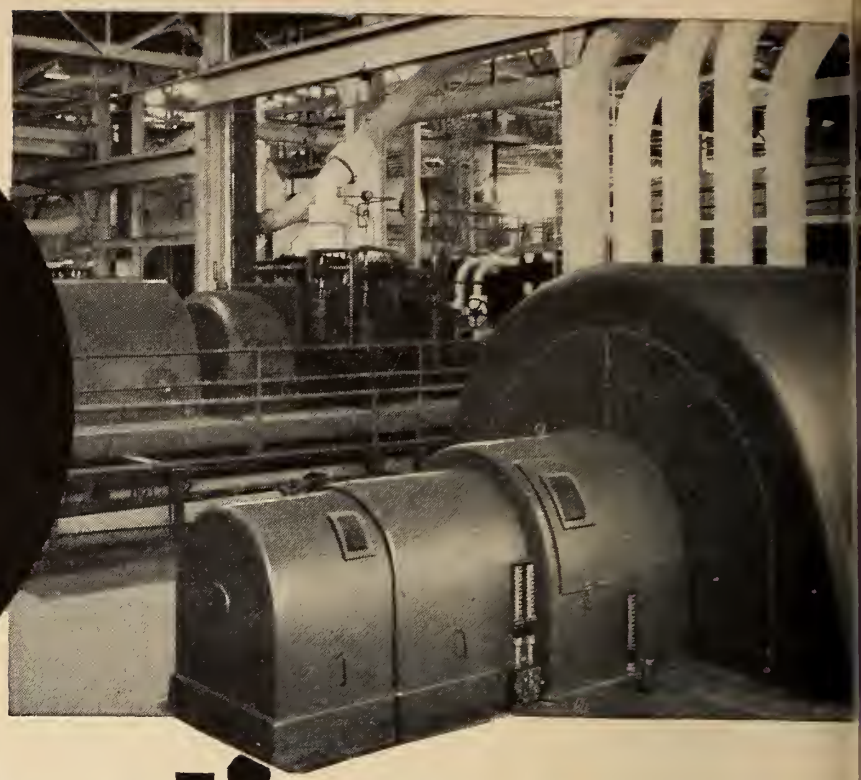

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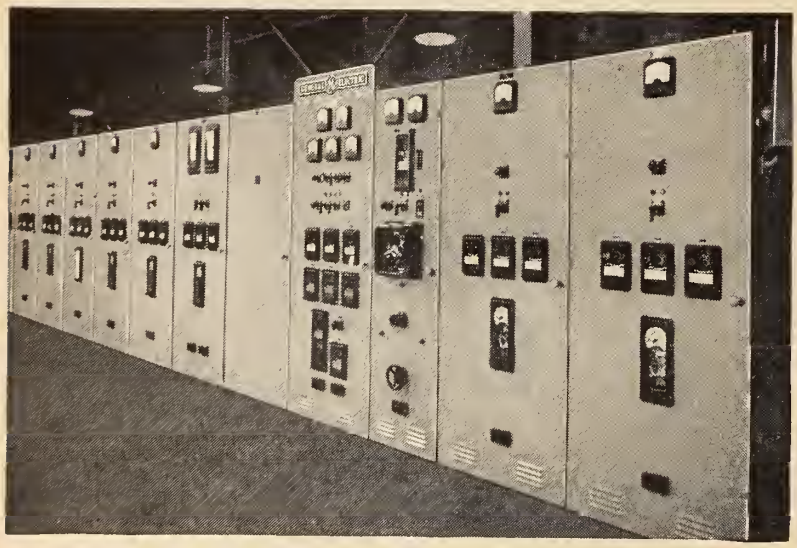

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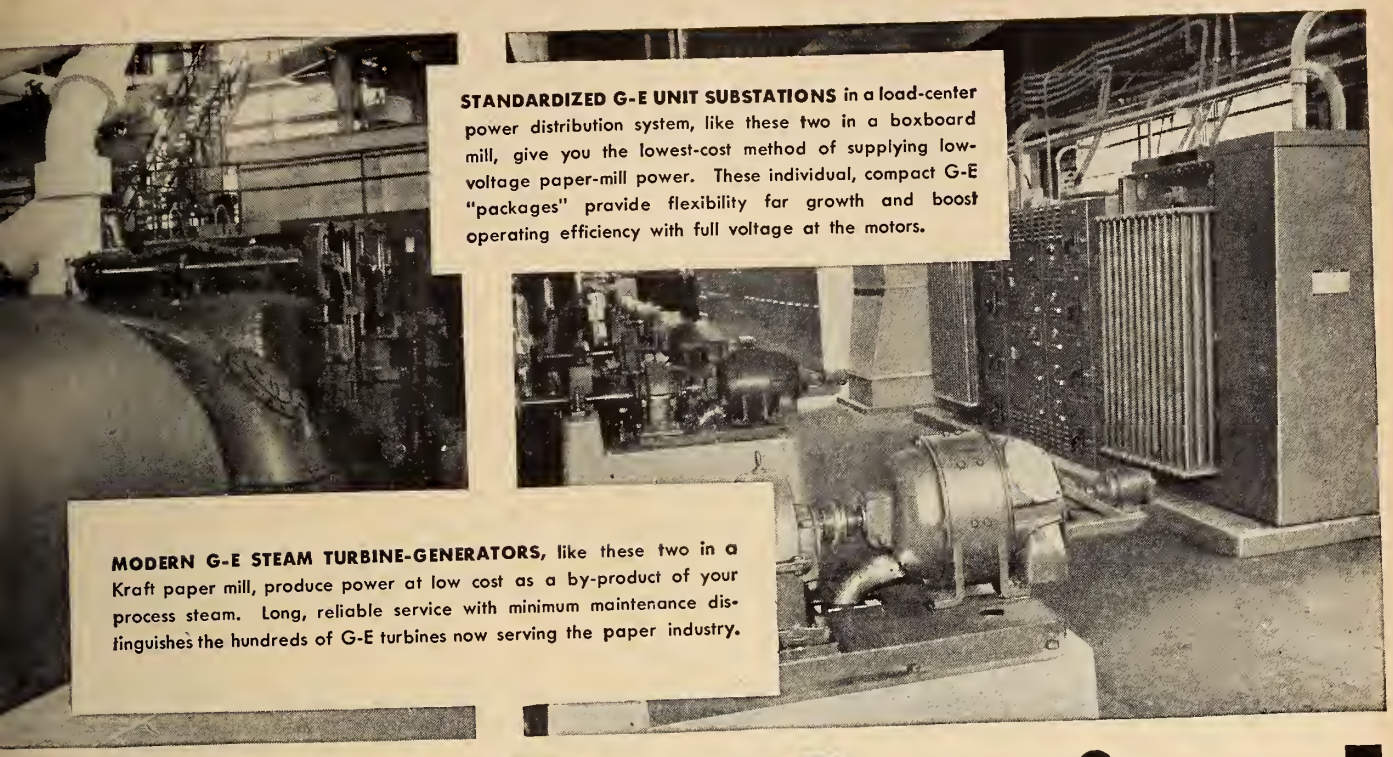

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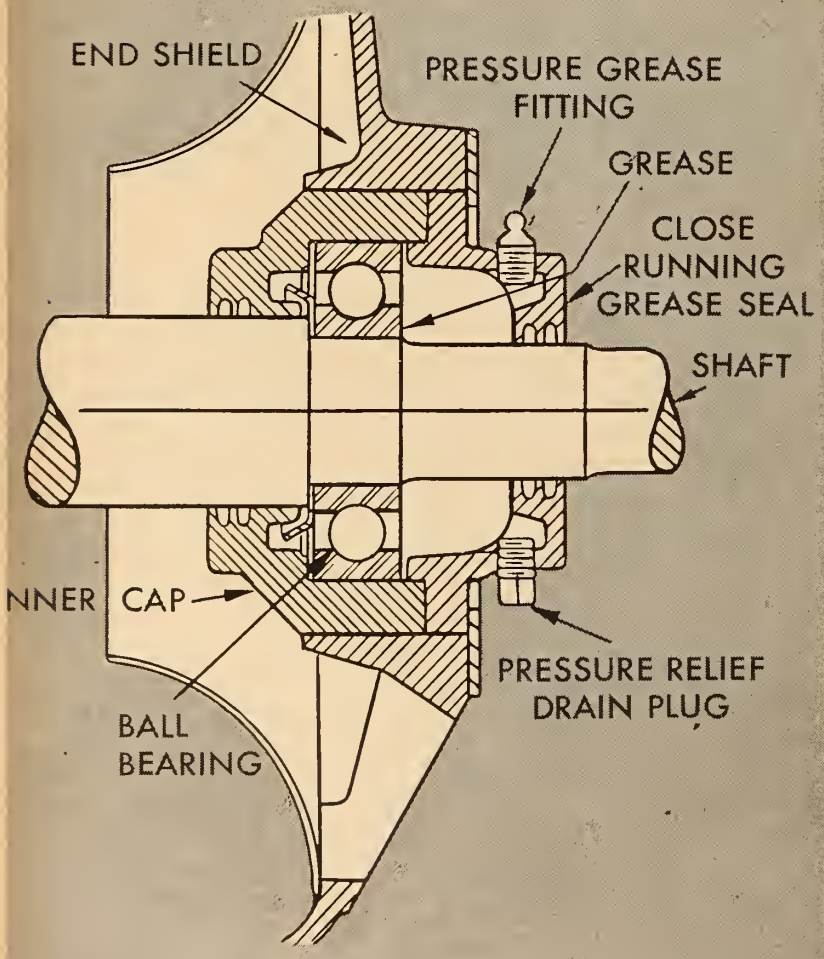

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Very Severe	6 Mo.	3 Mo.	3 Mo.

Write today for "Facts About Ball Bearing Lubrication": Bulletin CGEA 5354.

CANADIAN GENERAL ELECTRIC COMPANY
LIMITED

Head Office: Toronto — Sales Offices from Coast to Coast

AAD-02401

CANADA BUILDS

HOW THE PROFESSIONAL ENGINEER HELPS INDUSTRY BUILD BETTER

By JOHN ROSS, P. Eng. for The Association of Professional Engineers of Ontario.

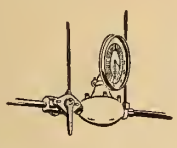
CONSTRUCTION, EXPOSURE AND LOCATION

are all involved in your heating problem. The Professional Engineer will design a heating system based on these factors and prepare drawings and specifications for the tendering and the guidance of the heating contractor.

PROPER INDUSTRIAL LIGHTING

is difficult and complicated—correct design will result in greater comfort, production and a better product. The Professional Engineer will design your lighting system utilizing all factors affecting the design to produce efficient lighting at a minimum of installation cost and operating expense.

CORRECT SIZE OF WATER SERVICE

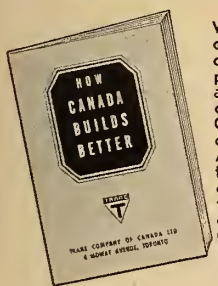


is determined by the type and number of plumbing fixtures in the building, together with the pressure available and the height of the building. The solving of this problem in applied hydraulics is a service of the Professional Engineer.

PROBLEMS OF HEATING AND VENTILATING

Most modern offices are completely air-conditioned and this installation is closely allied with that of heating. The Professional Engineer will correlate the problems of heating and ventilating so that the equipment will work in harmony in the interests of comfort.

THIS BOOK CONTAINS . . .

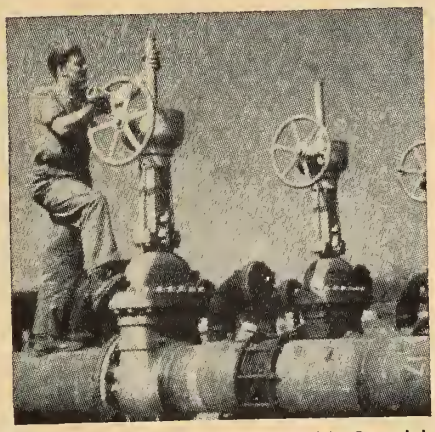


Valuable points to check whenever industrial expansion is planned. It is made available through the cooperation of the Ontario Association of Architects and the Association of Professional Engineers of Ontario. You will find the information of real assistance. Copies are available upon request without obligation from

Trane Company of Canada Limited
4 Mowat Avenue, Toronto, Ont.

Karsh

STEELMAKING facilities are being expanded. Atlas Steels Limited, makers of tool, alloy and stainless steels are increasing production with an aggressive building program. Trane convector-radiators supply heating comfort to executive and administrative offices.



OIL from Alberta oil fields builds Canada's industrial potential. At pumping stations of Interprovincial Pipe Line Co. along the pipe line, Trane specialized equipment supplies the heating and ventilating.

FOOD is vital. Expanded Christie Brown production facilities are answering the needs of the nation, Trane "Precision Heating" serves this important company.

THEY ALL ADD UP TO *More Production*

Your architect and consulting engineer will help you get MORE PRODUCTION by helping you make sure that your new building meets **every** requirement.

Trane assists by manufacturing equipment designed to meet specific heating assignments—"Precision Heating". This Trane equipment provides **exact** amounts of heat established by thorough test and clearly shown by published ratings.

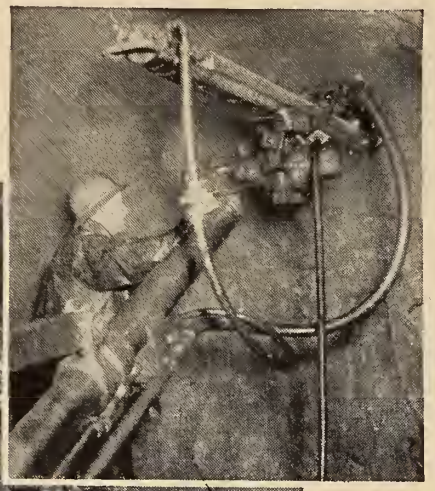
Working closely with architect, consulting engineer, general contractor and heating contractor, Trane representatives located across Canada bring you the full advantages of Trane "Precision Heating".

"Precision Heating" cuts costs and assures heating comfort. Specify Trane "Precision Heating".

***Specify* TRANE—MAKE SURE YOU GET TRANE**

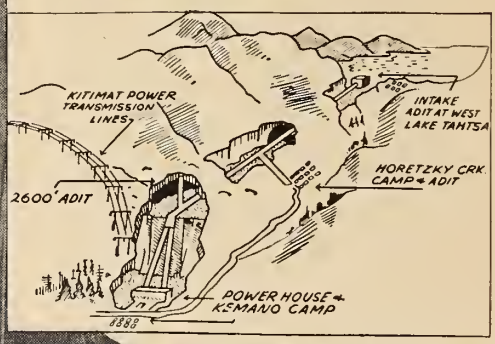
TRANE COMPANY OF CANADA LIMITED
4 MOWAT AVENUE, TORONTO

B. F. Goodrich helps hollow a mountain at Alcan's multi-million dollar KEMANO



HIDDEN 1600 FEET DEEP INSIDE A MOUNTAIN, ONE OF THE WORLD'S LARGEST SINGLE POWERHOUSES WILL POWER THE GIANT ALUMINUM SMELTER AT KITIMAT

Gigantic in scope, in northwestern British Columbia, the Aluminum Company of Canada, Ltd. has embarked on the first stage of an undertaking which will eventually result in the world's largest aluminum smelter. In a reservoir area of 350 square miles, some lake levels have been raised a hundred feet or more by the largest rockfill dam in the Commonwealth, and ten miles of tunnels drilled through solid rock. At Kemano, one of the world's largest single powerhouses will supply power to Kitimat smelter for a potential aluminum output of 500,000 annual metric tons. B. F. Goodrich is proud to play a part in this strategic Canadian development.



Cut-away view showing ten-mile tunnel and Kemano powerhouse.

B. F. Goodrich

PRODUCTS ON-THE-JOB AT KEMANO

TYPE 50 AIR DRILL HOSE

TYPE 98 BULL HOSE

SUPER LONGLIFE CONVEYOR BELTING

MULTI-V BELTS

MUCKER BELTS

GROUTING HOSE

DELUGE WATER HOSE

52-526

RESEARCH KEEPS B.F.Goodrich FIRST IN RUBBER

B.F.Goodrich *Engineered* **INDUSTRIAL PRODUCTS**

Specify B.F.G. Industrial Rubber Products On Your Job . . .

WRITE OR PHONE B. F. GOODRICH RUBBER COMPANY OF CANADA LIMITED, MONCTON, MONTREAL, TORONTO, KITCHENER, WINNIPEG, REGINA, CALGARY, EDMONTON, VANCOUVER.

Moto-Bug

"THE POWER WHEELBARROW"

ABOVE: Moto-Bug with tilting flotbed platform 4' long, capacity 1200 lb.

Ailing production schedules and materials handling bottlenecks never cure themselves. You know what is required — you could write the specifications yourself. It must be a machine with the strength to carry your loads . . . the manoeuvrability to pick its way through the plant . . . the compactness dictated by aisle width and door openings . . . the versatility to perform varied tasks. Well — MOTO-BUG gives you all these, and at a price you will concede to be moderate.

All **MOTO-BUG** attachments are interchangeable.
All **MOTO-BUGS** are 33 inches or less in width.

LEFT: Fork-lift Moto-Bug with hydroulic pump; 1000 lb copacity, 5' lift.

BELOW: Moto-Bug with 12 cu ft tilting materials hopper easily handles load of castings.

SPECIFICATIONS

SPEED: 1½ to 4 MPH (forword & reverse)
ENGINE: 6 HP Wisconsin
GRADEABILITY: 20%
WEIGHT: 615 lb. with hopper
LENGTH: Varies, 5' 9" opprox.
RIDING STEP: Folding (optionol)
TIRES: Pneumotic
Front: 16 x 500
Rear: 12 x 400

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CE-531

Construction Equipment Co. LIMITED

HALIFAX	MONTREAL	TORONTO	LONDON	EDMONTON
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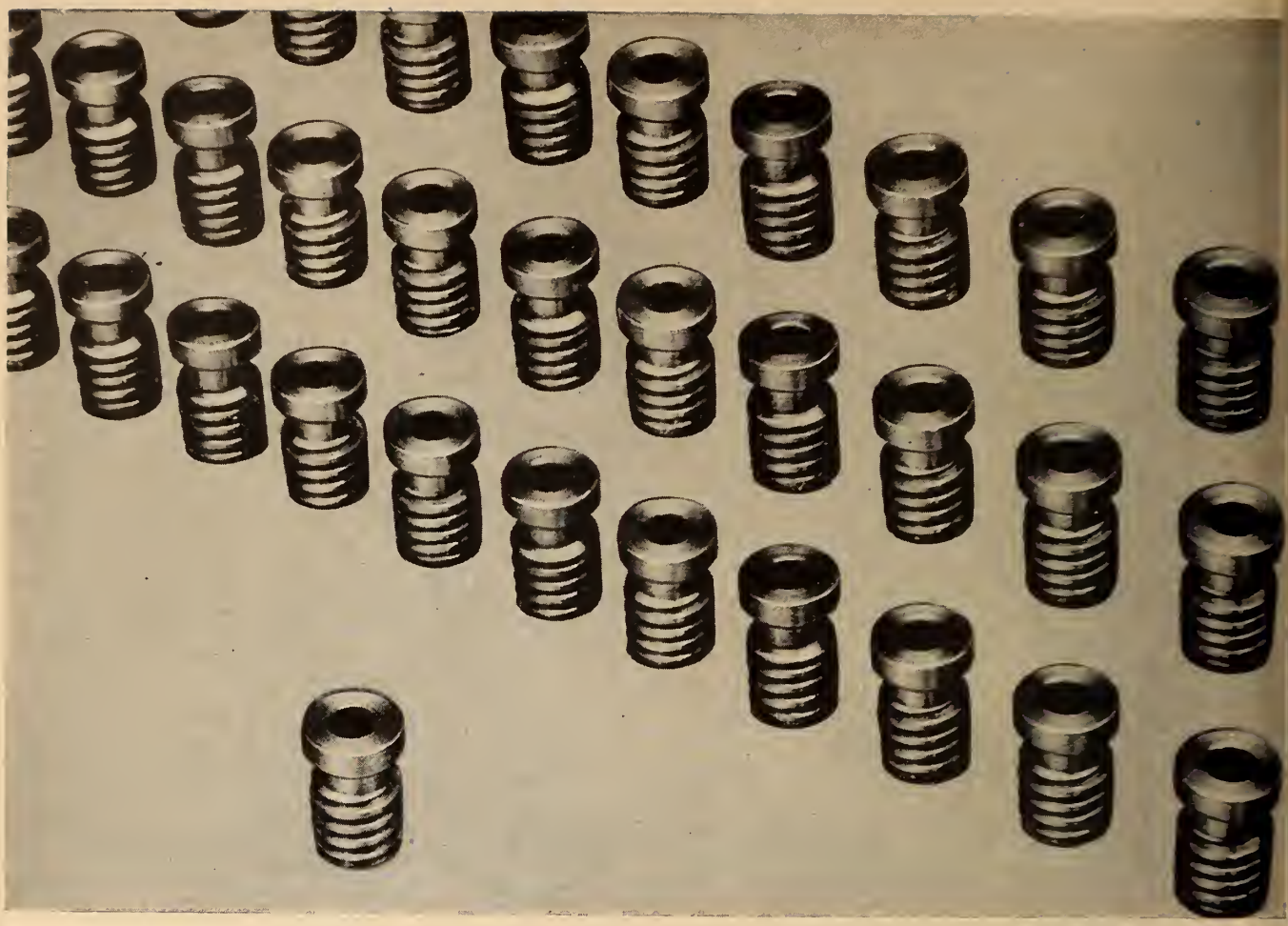
SALES • SERVICE • PARTS • RENTALS



"ALL PRESENT AND CORRECT, SIR!"

When the job is completed, Wallaceburg Brass Limited "call the roll".

All parts within limits specified, the desired quality maintained, quantity correct — and delivery made *on time*. "All correct" is the usual report we make to the customer. Wallaceburg Brass Limited has a growing reputation for *service* and *quality*.

How do we get it?

One reason is that we're happy to show what we can do — even on the "tough ones" — and to let you judge on the basis of performance.

With the most modern equipment available, with an experienced sales and work staff, and with a flexibility of approach, we have confidence in our ability to produce any part by the best method at a fair price.

Looking for a better source for screw machine products, sand castings, forgings or die castings? See the Wallaceburg people. Since 1905, we've had a reputation for giving customers *what* they want — *when* they want it!

DOMINION DIE CASTING LIMITED Wallaceburg, Ont.

WALLACEBURG BRASS LIMITED Wallaceburg, Ont.

MONTREAL, TORONTO, LONDON, CALGARY, VANCOUVER

DIE CASTINGS • SAND CASTINGS • FORGINGS
AUTOMATIC SCREW MACHINE PRODUCTS

THERE'S MORE THAN SPECIFICATIONS IN A *UBJ* BRIEFCASE

Catalogues about mill supplies and specifications of new Machine Tools are the *visible* contents of a UBJ representative's briefcase ... But he always carries something more with him — the instant availability of specialized advice by the machinery and production specialists on the U.B.J. staff. This professional help is available both to him and you, the customer, to ensure the selection of the right equipment to fill the job.

UBJ

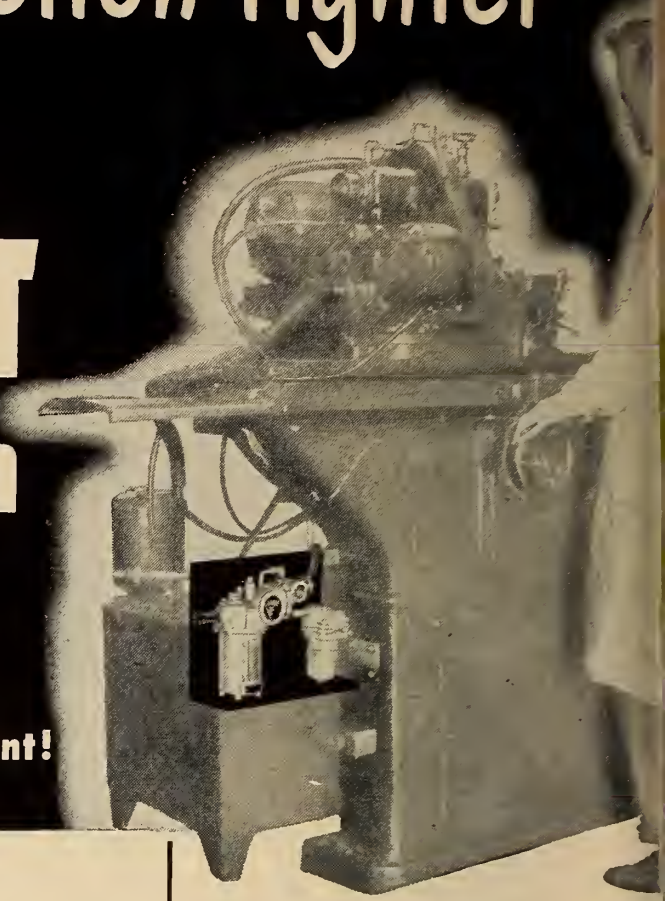
UPTON BRADEEN and JAMES LIMITED

MONTREAL • TORONTO • WINNIPEG • VANCOUVER • MONCTON • OTTAWA • HAMILTON • WINDSOR

UBJ lines include:
Machine Taals, Waadwarking Machinery, Mill Supplies and Equipment far Materials Handling, Resistance Welding, Injectian Maulding, Die Casting, Pumping and Railways and Contractars.

Air-Borne "Friction Fighter"

Alemite OIL-MIST Lubrication



* extends bearing life as much as *17½* times!
cuts oil consumption up to *90%*
boosted production *50%* at one plant!

Here from Alemite—world leader in lubrication—is lubrication progress so major—so far reaching—as to command the interest of *everyone* concerned with industrial lubrication practices and costs. Alemite Oil-Mist! The most efficient, continuous, fully automatic system in the field of machinery lubrication.

Alemite Oil-Mist! The system that atomizes oil into *mist*—distributes it through tubing to bearings—bathes *all* bearing surfaces with fresh, clean, cool oil film. A system that simplifies and materially cuts the cost of machinery lubrication. A lubricator unit that has no moving parts.

Oil-Mist uniformly maintains oil film on plain and anti-friction bearings, gears and chains *regardless of variations in load, temperature or speed.* Eliminates the "human element."

Delivers Oil to Bearings 3 Ways

Oil-Mist as Such. Most commonly applied to any type of anti-friction bearing—ball, roller or needle.

Oil in Spray Form. For open and enclosed gears and chains. Spray nozzle partially condenses mist into semi-liquid form and directs the spray onto a concentrated area.

Oil in Liquid Form. For plain bearings, slides, ways, vees, cams and rollers. In these applications, condensing fittings are used.

Check All the Oil-Mist Advantages

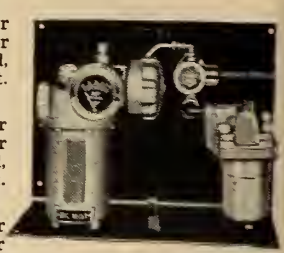
- Reduces bearing temperatures as much as 20%.
- Cantinuaus, uniform lubrication of all bearings.
- Air pressure seals bearings against dirt.
- Prevents praduct spoilage.
- Eliminates guesswark—each bearing picks up as much Oil-Mist as it needs.
- Reduces starting and running torque.

WRITE FOR DETAILS OF THE ADVANTAGES OF THE ALEMITE OIL-MIST SYSTEM . . .

ALEMITE

DIVISION
STEWART-WARNER CORPORATION
of Canada, Limited
BELLEVILLE ONTARIO

A PRODUCT OF SW STEWART WARNER



MODEL 4955-D Oil-Mist Lubricator with Water Separator and 115-volt Solenoid, mounted on bracket.

MODEL 4955-E Oil-Mist Lubricator with Water Separator and 230-volt Solenoid, mounted on bracket.

MODEL 4955-F Oil-Mist Lubricator with Water Separator and 440-volt Solenoid, mounted on bracket.

MODEL 4955-C. Oil-Mist Lubricator with Water Separator mounted on bracket.

Tubes and tube-sheet in this caustic cancentratar, made by Taranta Iran Warks, Limited, are af wraught nickel.

wrought nickel

PROVEN METAL FOR THE PROCESS INDUSTRIES

Wherever product purity protection is important, consider the advantages of pure nickel. Commercially pure nickel is widely used in processing foods, drugs, chemicals and beverages. This corrosion-resisting white metal responds readily to all the usual fabricating practices. It retains desired properties both at elevated and sub-zero temperatures.

Made of ⅛ inch thick nickel sheets, this truck tank of 2000 gallan capacity, fabricated by Electric & Gas Welding Ca., Ltd., Mantreal, will canvey caustic ta a large Canadian textile mill.

INCO *proven* SERVICE GOES WITH INCO NICKEL

Frequently, problems arise due to metal contamination in the processing of materials. Available from Inco's Corrosion Engineering Section is a vast amount of information on industrial corrosion and on the properties and fabrication of metals and alloys. Acquired in many different ways—by plant tests, by co-operative field tests, by laboratory investigations and by other means—this fund of information is constantly being increased. It is all at your service.

MBLEM OF INCO SERVICE NICKEL TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED - 25 KING ST. W., TORONTO, ONT.

Business & Industrial Briefs

A Digest of Information received by The Editor

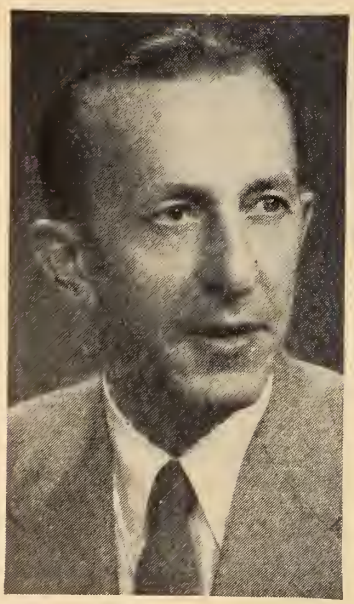
Appointments and Transfers

Westinghouse Promotions. — Canadian Westinghouse Company Limited have made the following changes

E. E. Orlando, M.E.I.C., formerly eastern regional manager has been appointed general manager of the district apparatus division. *(See "Personals")*

J. W. Kerr, M.E.I.C., has been appointed general manager of the power products division. *(See "Personals")*

Carl Pollock has been appointed general manager of the industrial products division.



C. Pollock

A. A. McArthur has been named manager of the power products division and A. A. Moline, M.E.I.C., has been appointed manager of the engineering department *(See "Personals")*

W. M. Campbell is now manager of the manufacturing department.

J. E. Cranswick is manager of sales of the industrial products division and A. G. Bentley is manager of the manufacturing department.

●

Vlier Representatives.—Vlier Manufacturing Company of Los Angeles, California, has announced the appointment as Canadian distributors of Dibblee Chase Tools, Ltd., 581 St. David St., Montreal, and Higginson Engineering Sales, P.O. Box 23, 275 James North, Hamilton, Ont.

●

John W. Kennedy.—John W. Kennedy has been appointed assistant chief engineer of Amalgamated Electric Corporation Ltd.

●

New Torrington Company Offices. — The Torrington Company Limited have opened their new offices at 925 Millwood Road, Toronto 17, Ontario. The telephone number is Hyland 1149.

●

R. F. Carr, Jr.—Robert Adams Carr, president of Dearborn Chemical Company, Chicago, Illinois, has announced the election, by the board of directors, of Robert F. Carr, Jr., as vice-president of the Company effective January 1. 1953. Mr. Carr will make his headquarters in Chicago after February 1st.

●

Peacock Appointment. — John Waldron Corpn., of New Brunswick, New Jersey, has announced the appointment of Peacock Brothers Limited as distributors of all the products of the Waldron Coupling Division in Canada. These products include the complete line of Waldron "Series A" Gear Couplings, the new Waldron "Junior" nylon gear coupling, the Waldron Francke pin type coupling and the Anchor-Waldron automatic overload cutout and cutout coupling. Descriptive literature may be obtained from Peacock Brothers Limited, Ville LaSalle, Montreal.

●

Crane Changes. — Lucien Cowan has been appointed executive assistant of Crane Limited, at the general office, Montreal. He formerly held the position of co-ordinator.

Robert E. Strain has been appointed general manager of western factories for Crane Limited. He will be in complete charge of the new Crane factory in Calgary as well as that of Alliance Ware Limited (a Crane subsidiary) in Vancouver where he will continue as vice president and general manager.

●

E. W. Moodie

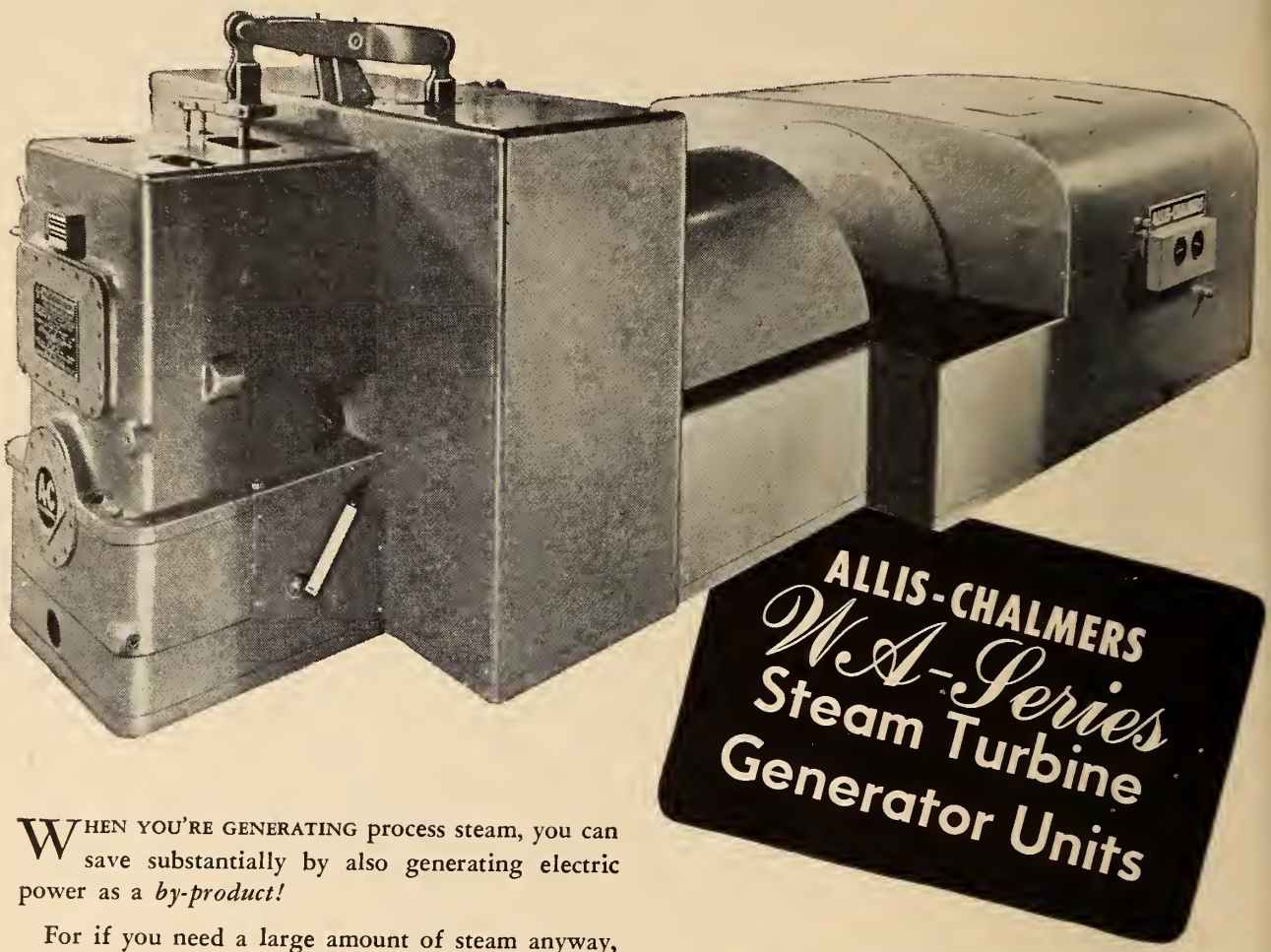
E. W. Moodie. — E. W. Moodie, has been appointed chief engineer of The Square D Company Canada Limited. Mr. Moodie was formerly with the department of public works of Ontario, where he was in charge of electrical engineering and construction.

●

(Continued on page 192)

Let us handle your handling problems
Before we built these 75 ton ladle cranes for the new smelter of Quebec Iron & Titanium Co. Ltd., at Sorel, P.Q., we had already built over 1000 cranes in just over 50 years. This experience was of the utmost value in designing hot metal handling equipment for this extremely arduous 24-hour service.
Your handling problem may be quite different, but whatever it is, you can depend on experienced advice, modern designs and first-class workmanship when you come to Dominion Bridge.
MAIN PRODUCTS OF OUR MECHANICAL DIVISION:
Overhead Cranes... Ore and Coal Unloaders... Ore Bridges... Log Stackers... Dock Cranes... Hydraulic Regulating Equipment... Special Machinery.
Plants and offices throughout Canada.
*Other Divisions: STRUCTURAL, PLATEWORK, BOILER, WAREHOUSE.
MECHANICAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED

Make Your Process Steam Serve Double Duty!



WHEN YOU'RE GENERATING process steam, you can save substantially by also generating electric power as a *by-product!*

For if you need a large amount of steam anyway, it costs only slightly more to establish higher pressure steam conditions for operating a turbine-generator unit as an efficient pressure reducing valve. Process steam leaves the turbine at controlled pressure; power is generated as an economic by-product.

Allis-Chalmers modern WA-Series impulse steam turbine generator units are built especially for the economics inherent in such applications. WA-Series unit designs fit into your plant; tie-in thermodynamically, as well as electrically paralleling with other units or systems.

They are being built in NEMA ratings from 2000 to 7500 kw, for both condensing and non-condensing service, with or without automatic extraction. The WA-Series brings to the industrial and utility power plant the economics of repetitive manufacture as well as the design refinements proved by long steam turbine generator experience.

Purchaser convenience and simplicity are paramount in WA-Series design. Three-bearing construction, above-floor oil piping and bracket bearing, housing type generator — all make a compact unit with simple foundation requirements.

Get the *full* story on the modern WA-Series! Be sure your next generating unit has *all* the latest features. Call your nearest CA-C Sales Office or write for Bulletin B7654 to Canadian Allis-Chalmers (1951) Limited, P. O. Box 37, Montreal, Quebec.

CANADIAN ALLIS-CHALMERS

A-C ALLIS-CHALMERS

52-CAD-10

You too can rely on

B.F.Goodrich RESEARCH *and* "KNOW-HOW"

WHEN IT COMES TO ACID HANDLING SYSTEMS

RIGHT AT YOUR DOOR WITH VULCALOCK. A tanker unloading acid into a B. F. Goodrich "Vulcalock" rubber lined storage tank.

Because of the B. F. Goodrich "Vulcalock" process of rubber to metal adhesion, time and money have been saved—operating costs reduced in many Canadian industries. "Vulcalock" rubber lined, acid-resistant storage tanks receive acids from tank cars. "Vulcalock" rubber lined pipelines deliver acids to on-the-job points at the simple turn of a valve. The time-wasting, dangerous and uneconomical method of handling acids in carboys has been eliminated by this great B. F. Goodrich process . . . another development of B. F. Goodrich research.

If, in your plant or operations, you store and handle acids—contact B. F. Goodrich now. Find out how easy it would be to save yourself time and money with B. F. Goodrich "Vulcalock" rubber lined storage tanks and pipelines. Phone or write your nearest branch of the Industrial Products Division.

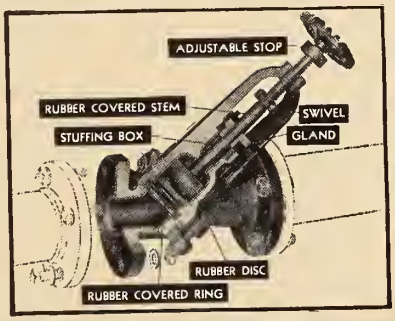
52-524

Industrial Products Division

THE B. F. GOODRICH RUBBER COMPANY OF CANADA LTD.

MONCTON • MONTREAL • TORONTO • KITCHENER • WINNIPEG
REGINA • CALGARY • EDMONTON • VANCOUVER

RIGHT TO YOUR DOOR VIA VULCALOCK. This 3,250 gallon tanker, rubber lined by the B. F. G. "Vulcalock" process, carries Muriatic Acid right to the customer's door. The "Vulcalock" process ensures complete resistance to acid corrosion.



NO ACID CORROSION HERE. This "Vulcalock" valve is an example of how the B. F. G. "Vulcalock" rubber lining affords complete protection. Complete piping layouts can be engineered by B. F. G.

RESEARCH KEEPS B.F.Goodrich FIRST IN RUBBER

B.F.Goodrich

Engineered

INDUSTRIAL PRODUCTS

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 188*)

L. A. Stacey. — In keeping with the policy of replacing U.S. personnel, E. V. Rippingille, Jr., president and general manager of General Motors Diesel Limited, announced, on January 3, the promotion of L. A. Stacey to the position of service manager. He replaces T. N. Snyder who is being transferred to the Cleveland Diesel Engine Division of General Motors Corporation at Cleveland, Ohio.

Only five of the fifteen original key personnel from the United States are with the Canadian Company today. The remainder have been replaced by Canadians.

Mr. Stacey is a graduate in mechanical engineering from the University of British Columbia. In June, 1950, he joined the service department of General Motors Diesel as an operating instructor. He was promoted to maintenance instructor in February, 1951, and subsequently to service and district engineer.

●

H. A. Turner.—Harold A. Turner has been appointed to the sales staff of Charles Churchill (Canada) Ltd., to handle machine tools.

●

Kent-Norlantic Ltd.—The former Canadian Branch of George Kent Limited of London and Luton, England, has now terminated its operations at the Royal Bank Building, Toronto 1. In its place a new and separate Canadian company, Kent-Norlantic Limited has been incorporated and has established a plant and offices at Horner Avenue, Toronto 14, Ontario.

●

G. S. Hanna.—G. S. Hanna has been appointed director of the petroleum division of the Department of Defence Production. He has succeeded Dr. D. M. Morrison who has returned to the Shell Oil Company of Canada Limited.

●

W. A. Wachsmuth. — Permutit Company of Canada Limited has announced the appointment of William A. Wachsmuth to the position of district representative in charge of the Toronto Office at 137 Wellington Street, West.

●

J. W. Henley.—J. W. Henley has been appointed industrial relations manager at Canadian Westinghouse Company Limited, Hamilton, Ont.

●

J. W. Henley

New Reliance Office.—As a further step in providing improved customer service, Reliance Electric & Engineering (Canada) Ltd., has moved its Toronto district sales office to larger quarters at 3086 Bloor Street West, Toronto.

The new office has also increased its staff of sales engineers and has added improved office facilities. Activities of the new Toronto Office are under the direction of V. E. North, district manager.

●

New Canadian Company.—On Sept. 5, 1952, The Owatonna Tool Company with home offices at Owatonna, Minnesota, incorporated in Canada under the name of Owatonna Tool Co. of Canada Ltd.

Earl Maybee who is well known in automotive and industrial circles in Canada, introduced the Owatonna Tool Co. line in 1945 as Canadian representative through automotive and industrial jobbers. He has been elected vice-president and general manager of the Canadian operation.

The new Company has acquired property and is building new premises for offices and warehouse at 40 Birch Avenue, Toronto.

●

Chas. Warnock & Co. — Charles Warnock and Company Limited, of Montreal, Toronto, and Hamilton, announce the following changes in their Company officers, made necessary by the untimely death of J. M. Fairbairn, M.E.I.C., the late president.

R. B. Jones, M.E.I.C., is chairman of the board and general manager. *(See "Personals")*

S. E. Goodwin, is president, F. L. Windsor is vice-president, Gordon Harvey, is assistant vice-president, Charles Hawke, M.E.I.C., is chief engineer. *(See "Personals")* Mrs. Jean Macdonald, is secretary and V. C. Iverson is treasurer.

The corresponding changes in Charles Warnock's associated company — Construction Borings Limited — are: R. B. Jones, M.E.I.C., is president, Gordon Harvey, is vice-president, Charles Hawke, M.E.I.C., is chief engineer.

●

Dr. D. M. Morrison.—Following his return from the Department of Defence Production to the Shell Oil Company of Canada Limited, Dr. D. M. Morrison, was appointed manufacturing manager of Shell Oil Company of Canada Limited. While in the service of the Government, he was director of the Petroleum Division. Dr. Morrison will have headquarters in Toronto and will direct Shell's manufacturing operations throughout Canada.

●

Dominion Bridge Appointments.—The following executive changes have taken place at the Dominion Bridge Company Limited.

F. W. Evens who has been secretary-treasurer of the Company for 24 years has retired. He has been succeeded by Wm. Baxter and the assistant secretary-treasurer will be D. H. Smith.

●

(*Continued on page 196*)

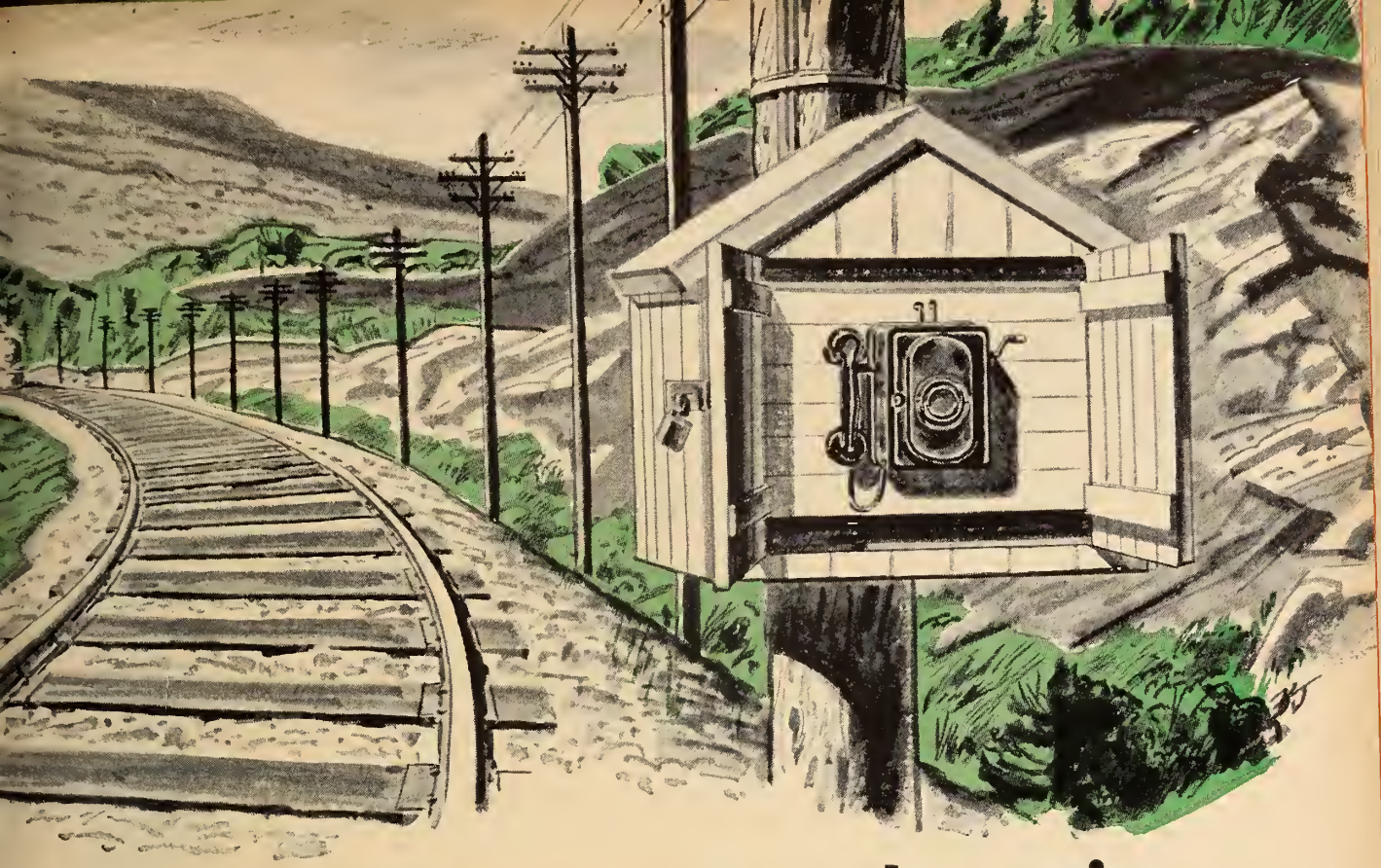
FOR SALE — *Direct from User*

ONE WESTINGHOUSE A.C. TURBO GENERATOR SET, 4,000 KVA., 2,400 volts, 3,600 RPM., 2 phase, 60 cycles, direct connected to a Westinghouse Parsons Type Steam Turbine operating at 175 p.s.i. — Complete with generator control, metering and switching equipment and 3 Babcock & Wilcox Safety Water Tube Boilers, 500 HP each, complete with all station auxiliaries.

This equipment was installed in 1914 and operated intermittently until 1938. In 1949 it was completely rehabilitated and operated from January to May, 1949.

FOR FURTHER INFORMATION

Direct enquiries to: THE OTTAWA TRANSPORTATION COMMISSION
56 SPARKS STREET, OTTAWA, ONT.



complete advisory and supply service to the transportation industry by

ommunications Specialists

Whether it's a single monophone for a local service bus line or a complete communications system for a national railway, Automatic Electric is the logical source of supply. From heavy trolley wire to intricate switchboard cables . . . from call box equipment to complete automatic telephone systems . . . design, production and delivery service are under one control through our completely Canadian manufacturing facilities at Phillips Electrical Works Ltd., Brockville, and our sales offices and warehouses from coast to coast.

Inquiries are always welcomed at your nearest Automatic Electric office.

Distributor in Canada

AUTOMATIC ELECTRIC

(CANADA) LIMITED

HEAD OFFICE: 26 Hollinger Road, Toronto 13, Ont.

ONTREAL • OTTAWA • BROCKVILLE • HAMILTON • WINNIPEG • REGINA • EDMONTON • VANCOUVER

TOWERING 115-FOOT STACK WELDED WITH STELCO "ELECTROD"

THE MARK OF QUALITY

19 TONS OF STELCO PLATE AND 500 POUNDS OF No. 704D STELCO "ELECTROD" CREATE ALL-WELDED SOAKING PIT STACK

● Completely shop fabricated and shipped on three flat-cars from Sarnia to Hamilton, erection on site took a matter of two and one-half hours. Customer inconvenience was reduced to a minimum.

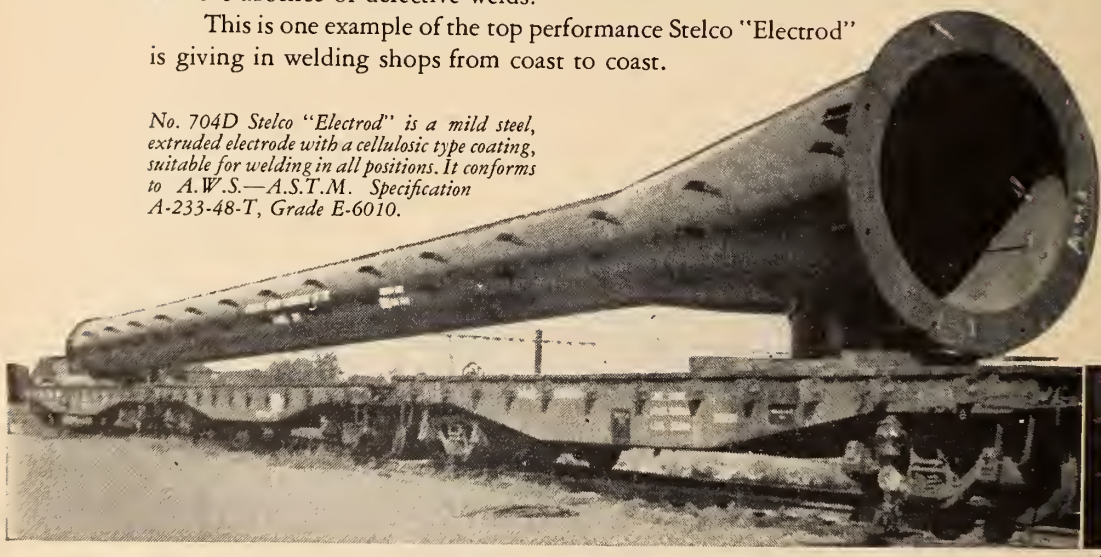
A unique shop-fabricating procedure was followed which proved the high strength and versatility of Stelco "Electrod" No. 704D.

Six-foot sections, five feet in diameter, were formed and tack welded along the longitudinal seam with 1½" long tack welds on 12" centres. The sections were welded together forming a 100-foot length self-supported on two rollers demonstrating the high strength of the tack welds. Complete welding of the longitudinal seams followed.

The welders reported very satisfactory operation, good production rates and the absence of defective welds.

This is one example of the top performance Stelco "Electrod" is giving in welding shops from coast to coast.

No. 704D Stelco "Electrod" is a mild steel, extruded electrode with a cellulosic type coating, suitable for welding in all positions. It conforms to A.W.S.—A.S.T.M. Specification A-233-48-T, Grade E-6010.



Unsupported during shipment—illustrates the strength of the all-welded stack.

The 115-foot stack, bricked and erected at Stelco's Bloom Mill, Hamilton Works.

THE **Steel Company of Canada,** LIMITED

WR 5209

EXECUTIVE OFFICES
HAMILTON — MONTREAL

STELCO
THE MARK OF QUALITY

SALES OFFICES: HALIFAX, SAINT JOHN, MONTREAL, OTTAWA, TORONTO, HAMILTON, LONDON, WINDSOR, WINNIPEG, VANCOUVER
J. C. PRATT & CO. LIMITED, ST. JOHN'S, NEWFOUNDLAND

ductile iron

...a strong, tough, ductile cast iron... readily machinable

The high yield point of Ductile Iron and its excellent machinability, are combined with adequate toughness. In applications where high wear resistance is required the iron can either be supplied with a chill or with a heat treated surface having hardness in the order of 500 Brinell.

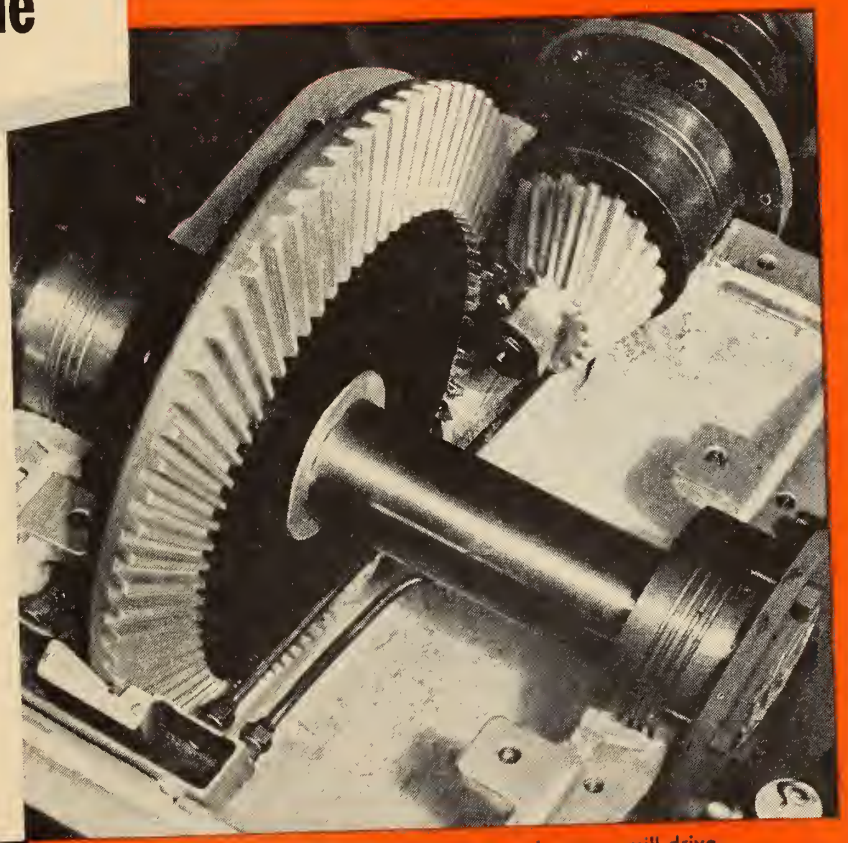
Ductile Iron is highly fluid at the casting temperature and so produces intricate mould detail faithfully; yet it offers good resistance to shock loading and, when properly treated, excellent resistance to wear.

For many applications involving cost and machining factors, Ductile Iron is the economic choice.

For additional information write to The International Nickel Company of Canada, Limited, or to any of the foundries listed.

INCO *proven service*

Inco's experience in working closely with foundries, metallurgists and design and production engineers has developed a fund of valuable data. Inco's technical staff is ready at all times to assist you.



Flame-hardened Ductile Iron ring gear in paper mill drive

Companies licenced to produce DUCTILE IRON

ell Foundry Co. Limited, St. James, Man.

Canada Iron Foundries, Limited
Montreal, P.Q.

Cockshutt Farm Equipment, Limited
Brantford, Ont.

Dominion Wheel and Foundries, Limited
Toronto, Ont.

Lakeside Foundry Limited
Port Colborne, Ont.

Letson & Burpee Ltd.
Vancouver, B.C.

Otaco Limited, Orillia, Ont.

EMBLEM OF INCO SERVICE
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED · 25 KING ST. WEST, TORONTO, ONT.

(*Continued from page 192*)

New Equipment and Developments

Food Processing Vibrator. — A new vibrating screen for the food processing industry has been introduced by Link-Belt Limited. It will be known as the Vibro-Clean Screen. It is designed for effective removal of foreign matter from vegetables and for rapid dewatering without damage to the product. The Vibro-Clean Screen has no ledges or pockets to cause bacteriological build-up. Dewatering and sizing efficiency has been improved by the use of a specially developed screening deck.

Further details, including drawings and dimensional specifications, may be obtained from Link-Belt Limited, at Eastern Avenue at Leslie and Keating Streets, Toronto.

●

New Vancouver Building. — Formation of a private company, George Development Company, to build Vancouver's new skyscraper office building at Burrard and George Streets has been announced by city architect, C. B. K. Van Norman, originator of the project.

Mr. Van Norman, who is president, says directorate of the new Company will be disclosed shortly.

It is estimated that construction will begin in March, 1953, and will be completed by June, 1954.

Mr. Van Norman has reported that complete financial arrangements for the multi-million dollar, 19-storey development has been finalized by the Metropolitan Life Insurance Company of New York and Eastern Canadian Investment interests.

Construction costs have been estimated at between $5 and $6 million.

●

Largest Dredge.—What is claimed to be the world's largest hydraulic pipeline dredge, the "Hydro-Quebec", has started work in the Beauharnois Canal. The dredge is deepening and widening the canal to provide the volume of water necessary to operate the expanding facilities of the Quebec Hydro-Electric Commission. When completed the Beauharnois installation will be the largest single site hydro-electric plant in the world producing more than 2,000,000 horsepower.

The 15 mile long Beauharnois Canal between Valleyfield and Beauharnois, Quebec, is the life-line of the Beauharnois power plant. Eventually it will direct practically the entire flow of the St. Lawrence River. Included in its 3,300 foot width is a navigation channel 600 feet wide and 27 feet deep, which will permit passage of ocean-going vessels.

The giant hydraulic dredge, like those that dug the Panama Canal, and maintain it, was designed by the Ellicott Machine Corporation, Baltimore, Maryland, U.S.A. It has already pumped boulders up to 30 inches in diameter and weighing as much as 1,000 pounds each. Preliminary digging and production trials have been completed and full scale operation will start in the spring.

●

Fuel Additive. — A new fuel addition agent which prevents screen and filter clogging of household and industrial oil burners is available in commercial quantities from Monsanto Chemical Company.

"Santolene H" is the name of the new product. It prevents clogging in three ways—by inhibiting the formation of fuel oil sludge and sediment, by preventing deposition of sludge and sediment already present and by sharply reducing rust.

Diesel engine tests on fuels treated with Santolene H indicate that identical benefits result, without harmful effects to engine operation or deposits.

●

Dual-Frequency Refrigerators. — Canadian Westinghouse Company Limited has started production of dual-frequency refrigerators in one model. The scheme, originally suggested by the Ontario Hydro and developed by Westinghouse, will save the Hydro an anticipated $12,500,000 on frequency changeover in Southern Ontario.

When changeover is made from 25 to 60 cycles, Hydro workmen will merely move a plug.

●

Vancouver Bridge.—The latest estimate on the opening of Vancouver's new $11,000,000 Granville Bridge to traffic is early in March, next year. By that time more than one mile of approach ramps will be ready. The only work remaining will be the traffic cloverleaf systems at each end of the bridge.

●

Pipe Hangers. — Constant support that is mathematically perfect for all positions of travel for high temperature process and steam piping is claimed for the new Model "R" Grinnell Constant support hangers. An exclusive feature of their design permits 10% increase or 10% decrease in their load by field adjustment of a single bolt, without impairing their constancy.

This new design results in hangers which are smaller in size for the loads carried. Less head room is required and Model R Constant support hangers can be bolted directly to the building structure and the frames are drilled for either single or double rod suspension. Three regular frame sizes providing maximum travels of 4 inches, 8 inches and 12 inches will take care of all loads from 48 pounds to 9,304 pounds.

●

Sales Record. — Johns-Manville sales volume in 1952 established a new all-time record.

●

Accurate, Inexpensive, Calculator.—Of particular interest to engineers required to do rapid or accurate calculating is the "Curta" portable calculator which adds, subtracts, multiplies, divides, square roots and cubes. All factors can be checked back after completing the computations. A number of 8 digits can be multiplied by one of 6 digits and an answer of 11 places will be given.

It is claimed that this "Curta" Calculator is more accurate than a slide rule where additions and subtractions are needed besides the other operations and where guessing of the decimal point must be avoided.

The machine weighs half a pound and is approximately the size of a fishing reel. It is a first class precision instrument of all metal construction, completely corrosion free and the axles run on dry bearings and requires no oiling. The machine is of Swiss manufacture but complete technical service is available in Canada. For complete information communicate with General Adding Machine Company, 229 Yonge St., Toronto, Ont. Sample Calculators, with instructions, will be mailed to Institute Members, for trial, on receipt of application written on official company letterhead.

●

Nickel Output. — In presenting a year end review of the free world's nickel industry, Dr. J. F. Thompson, chairman of the board of directors of The International Nickel Company of Canada, Limited, stated that it is estimated that the output of nickel will approximate 315,000,000 pounds as compared with 295,000,000 pounds in 1951. Canadian production will be approximately 280,000,000 pounds or about 90 per cent of the total. The free world production of nickel is believed to be over five times that of the rest of the world.

●

New Monsanto Laboratory. — On January 23, Monsanto Canada Limited officially opened their new $400,000 research laboratories and pilot plant at Ville LaSalle, Montreal.

The new laboratories will be named the L. G. Ryan Research Laboratories in honour of Leo G. Ryan, the present chairman of Monsanto (Canada) board of directors and founder of the Canadian Company. The new building will house the latest in chemical research equipment instrumental in the development of new and better chemicals and plastics.

The staff of the new laboratories will conduct both fundamental research and applied research in the field of industrial chemistry. All activities of the laboratories will be under the direction of Dr. F. J. Leger, director of research for Monsanto (Canada) Limited.

●

Huge Fan.—The only one of its type in Canada, a towering 20-ton exhaust fan, shaped like a huge malted milk container, has been installed by The International Nickel Company of Canada, Limited, to ventilate the underground workings of the new caving project at its Creighton Mine in the Sudbury District of Ontario.

The giant vertical fan, driven by a 350-horsepower motor weighing five tons, ventilates the workings by a flow of fresh air at the rate of 300,000 cu. ft. per minute. The fan draws the air down from the surface, directly through the caved or broken ore, circulates it through the underground workings and carries it back to the surface through a main return shaft. It is at the top of this shaft that the fan is mounted.

(*Continued on page 201*)

Is this your boiler-room dollar?

DOLLARS you invest in your boiler-room don't go to work and bring in returns automatically. The less efficient your boiler-room, the less each dollar does for you—and the more it costs you to operate your plant.

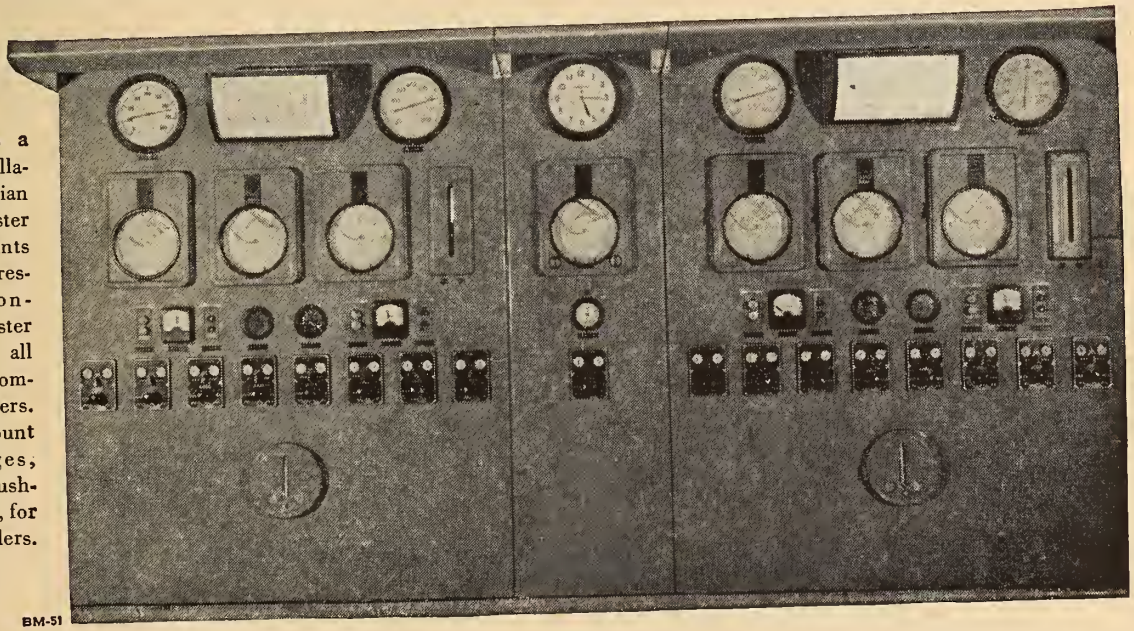
To get the most from your boiler-room dollars, the fuel and equipment they buy must do the most efficient job possible. Here's where Bailey Meters and Controls can help.

1. Bailey Efficiency is Unequalled. Bailey Controls, working from accurate measurements of Bailey Meters, positively reduce fuel consumption and operating costs as well as adding greatly to safety in the plant.

2. Offer Complete Range of Equipment. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer complete boiler control systems.

3. Experienced Engineering Service. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

4. Sales-Service Conveniently Located. Bailey sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems. You get prompt, experienced service with a minimum of travel time and expense.



Shown at right is a typical Bailey installation in a large Canadian paper mill. The master panel, center, mounts the master steam pressure-recorder controller, the plant master selector valve, and all other equipment common to both boilers. The side panels mount recorders, gauges, meters, controls, push-button stations, etc., for the individual boilers.

BM-51

For maximum safety and savings in your steam plant, consult your local Bailey Engineer; or, write for Bulletin 15-C which briefly describes Bailey Meters and Controls. We're proud to stand on our record: "More power to you!"

Bailey Meter Company Limited

HEAD OFFICE: 1980 CLAREMONT AVE., MONTREAL
BRANCH OFFICES: HALIFAX TORONTO WINNIPEG VANCOUVER

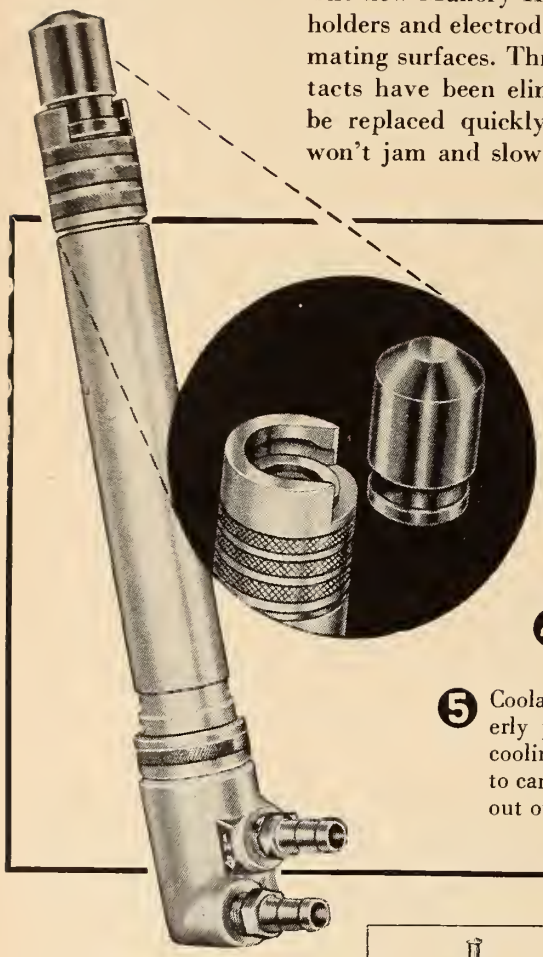
J. M. & M. announces the "Nu-Twist"*

. . . an entirely new approach to electrode and holder construction for spot welding pressures over 6000 pounds

The new Mallory Heavy Duty "Nu-Twist" holders and electrodes are designed with flat mating surfaces. Threaded and tapered contacts have been eliminated. Electrodes can be replaced quickly and easily . . . they won't jam and slow down production.

If you are using spot welding pressures over 6,000 pounds in your plant on aircraft structures, ordnance equipment, jet engines and similar components . . . "Nu-Twist" holders and electrodes will save "down time" . . . speed production. Study the cut-away and you'll see why.

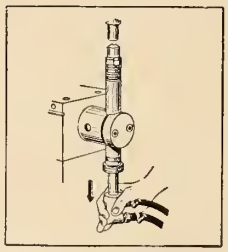
** Trademark; Patent Applied for*



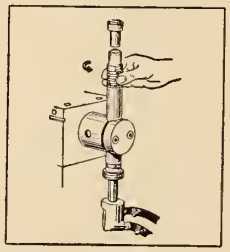
1. Manually operated locking nut requires no tools and permits fast, easy replacement of electrodes.
2. Flat, silver-plated mating surfaces between electrode and holder give good electrical contact and effectively support the highest welding pressures.
3. "O" Ring seal provides water tight seal at all times.
4. Double groove construction in locking nut positively aligns electrode in holder.
5. Coolant hole and wall thickness properly proportioned to insure efficient cooling with adequate metal section to carry higher welding currents without overheating.

Write for your copy of Bulletin 8-17. It is just off the press and contains complete data on "Nu-Twist" holders and electrodes.

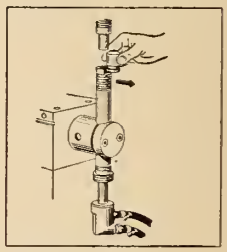
"Nu-Twist" electrodes are fast and easy to change . . .



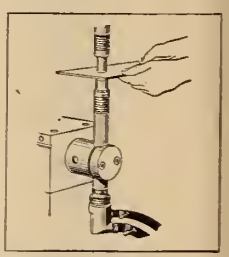
1. Shut off water and pull down coolant head.



2. Loosen locking nut.



3. Slide out old electrode . . . slide in new one.



4. Reassemble and you're ready to weld.

JOHNSON MATTHEY & MALLORY LIMITED

110 INDUSTRY STREET, TORONTO 15.

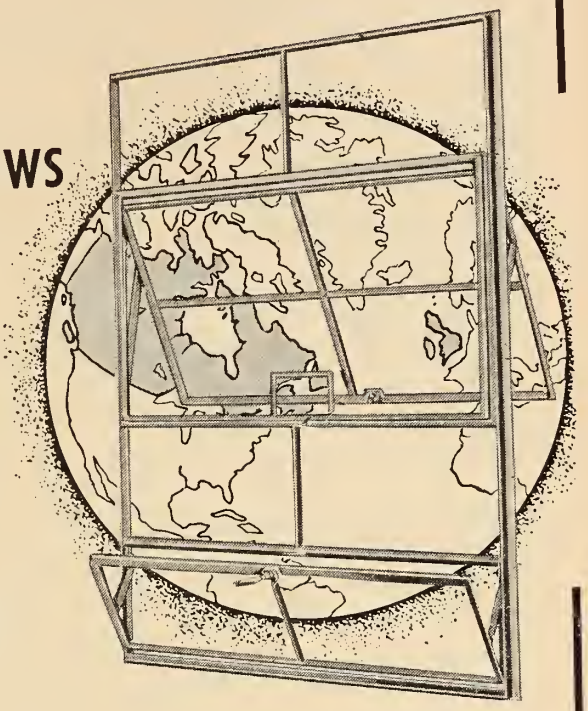
MONTREAL BRANCH, 606 CATHCART ST., MONTREAL, QUE.

SERVING INDUSTRY WITH

Silver Brazing Alloys
Electricol Contacts
Precious Metals
Resistance Welding
Materials
Electrolytic Capacitors

LOOK!

The 2 top names in Metal Windows in Canada and Great Britain



Fenestra
and
CRITTALL

ARE NOW AMALGAMATED for business in Canada

- What does this mean to YOU, Mr. Buyer of Metal Windows? It means that, because CANADIAN METAL WINDOW & STEEL PRODUCTS LTD. have amalgamated in Canada with THE CRITTALL MANUFACTURING CO. LTD. of Braintree, England, you now have the combined experience of *two leading firms* to draw upon when buying Metal Windows. We are HERE—at the end of your telephone—ready to serve YOU. And we now have a vastly increased range of windows to offer you, including:

COMMERCIAL & RESIDENTIAL WINDOWS
IN STEEL & ALUMINUM

HOT-DIP GALVANIZING PROCESS FOR RUSTPROOF WINDOWS

STANDARD, PICTURE & SPECIAL WINDOWS FOR ANY PURPOSE

CANADIAN METAL WINDOW & STEEL PRODUCTS LTD.
139 Stephenson Ave., Toronto, 13 — 4862 Wilson Ave., Montreal, 29

THE CRITTALL MANUFACTURING CO., LTD.
BRAINTREE, ENGLAND

Put your spring problems in our hands ....

Any Size...

Any Type..

Any Quantity

Wallace Barnes Springs

The Wallace Barnes Company, Limited **Hamilton, Ont.**

Western Agent: E. A. Tipping, 957 Notre Dame Ave., Winnipeg, Man.

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 196*)

The fan stands 42 feet above its concrete base, and the diameter at the inlet is 15 feet. The 124-inch impeller has 12 stainless steel blades which are adjustable in pitch through 25 degrees to accommodate the load as the mining operation moves farther from the main return air shaft.

●

British Industries Fair. — Canadian attendance at the 32 British Industries Fair promises to be the highest ever registered. Acceptances, booked passages and accommodations to date and the steady stream of enquiries by Canadian businessmen, federal, provincial and municipal authorities and research institutions, indicate this clearly.

Canadian visitors to the Fair, to be held in London and Birmingham from April 27 to May 8, are promised the most exhilarating exhibition of British products ever held. The coronation has inspired United Kingdom designers, manufacturers and craftsmen to produce their finest wares and to present an exceptional range of new ideas, new methods and new materials.

Some 2,500 leading manufacturers, representing more than 80 industries, will show their latest products at this, the world's largest trade fair. Prices over a wide range of merchandise will be lower and delivery dates will be shorter than at any Fair since the war. As a generalization, firms this year can deliver "in weeks" instead of "in months".

Some 500 manufacturers occupying the engineering section—the largest in the Fair—will all be showing new items. These include the world's largest moving drag-line, the latest conveyor belt lacing machine for coal mines, a multi-purpose air compressor, speedy methods for mixing and weighing powders and grains, the first all-bronze and stainless submersible pump, an electrical finishing process making garments fully absorbent, and an instrument capable of controlling temperatures to within 0.2 degrees C. at working temperatures of 1000° C.

For complete detail on the Fair, communicate with any United Kingdom Trade Commissioner.

●

Welding Blowpipes. — Dominion Oxygen Company Limited, 40 St. Clair Avenue East, Toronto 5, Ontario, has announced two new welding blowpipes — the Purox W-202 for all-purpose welding and the W-201 for light-to-medium work. Thirteen new welding heads of the snap-in-type fit interchangeably on either blowpipe. The heads snap on or out of position with one easy hand motion, and are locked to the handle with a hand-tightening connection nut. Two synthetic rubber "O" rings provide a long-wearing seal between head and handle.

Flames over the entire ranges of both blowpipes are highly resistant to popping and backfires.

Type W-202 blowpipe has ample capacity for continuous heavy welding and heating on any metal from 32 gauge to plate or castings 1" and over in thickness.

The handle of the W-201 blowpipe is 1½" shorter than the W-202; but otherwise the two blowpipes are identical. Because of its shorter handle, jobs requiring more than 55 cu. ft. of oxygen and acetylene per hour are usually too hot for the W-201. This blowpipe is designed for users with a large volume of welding of any metals from 32 gauge to ⅝ in. thick.

Complete information may be obtained from the Company.

●

Ontario Hydro Expansion.—On December 5th, Robert H. Saunders, chairman, the Hydro-Electric Power Commission of Ontario, stated "With initial power expected from Ontario's giant 12-unit, 1,200-000-horsepower Sir Adam Beck-Niagara Generating Station No. 2 by 1954, new transmission line facilities to handle it are being pushed forward in Western Ontario."

"Associated with these facilities is a new 230,000-volt line now being constructed between Glanford, south of Hamilton, to Petersburg Transformer Station, near Kitchener. It is being built at an estimated cost of $2,492,000."

"When power for the Southern Ontario System is first received, in 1954, from Sir Adam Beck No. 2, it will be fed into the 230,000-volt Hydro high tension line network. This network, in turn, feeds it to the strategic points of Allanburg Transformer Station, near Welland; E. V. Buchanan Transformer Station, London; Petersburg Transformer Station, near Kitchener; Burlington Transformer Station, Burlington; A. W. Manby Transformer Station, Islington; and Essa Transformer Station, near Barrie. The J. Clark Keith Generating Station is also connected to this network."

●

Refrigeration For Fish.—A new type of refrigeration equipment from Toronto will shortly go into operation in St. John's, Newfoundland. Until recent years, much of this type of apparatus was imported from the United States.

When Newfoundland entered Confederation, the Province's great fishing industry became of vital importance to Canadian economy. 1½ million tons of fish are caught annually round the coasts of Canada with a market value last year of $200 million. Newfoundland is among the leading producers and exporters of fish in the world.

Owing to the long distances involved in transporting the produce either for home consumption or export, the vast majority of Newfoundland's fish must be processed as soon as it is landed, and a large percentage of Canada's canneries and fish plants are located in the new province.

John Inglis Company Limited recently shipped to Newfoundland several contact plate freezers. These constitute a new manufacturing development for Canada and are considered by fishery officials as an enormous stride in fish-processing equipment. The freezers have a capacity of 1,000 pounds of produce per hour each, and are installed at the plant of Fishery Products Limited for the freezing of packaged fillets of fish.

In shape the freezers are like boxes approximately six feet high, eight feet wide and five feet deep. The product is fast frozen in packages under hydraulic pressure. This pressure on the packages speeds up the freeze and maintains uniform package shape.

●

Business Outlook.—Commenting on the business review and outlook for 1953: H. H. Rogge, President, Canadian Westinghouse Co. Ltd., said: "Canada's growth during the past few years has been unparalleled. Since the war, this rapid expansion has been caused in part by increased private and capital investment, accelerated exploitation of natural resources and increased foreign trade. Accompanying this growth has been a tremendous consumer demand supported by a greater population, increased employment, higher wages, a higher standard of living, and a strong desire for new and improved products."

" . . . This growing consumer demand must be analysed in order to foresee the inevitable ups and downs that do occur in any expanding economy. Here we must consider the 'unknown factor' which for no apparent reason may crop up in the mind of the consumer and thus curtail his demands for goods and services. Canadian business can assume, however, that the present phenomenal rebound of consumer buying will continue well into 1953 with more pressure on manufacturers for new products and competitive pricing.

" . . . Much of the buoyancy in retail buying of consumer durables has been the direct result of the removal of credit restrictions. Although this is causing some concern, credit is by no means exhausted and as yet, has not become excessive.

" . . . Another factor ultimately affecting consumer demand is the degree of harmony which exists between management and labour. In the post-war rounds of wage increases, wages have risen faster than productivity with the result that prices have had to go up. Any future wage increases will have more significance than merely increases in prices. The paramount question posed by labour demands is 'how long will the consumer be willing to accept this gradual inflationary increase in prices before resistance begins and causes the market to shrink and unemployment to occur?"

In other aspects, 1953 appears promising. Defence spending, if not increased, will be well maintained, hydro electric and transportation developments are being planned, and the presently favourable construction prospects should be further enhanced by the removal of material restrictions and the deferred depreciation curb. Resource development promises to continue on a large scale during 1953, and the inflow of capital to the country continues to reflect the interest of foreign nations in our basic commodities and our growth potential.

" . . . Our foreign trade outlook, however, is more sobering. Domestic exports have been decreasing recently—mainly a result of a decline in shipments to the United Kingdom which had been buying heavily in Canada despite a persistent dollar shortage. The ability of these overseas markets to increase or even maintain their purchases suggests a soft spot in our economy in 1953.

●

(*Continued on page 204*)

Enjoy benefits of smaller Cleveland worm gear units

WHEN you want a quiet, powerful, dependable drive for a small machine, choose a Cleveland Worm Gear Speed Reducer.

As built by Cleveland, the worm gear reducer is a drive of many advantages:

1. It is compact and inherently quiet, transmitting power with smooth, uninterrupted torque flow.
2. Its right-angled design saves valuable space.
3. It has a minimum of moving parts.
4. Shock load resistance and other factors of safety are high.
5. Rate of wear of case hardened steel worm on nickel-bronze gear is very low, insuring long life.

Illustrated abave are the 10 AT (left) and 00 D (at right) speed reducers.

Write for Bulletin 114F which illustrates and gives engineering data on smaller size Clevelands—many now available for immediate delivery. Peacock Brothers Limited, 224 St. Patrick St., Montreal 32, Que. Also Calgary, Noranda, Sudbury, Sydney, Toronto, Vancouver and Winnipeg.

Representatives in Canada of The Cleveland Worm & Gear Co., and The Farval Corporation.

CLEVELAND
Worm Gear
Speed Reducers

Annual Meeting

Halifax, N.S.

May 20-21-22

Mark your Memo pad

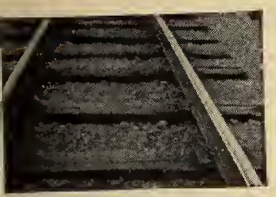
NOW!

...IT BEGINS A *new life*

... as one of the many products made of wood. Under our climatic conditions unprotected wood is soon attacked by moisture, rot, insects and termites.

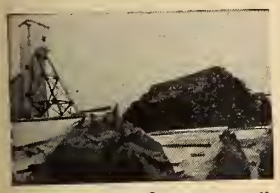
All this can be avoided by using tested and proven "Osmose" wood preservatives. Simply applied by mopping or dipping, "Osmose" utilizes the moisture in the wood to penetrate and protect ... increasing the life of wood from 3 to 5 times.

This economical protection is widely used by Federal and Provincial governments, pulp and paper companies, leading mines and power companies, contractors and others. Its effectiveness is well substantiated by service records available on request. Write for descriptive literature — consult our free service department.



RAILWAY TIES. Osmose-treated Birch ties, 12 years in track and still sound. Untreated life in the same location, 3 to 4 years.

BRIDGE in P.Q. No rot 12 years after treatment. Untreated bridges, same road, needed extensive maintenance after 7 years.



QUANTITIES of "Osmose" used since 1936 in Canadian mines. Under severe conditions, treated wood lasted up to 12 times longer.

OSMOSE

WOOD PRESERVING COMPANY

OF CANADA LIMITED

Head Office and Plant: 1080 Pratt Ave., Montreal

Halifax • Toronto • Winnipeg • Edmonton • Vancouver

MANUFACTURERS OF INDUSTRIAL AND DOMESTIC WOOD, PRESERVATIVES, PRIMERS AND SEALERS

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 201*)

Prismatic Bulkhead Lanterns. — A weatherproof 40-60 watts prismatic bulkhead lantern unit has been added to the non-flameproof underground lighting equipment made by the Simplex Electric Company Ltd., of Broadwell, Oldbury, Birmingham, England.

●

Unit Dust Collector. — Known as the "Dustmaster", a new type of unit dust collector has just been brought out by Dallow Lambert and Company Ltd., of Spalding Street, Leicester, England. At present it is available in the 100 series and will shortly be offered in two other series, 50 and 150, making a total of 135 different combinations from which requirements may be selected. The unit can be supplied with one of five different fans and motors, two different filter assemblies and four different dust storage containers.

This means that applications requiring a large air volume but producing little dust can be dealt with as effectively as those in which the air requirement is small and the dust load heavy; light bulky dusts can be handled as easily as heavy concentrated dusts. The units now available as standard have a fan capacity range of 175 cu. ft./min. to 2,000 cu. ft./min. and are driven by motors of from 1/3 to 2.5 horsepower.

●

Heated Flexible Sheeting. — Flexible heat resistant rubber sheeting incorporating elements is now being marketed by Electro-Thermal Engineering Ltd., of 270 Neville Road, London, E.7, under the name "E.R.S." for all kinds of surface heating applications. It will withstand considerable mechanical pressures and is available for 150, 250 or 400 W/sq. ft. operation from 100/120 V or 200/250 V mains. It is supplied in widths ranging from the narrowest strip up to six ft. wide and 3/16 inch thick. Standard sizes range from 12 inch by six inch to 96 inch by 48 inch (heated area) but special sheets can be produced to suit individual requirements.

●

Treating Woodworm. — In the treatment of woodworm it is essential to secure deep penetration with the insecticide if the pest is to be completely exterminated. This is claimed to be achieved by the new "Rentokil" squeezer injector. The flexible plastic container gives the operator complete control. The tight closure secured with the nozzle washer seals at the point of injection, excluding air and so allowing the timber fluid to be forced into the galleries made by the tunnelling grub. Makers are Rentokil Ltd., Woodworm and Dry Rot Centre, 23, Bedford Square, London, W.C.1.

●

New Valveholders. — Two new valveholders, type B4A and B4D have been added to the Ediswan Clix range of components. These valveholders have silver-plated hardened beryllium copper contacts conforming to R.C.S.C. Specification 251. The quartz-phenolic body has low temperature absorption, high surface and volume resistivity, low permittivity and low power losses. The silver-plated beryllium copper sockets are designed to provide good contact pressure and resistance, while the specified limit figures for insertion and withdrawal forces are attained with a wide margin. Manufacturers are Ediswan Swan Electric Company, Ltd., 155, Charing Cross Road, London, W.C.

●

Direct-Reading Hardness-Testing Machine.—Recently developed by W. and T. Avery Ltd., Soho Foundry, Birmingham, 40, England, are two hardness testers. One of these, known as the No. 6405 direct-reading Brinell hardness-testing machine, is a development of the firm's standard Brinell machine. The load is applied to the specimen through a lever and proportional weights acting on a floating, frictionless penetrator, the load being applied and removed by means of a motor-driven hydraulic pump and ram, the action of which is controlled by a small lever. The unit remains a true Brinell machine in that the impressions produced are in accordance with B.S.S. No. 240, part 1, and can be read at any time by a microscope in the usual manner. It is provided, however, with a dial gauge that indicates the depth of the impression and this reading can easily be converted into the appropriate Brinell number.

The depth recorded is not the depth from the surface of the material to the bottom of the impression but the difference between the depth of an initial impression under a load of 250 kilograms and the final depth under a major load of up to 3,000 kilograms, the depth being read after the major load has been removed so that frame and test-piece distortions do not confuse the result.

It will be appreciated that the system is similar to that used in the Rockwell test but, due to the greater loads imposed and the greater depth, therefore, of penetration, most of the difficulties associated with this form of test are overcome. Tests carried out on the machine have shown an outstanding measure of reproducibility and the ease with which it may be operated enables 300 or more tests an hour to be carried out without difficulty.

●

Medium Pre-Focus Lampholder. — A new medium pre-focus lampholder has been produced by the General Electric Company, Kingsway, London, W.C., for use in cinema projectors and photographic enlargers. The body of the lampholder is of glazed vitreous porcelain with a deep wiring recess having apertures at both sides for through wiring. Although it has a greater overall bulk, it is interchangeable, so far as fixing is concerned, with the company's now discontinued S1230 holder and allows the same focal position for the lamp when fixed.

●

Extending Elements.—The "Universal" safety-guarded replacement pencil elements, obtainable from S. I. Engel, 23-25, Kensington Park Road, London, are made in both nine inch and ten inch lengths. The elements can be extended by easy adjustment up to three inches and are provided with fittings to meet the requirements of various types of reflector fires. Normal loading is 1,000 watts but 750 watts is available on application, and they can be supplied without guard if required or as standard elements without extension.

●

Hand Pallet Truck. — A new pallet transporter has been added to the range of equipment produced by I.T.D. Ltd., 95, Ladbroke Grove, London, W., to extend a materials handling system which, it is claimed, is already being successfully applied to industry throughout the world.

There are certain places where, because of its size, a driver-seated fork truck cannot be economically operated, and the new transporter is said to fill this need. The machine is light and robust while the careful attention which has been paid to the direct-steering unit and suspension has resulted in a short wheel base, which enables it to operate with ease even when laden to its full capacity of 2,240 lb. in a very small area.

At all times the direction of steer is entirely under the control of the operator who can manoeuvre the machine with meticulous accuracy in an aisle width generally no greater than the length of the machine itself. Incorporating the most up-to-date design and manufacturing techniques, both in metal fabrication and hydraulic engineering, this equipment will, it is claimed, provide many years of long and trouble-free service.

●

Lead Earth Continuity Tester. — Now going into production is a new version of the well-known "B.C.E." full lead earth continuity tester, generally known as the full load earth tester. Originally designed and manufactured to fulfil a need in the electrical industry, in order to check and test the earth connection in cables for all types of portable electrical apparatus, this instrument is used mainly in large organizations where portable tools are loaned to employees from a central store.

Each time a portable tool is returned to the stores, it is tested on this test set so that it is certain that, when the tool is next issued, it is in a safe condition. The output of the new tester has been increased to approximately 20 amps. The instrument has been made portable by the inclusion of a handle and the pilot light. This pilot light illuminates if the earth connection of a portable tool is faulty. It is surfaced mounted on the tester so that it can be observed from all directions. The tester can be operated in vertical or horizontal position. Manufacurers are the British Central Electrical Company, Ltd., 6 and 8, Rosebery Avenue, London, E.C.1.

●

Three-Position Toggle Switch. — A three-position toggle switch with a true Q.M.B. action has been designed by Arcolectric Switches Ltd., Central Avenue, West Molesey, Surrey, England, in which each position is obtained with a positive snap. The switch is provided with six terminals for connection and will switch three separate single

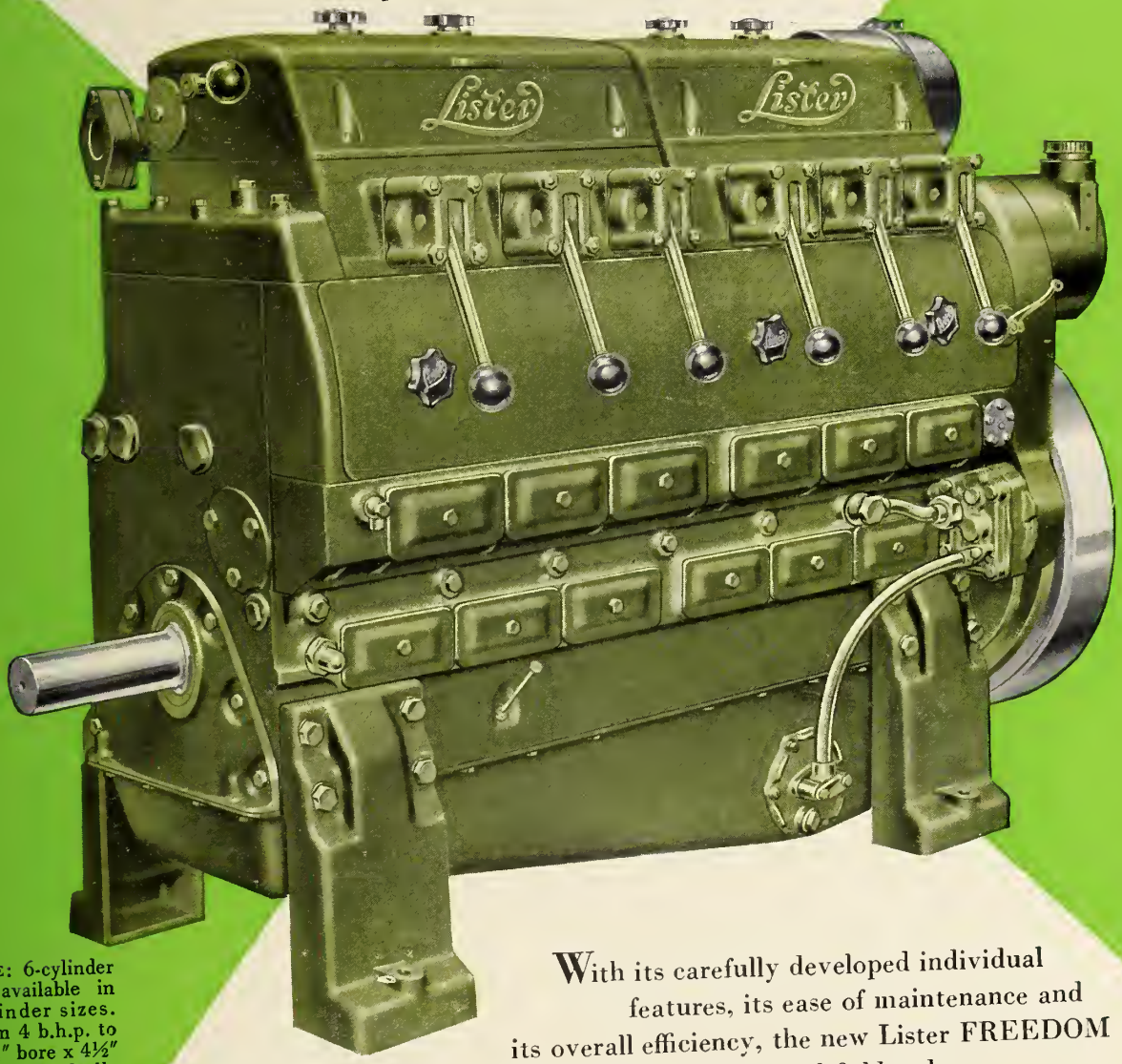
(*Continued on page 208*)

Announcing the New—

LISTER FREEDOM

RANGE OF STATIONARY DIESEL ENGINES

A major advance in diesel design—
higher speeds and greater power—
plus new ease of maintenance



OWN HERE: 6-cylinder
it. Also available in
2-3-4-cylinder sizes.
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b.h.p. 3¾" bore x 4½"
oke. All units ideally
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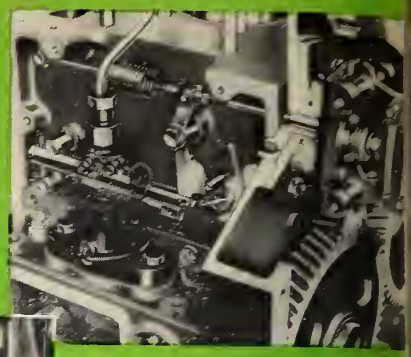
cles.

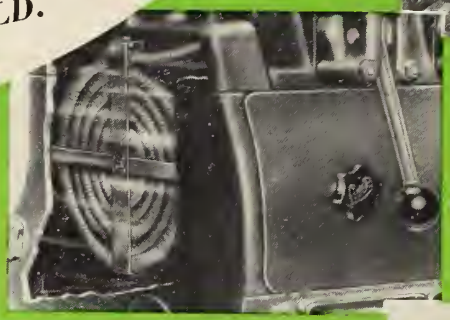
With its carefully developed individual features, its ease of maintenance and its overall efficiency, the new Lister FREEDOM is your best value in the diesel field today.

The new FREEDOM engines represent a significant advance in diesel design and diesel efficiency, the result of a full decade of intensive development work *carried out by highly skilled engineers and designers.* Special effort was concentrated on achieving smaller, more compact diesels, free from any drawbacks which may have been associated with high-speed diesels in the past.

IMPORTANT DEVELOPMENTS

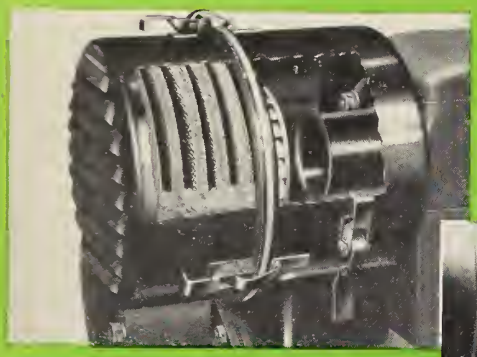
SIGNIFICANT FEATURES THAT MAKE THE NEW FREEDOM YOUR BEST VALUE IN THE MEDIUM SIZED STATIONARY DIESEL ENGINE FIELD.



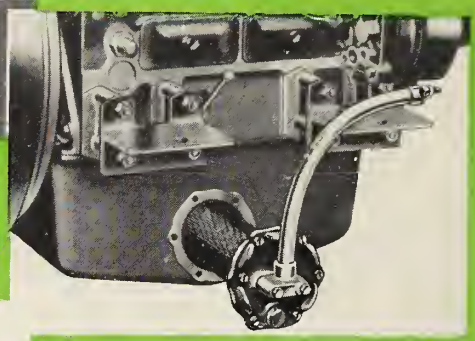


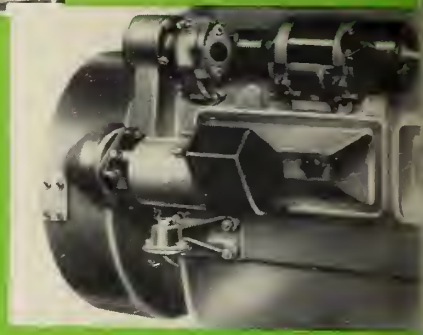
CLOSE SPEED CONTROL
Centrifugal governor maintains "settled" varia within 2%, whilst a fully automatic release g overloading to 10%.

NEW TYPE FUEL FILTER
A large capacity fuel element is contained built-in settling chamber, thus eliminating all necessary piping. Easily removable for clean



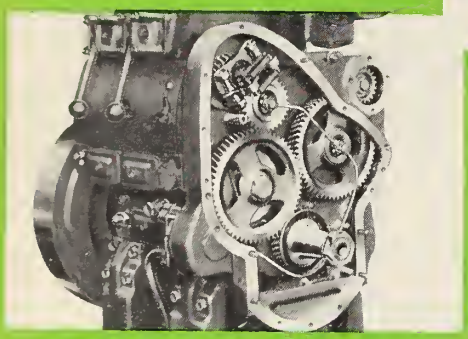
AIR CLEANER AND SILENCER
Large capacity air cleaner of the oil bath type deposits foreign matter in easily detachable oil-filled trough. Lister Patented Air Silencer reduces air intake noise considerably.





DETACHABLE SUMP and STRAINER
A detachable sump gives easy access to all crankshaft bearings. The large capacity lubricating oil strainer is a removable unit, providing a large hand hole for cleaning the sump.

ELECTRICAL STARTING EQUIPMENT
12-Volt Generator and Starting Motor for Flywheel startir

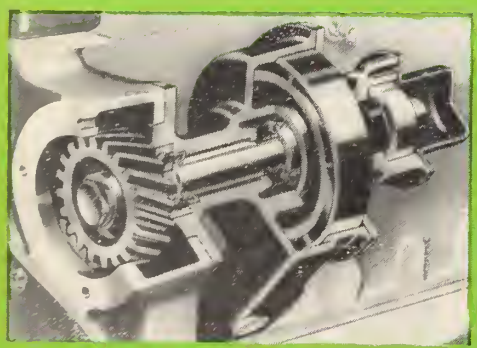


GEARS DESIGNED FOR SILENT RUNNING
Helical gears cut to extremely fine limits ensure a minimum of backlash and consequent silent running. Each gear supplied with pressure-fed lubrication.

More IMPORTANT FEATURES OF THE NEW FREEDOM ENGINES

- New unified US/UK thread system. Service work done with standard tools.
- Cylinder liners chrome-hardened by patented "Listard" process—proven to give greatest wear-resisting surface known.
- Crankshaft built to Lloyd's specifications. Extra large bearings and journals withstand high speed.
- Individual rocker assembly for each valve. Much more compact arrangement of cylinder head—better positioning of valves and injectors.
- Full pressure lubrication to all working parts.
- Easy starting: The Lister dual combustio chamber, operated by a spring-loaded leve gives a higher compression ratio for eas starting.
- Easily accessible gear type oil pump.
- Freedom diesels develop their rated hors power for 12 hours continuously and 10 pe cent overload for one hour.
- Bearings of white metal, steel-backed precisio finish. Big end bearings are copper lined.
- Specially designed for running at high speed without impairing the standard of reliability

Orders filled promptly. • ***Spare parts and service available throughout Canada.***



WATER CIRCULATING PUMP
Impeller-type pump gives minimum output of 250 g.p.h. per cylinder. The driving shaft mounted on ball bearings on either side of the impeller is carried through the pump to provide dynamo and tachometer drives. Carbon seals give long life and freedom from leakage.

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1510 Drummond St. Montreal

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MEDLAND MACHINERY LIMITED
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Free Bulletin to help you select the RIGHT Paper-Insulated Cable

G-E Paper-Insulated Cables are ideal for the transmission of large blocks of power underground, overhead and underwater. Paper-insulated cables are recommended where reduced cable weight is desired, such as the interconnection of apparatus in central stations and substations.

This bulletin describes solid and gas-filled cables, explains why each was developed, and gives application information. Performance and accessory data plus eight complete pages of specifications for cables up to 15 kv are also included.

Ask your C-G-E Office for a copy of Bulletin 4446 or write to
Construction Materials Department, Canadian General Electric Company Limited,
212 King Street West, Toronto, Canada.

CANADIAN GENERAL ELECTRIC COMPANY
LIMITED

53-JA-7

(*Continued from page 204*)

pole circuits. Alternately it can be used to control two circuits, and either the end or central position can be the "off" position.

The contacts are of the self-cleaning low resistance type. The switch is rated five A 250 volts a.c./d.c. Fixing is by means of two inserts tapped six B.A. at one and a quarter inch centres. Applications for this switch include switching electric motors to give two speeds and "off", and controlling electric elements to give two heats and "off".

●

Light "Mud Hog" Pump.—A new design of pump known as the Pegson Marlow Lightweight Mud Hog has just been put into production by a Leicester, England, firm. The unit has already been well tried in North America for duties which include the emptying of septic tanks. Two sizes are being manufactured, the respective capacities being 2,000 gallons per hour and 3,200 gallons per hour.

The pump is completely portable—being mounted on a welded steel chassis with cushion rubber tyres—and is small and compact in design. Power is supplied by a one and a half horse power J.A.P. petrol engine with built-in speed reduction gear. The clean out and drain hole is readily accessible and the pump design allows liquids to pass freely under the diaphragm, increasing pumping capacity and reducing wear.

Other features of the machine include self-aligning crankshaft bearing, strong gear and chain drive with adjustable tension and oil lubrication, fully enclosed chain guard and self-cleaning valve seats. Manufacturers are Pegson Ltd., Minotaur Works, Coalville, Leicester, England.

●

An Ingenious Engine Heater.—An ingenious heater for internal combustion engines which is more than a mere frost protector, as it keeps an engine and circulating water at approximately 100 degrees Fahrenheit above the temperature of the surrounding atmosphere, has been developed by a Surrey, England, firm which specialises in electric water-heaters. This compact unit is only two and a half inches diameter, and projects four inches from the base. It is easy to fix either in a corehole in the engine block or by drilling a hole in a cover plate.

The unit is so designed that the water flows through the hole and circulates around the heating element, circulation being maintained by thermosiphonic action. Operation is perfectly safe as the unit is based on the makers' ring-type element which has proved efficient and reliable in various types of water-heater for many years.

Loading of the heater to be fitted to an engine depends on the circulating water capacity; there are four standard models available with a rating of 375, 500, 750, and 1,000 watts. Equipped with this heater, vehicles, sea craft, and stand-by engines can stand in the open or unheated shelters, where a main supply is available during the winter months without danger of frost and ready to start up again at a moment's notice. Makers are Eltron (London) Ltd., 2A Strathmore Road, Croydon, Surrey, England.

●

New Process For Casting Moulds.—A new method by which moulds capable of flawlessly casting complicated patterns can be produced quickly and cleanly by unskilled labour has been developed by a Birmingham, England, firm. The moulds are made of a mixture of sand and Bakelite resin, and take two and a half minutes to produce. Casting may then be done without moulding boxes or "backing".

It is claimed that these "shell moulds" enable the successful casting of metals which are difficult to cast by conventional means. They are also capable of casting thicknesses of metal.

To make the moulds, a steel pattern is heated to 250 degrees Centigrade and the sand and resin mixture is dropped on and left for two and a half minutes. The shell is then pressed off, and a fresh portion of mixture applied to the pattern. Makers are Bakelite, Limited, Tyseley, Birmingham, England.

●

Pressure Die-Cast Foundry.—Claimed to be the most up-to-date unit of its kind in the world, a new pressure die-casting foundry was recently officially opened at High Duty Alloys, Ltd., Slough, Buckinghamshire, England.

With 7,600 square feet of floor area and a clear 20 feet height from roof to roof truss, high-level lighting over the whole area, wide entrance and exit doors, and the carefully considered siting of the plant, the foundry has a spacious atmosphere free from the gloom and oppressiveness often associated with such places. The company has so blended old and new plant and machines to provide a complete production range at the most economic figure. At the same time, the size range of pressure die-castings has been increased with the result that it is now possible to produce castings in weights ranging from one ounce to 30 lbs.

Rigid precautions are taken to ensure control of the specification of the alloys used; material reaches the bulk foundry in ingot form after analysis by the laboratory and, after melting, is submitted once more to mechanical and analytical tests. It is then carried by overhead cranes to the individual gas-fired furnaces.

●

New Fork-Lift Truck Handles 18,000 Lb. Loads. — A fork-lift truck, the Freightlifter, which can handle loads up to 18,000 lbs. and has a lift of 20 ft., has been put into production in Britain. Powered either by the firm's own petrol engine or a Perkins P6 diesel engine, the Freightlifter has an all-steel welded frame which is heavily braced and counterweighted to ensure stability and freedom from distortion under operating conditions.

Among the special features of the vehicle is the hydraulically controlled side movement device fitted to the carriage and forks, which gives a five-inch lateral movement on either side of centre to facilitate loading and stacking. Another feature is the mast tilt cylinder, which will operate the lift mast to an extent of ten degrees backward and three degrees forward. At a recent demonstration given by the firm, 20 tons of steel girders were moved from one position to another in under five minutes. (Shelvoke & Drewry, Ltd., Letchworth, Hertfordshire, England).

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Hamilton Gear Data. — Hamilton Gear and Machine Co. Ltd., 950 Dupont Street, Toronto 4, offer copies of a new data sheet "Type 'D-W' Double Reduction Worm Gear Reducers".

●

Atlas Steel Calendar.—Atlas Steels Limited, Welland, Ontario, has published an excellent calendar for the year 1953. It carries six portraits in colour, by the celebrated artist and magazine illustrator, Courtney Allen.

The illustrations are based on the theme "Men Who Make Atlas Steels". The portraits show men in the pits, at the furnaces and forges and elsewhere on the production lines of the mile-long plant at Welland. Write to the Company for copies—supply is limited.

●

Ferranti "Flashes". — Ferranti Electric Limited, Mount Dennis, Toronto, publish a periodical "Ferranti Flashes". To obtain copies of this publication, regularly, write to the Company at the address given above.

●

C.I.L. Oval. — Canadian Industries Limited offers *Journal* readers copies of the C.I.L. Oval. This publication is now in its twenty-first volume and it is designed to present, in semi-technical form, information pertaining to C.I.L. products and developments which affect all phases of industry and every day life.

To obtain copies write: The Editor C.I.L. Oval, P.O. Box 10. State whether you prefer the English or French edition.

●

Welding Periodical.—Dominion Oxygen Company, Limited, 40 St. Clair Ave. E., Toronto 5, are publishers of "Dominion Oxygen Tips". This publication is highly informative and will prove to be of great service to those who are concerned with welding activities and problems. To obtain copies write to the Company.

●

Soil Engineering. — The Foundation Company of Canada, Limited, 1900 Sherbrooke St. W., Montreal, has published a profusely illustrated sixteen page booklet, "Soil Engineering Service". Copies of this publication are available to *Journal* readers. Apply to the Company.

●

(*Continued on page 212*)

YOU CAN MAP YOUR CITY FOR FAR LESS THAN YOU THINK!

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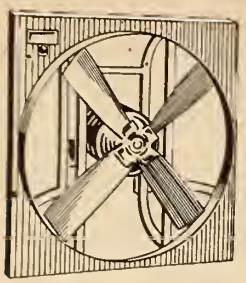
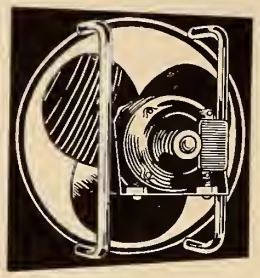
APPLIANCES



Industrial Exhaust Fans



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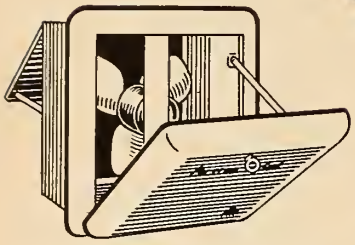
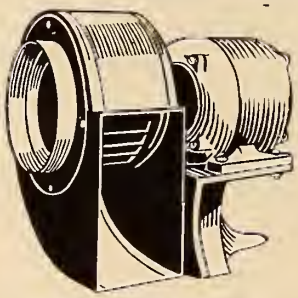
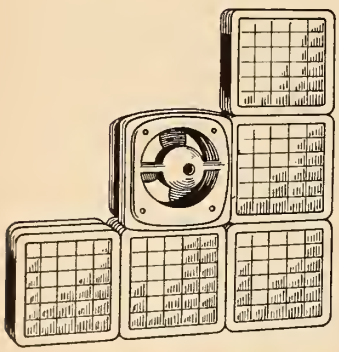


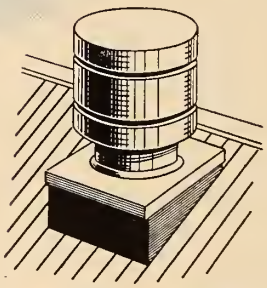
Kitchen Ventilatar De Luxe Cottage Unit



Baby Blower Exhaust Fans



Glass Block Ventilators



Electrically Operated Raaf Ventilatars

CANADIAN ARMATURE WORKS INC.

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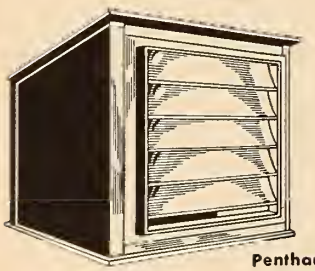
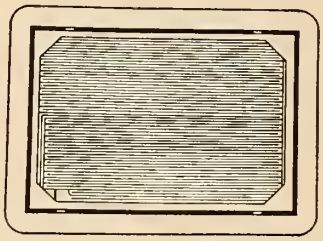
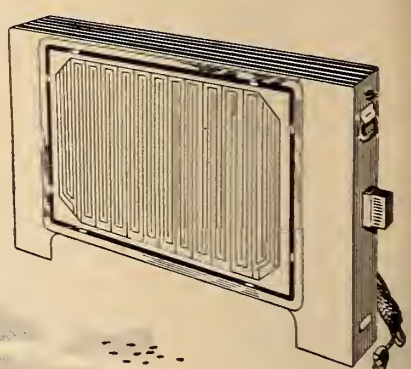
New 40 page catalogue now available.



Penthause Ventilatar Model PH



Recessed Mounting Radiant Electric Glass Heating Panel



Partable Radiant Electric Glass Heater

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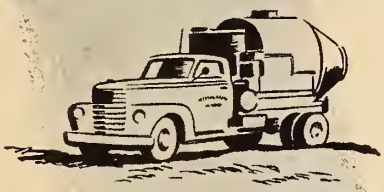

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Applications for Motorola communications equipment are as many and varied as Canada's great industries. Already Motorola 2-Way Radio is the vital, modern tool serving Lumber Companies, Fishing Fleets, Engineering and Construction, Oil and Gas, Bus and Truck Transport, Taxi Operators and even Veterinarians. In many communities Water Works, Light and Power, Police and Fire Departments and Metropolitan Street Railways rely on Motorola FM 2-Way Radio.

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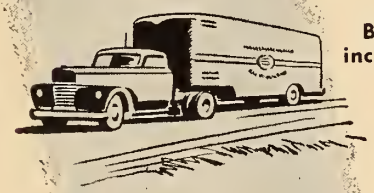

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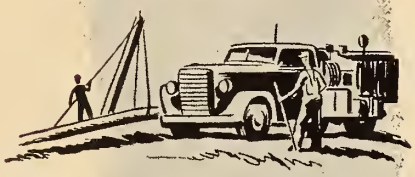

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Communications Division

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 208*)

C.G.E. Prices.—A new price schedule of Panelboards and Flex-a-Power Bus Feeder systems was released recently by the industrial products division of Canadian General Electric Company.

The new schedule takes the form of a catalogue digest and is comprised of two sections. Section A, identified by a blue cover index, consists of forty pages and gives the latest information on prices and electrical circuit hook-ups for Panelboards. Section B, identified by a green cover index, contains similar information on Flex-a-Power Bus Feeder systems.

Copies of the publication (No. 245P) may be obtained from your electrical wholesaler or from your nearest C.G.E. sales office.

●

"Weather Magic".—Trane Company of Canada Limited, Mowat Avenue at King St. W., Toronto, publish "Trane Weather Magic". This publication describes, in simple form, recent applications of Trane heating, cooling and air conditioning apparatus.

To be placed on the mailing list for regular receipt write to the Company at the address given above.

●

"Dominion Engineer". — Number 7 of Volume 19 of the "Dominion Engineer" is devoted to an excellent article "Constructive Salesmanship". To obtain copies of this and other issues of the Dominion Engineer, write to the Company at P.O. Box 220, Montreal, Que.

●

Hockey Schedule. — Ferranti Electric Limited, Mount Dennis, Toronto 15, publish, each year, a small pocket size National Hockey League schedule.

To obtain copies write to the Company at the address given above. Ask for "Hockey League Schedule".

●

Cleveland Worm Brochure. — The Cleveland Worm & Gear Company have released a new interesting, publication entitled "Clevelands at Work".

The publication shows Cleveland units powering equipment in such diverse industries as steel mills, pharmaceutical plants and refineries. For copies of the publication, write to Peacock Brothers, Ville LaSalle, Montreal, who are Cleveland Worm distributors in Canada.

●

Plastic Pipe.—Triangle Conduit & Cable (Canada) Ltd., 4006 Dundas St., West, Toronto, offer copies of a new publication "Triangle Plastic Pipe".

The publication contains information on Triangle's four types: Flexible, Semi-Rigid, Rigid High Impact and Rigid Polyvinyl Chloride Pipe. Detailed tables give chemical and physical characteristics of each type. Also included are advantages of using plastic pipe and simple directions on how to install and join the pipe.

●

Review of "Inco". — The International Nickel Company of Canada Limited, 25 King Street West, Toronto, offer an interesting publication "INCO".

This publication is a digest of information which has been issued by the Company in addresses to shareholders, annual reports, employee booklets and press releases. The publication contains biographies of the Company officials, summaries of plants and their operations, and up-to-date information on proven ore reserves, development and research, products and where they go, employees, etc., etc. Copies are available to readers of the *Journal*.

●

C.L.M. Catalogue.—Canadian Line Materials Limited, Toronto 12, Ontario, has published a digest version of heir Distribution Equipment Catalogue 51.

It presents, in brief form, data and information that will enable quick and correct selection of standard materials for electrical distribution installations. Only materials that are most readily available are listed.

A practical selection of helpful reference data has been included in the back of this twenty page catalogue. Copies may be obtained by writing to the company.

●

Electrode Prices.—Canadian Liquid Air Company Limited, 1111 Beaver Hall Hill, Montreal, offer *Journal* readers copies of their current price list of Electrodes. Ask for Form 676. Write to the Company.

●

Link-Belt Catalogue. — Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, have started distribution of their new, 1,296-page catalogue. It contains 1,673 tables and charts of basic data that greatly simplify the problems of designing all kinds of conveyor systems, mechanical power transmission and many different types of processing machinery.

The publication has required three years for compilation. Distribution is being made as rapidly as possible to industrial and engineering firms, engineering schools and libraries. It is suggested that Institute members who are interested, if copies are not received through their companies, communicate with the Company requesting copies if these are available after initial distribution to the names on the mailing list.

●

Power Transformers.—Canadian Westinghouse Company Limited, Hamilton, Ontario, offer *Journal* readers copy of a publication "Proven Values" which describes the Company's power transformers. The publication is printed in two colours and contains 14 pages of text and illustrations. To obtain copies, communicate with the Company.

●

Geological Report.—The Honourable C. D. French, Quebec minister of mines, has announced the publication of a geological report on the Canimiti River area. This area was examined and mapped by N. B. Gillies for the Geological Surveys Branch of the Department of Mines.

The map-area, which covers 200 square miles in the northern part of Pontiac county, lies 100 miles northwest of Mont Laurier and similar distances southeast of Noranda. Copies of this report (Geol. Rept. 52) which is accompanied by a full-colour geological map on a scale of one mile to the inch, may be obtained from the Department of Mines, Parliament Buildings, Quebec.

●

Instrument Data. — Instrumentation Data Sheet No. 10.19-1 describes the operation and application of the Brown B.t.u. Meter, which simultaneously records differential temperature and flow of a liquid, and provides direct reading of B.t.u. The instrumentation is applicable to heat exchanger testing; measurement of heat transfer in refrigerating and air conditioning installations, and recording of thermal data of processes in pilot plants, etc. To obtain copies, write to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario.

●

Electricity & Chemistry. — Canadian Westinghouse Company Limited, Hamilton, Ont., offer a well-produced publication "Electrical Equipment for Chemical Processing". This catalogue-type brochure will be most useful to members who are engaged in chemical processing industries.

●

Welding Publication.—Canadian Liquid Air Co., 1111 Beaver Hall Hill, Montreal, will be pleased to place *Journal* readers on the mailing list for regular receipt of their publication "Arc and Flame". Communicate with the Company and send your mailing address.

●

Steel Sheeting. — "Armco Steel Sheeting" is the title of a new illustrated folder just issued by Armco Drainage & Metal Products, Inc. It describes two types of sheeting, flange and interlocking, and shows how these can be used to control soil or water. A few of many uses are trenches, cofferdams, shore protection, diversion dams, bridge pier protection and lagging for tunnels and shafts. To obtain copies, communicate with the company at Guelph, Ontario.

●

Jeffrey Publications. — The Jeffrey Manufacturing Company Limited, P.O. Box 428, Montreal, Quebec, offer two interesting publications.

The new Jeffrey "Portable" catalogue is designated by the number C-2001. It contains specifications, descriptive illustrations and pictures showing actual installations of the various types of portable units made by the Jeffrey Manufacturing Company, who have had many years in the building and designing of conveying equipment of portable and permanent type.

The catalogue shows, in condensed form, the wide range of portable conveyors and unloaders having the conveying element of either belt, scraper or apron-handling capacities from 40 to 100 tons per hour of coal, coke and other like bulk materials; also for use in conveying or stacking bags and boxes.

Also available is a new 72 page catalogue illustrating and describing "Jeffrey Bucket Elevators", Catalogue No. 850.

This new catalogue contains pictures of actual installations handling various bulk materials, illustrates various types of elevators, and engineering notes are supplied to aid in selecting units.

There are also tables of specifications covering each type, showing recommendations as to speed and horse power.

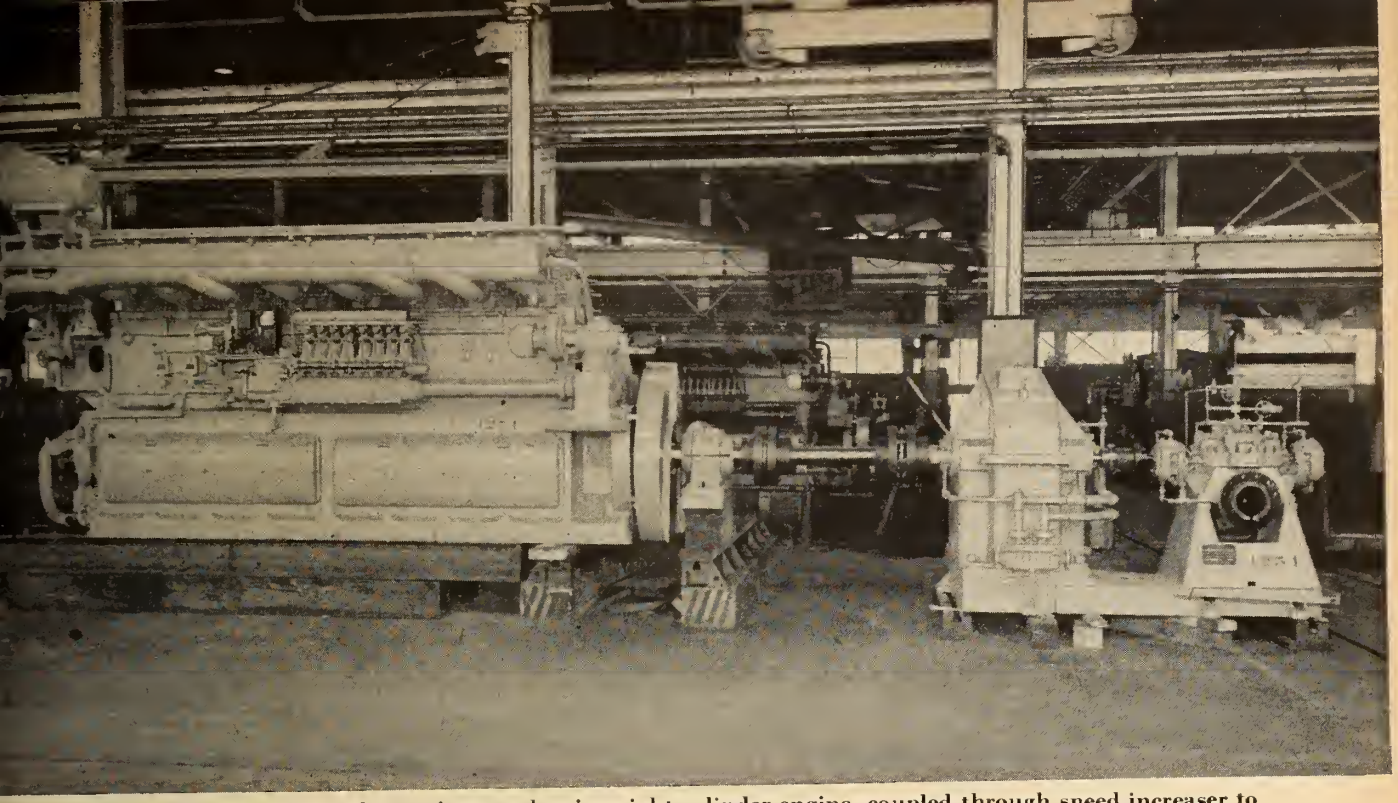


Fig. 3. Shop assembly of pumping set showing eight cylinder engine, coupled through speed increaser to centrifugal pump.

Diesel Engines in Pipeline Pumping Service

by

Hugh Paton

Chief Engineer,
Dominion Hoist and Shovel Company

A paper presented before the Montreal Branch of The Engineering Institute of Canada, Mechanical Section, November 4, 1952.

This paper records the lessons learned in the selection, manufacture and initial operation of Canadian-built diesel engines which power the Interprovincial Pipe Line pumping stations. Showing why diesel engines are uniquely suited for this service, the author describes the engines, pumping sets, turbochargers, heat exchangers, preheaters and pumping station layouts. He also shows how the engines are arranged for dual fuel operation, —either natural gas or crude oil, and the advantages of and precautions necessary in each case.

The extensive oil developments in Western Canada have opened up many markets for engineering products not hitherto developed or manufactured in this country. In particular it has introduced entirely new requirements for the transportation of oil by pipeline. In 1950 Alberta oil was brought to the large centres of population in the East by a combined pipeline and tanker operation, and a pipeline is now being laid to carry it across the Rocky Mountains to the Pacific Coast.

Many of you heard the talk and saw the film given before the Institute a year ago by Mr. Tom Johnson, now president of Interprovincial Pipe Line Company, describing the tremendous task of constructing the pipeline from Edmonton, Alberta to Superior, Wisconsin, a distance of 1,130 miles in 150 days. The film was devoted almost entirely to construction procedure, and gave little emphasis to the engineering design of the line or the means by which it is operated.

The purpose of this paper is therefore to pass on some of the interesting lessons learned in the selection, manufacture and initial operation of the Diesel engines which power this line. There was much to learn, because no major pipeline had previously been designed by Canadian engineers, yet all the responsible engineers, both in the group who designed and built the line and those who produced the engines, were Canadians.

Designing the Pipeline

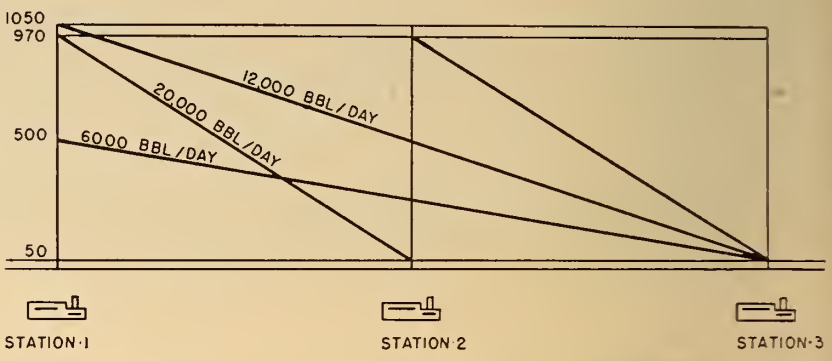
First let us look at the basic operation and power requirements

DIA. OF LINE	THROUGH PUT	TRANSPORTATION COST
INCHES	BBL/DAY	CENTS/BBL
10	20,000	24
20	80,000	12
24	120,000	10

Fig. 1 (above). Table of transportation costs vs. line diameter.

Fig. 2 (right). Hydraulic gradient in a typical line.

Fig. 4 (below, right). Cross-section through engine.

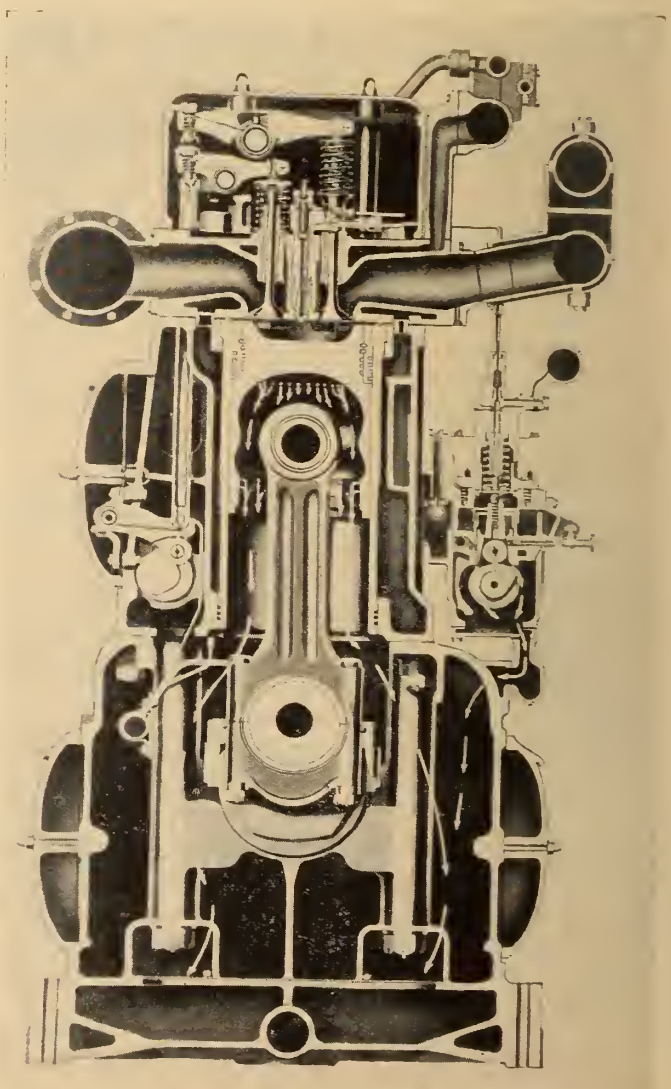


of a pipeline. The diameter of the line is decided by an economic study of the present and future potential throughout, in which the cost of construction, which increases with diameter, is balanced against the reduction in cost per barrel pumped. As an example Fig. 1 shows an estimate of total transportation cost for a recent Canadian proposition involving the piping of crude for a distance of 250 miles.

It is apparent that the largest size of line which can be kept operating up to capacity is going to be the most attractive economically. It also has the best potential for future expansion. Note that the throughput of the 20-inch line is four times that of the 10-inch. Even if the 10-inch were eventually quadrupled, the transportation cost would still be double that of the 20-inch line. This comparison explains why line size in all major projects has increased so rapidly in the past ten years. Lines up to 32-in. diameter are now in service in the Near East.

An important factor in the lower operating cost of the large line is the reduction in pumping power. Even in mountainous terrain the principal duty of the pumps is to overcome friction in the line. In the case of the Interprovincial and Lakehead pipelines there is a static head of 2,000 feet assisting the flow of oil, yet approximately 27,000 hp. is required to overcome the friction losses at the maximum throughput.

Figure 2 shows the effect of friction upon the flow of oil in a typical section of a pipeline. When first installed a throughput of 6,000 barrels per day is obtained at Station 3 by pumping at a pressure of 500 p.s.i. at Station 1. As the traffic builds up the hydraulic gradient or friction loss expressed in p.s.i. per 1,000 feet pipe steepens. At 12,000 barrels per day the pump-



ing pressure has reached 1,050 p.s.i. at Station 1, which is the limit of working pressure for the line.

It therefore becomes necessary to introduce an intermediate station, Station 2, and both Stations 1 and 2 then drop their pressure to approximately 500 p.s.i. for the 12,000 barrel per day throughput, building up again to a pressure of 970 p.s.i. as the 20,000 barrel per day capacity is reached. Still further increase in line capacity may either be accomplished by introducing additional stations, or by looping the line with additional pipe connected in parallel between pumping stations to lower the friction loss.

This diagram reveals two important characteristics of the pumping stations which have a bearing on the selection of the prime mover. The flow and pressure characteristics of the pumps must be very flexible to operate efficiently under the conditions which result from variation in throughput. Exact co-ordination of control between stations is required to maintain the desired pressure conditions in the line, and to avoid surges as flow rates are changed.

Modern pipelines are generally operated on the closed system, which means that there is no float tank or storage capacity at the pumping stations. On large lines, float tanks would have to be very large and costly to have any measurable effect on the control problem. Also they tend to decrease efficiency by increasing the friction losses. However, their elimination does require exact regulation of speed in the line stations, to maintain a constant suction pressure and to prevent surging.

Originally reciprocating ram pumps were universal in pipeline service. They were costly, bulky, apt to introduce pulsations and not particularly flexible. However, it must be said to their credit that they made the early development of pipelines possible, and many of them have built up extraordinary records of service.

In recent years the centrifugal pump has come to the fore. It may be built either in multistage units or single stage. Single stage pumps are employed on the Interprovincial line, each developing 350 p.s.i. at approximately 3,600 r.p.m. The pumps are connected in series, and normally three units are operated to develop a line pressure of 1,050 p.s.i. max. Since only three stages are required at each station, a higher pumping efficiency is obtained than would result from the use of multistage pumps in parallel, and the distribution of load between units is simplified.

Selection of a Prime Mover

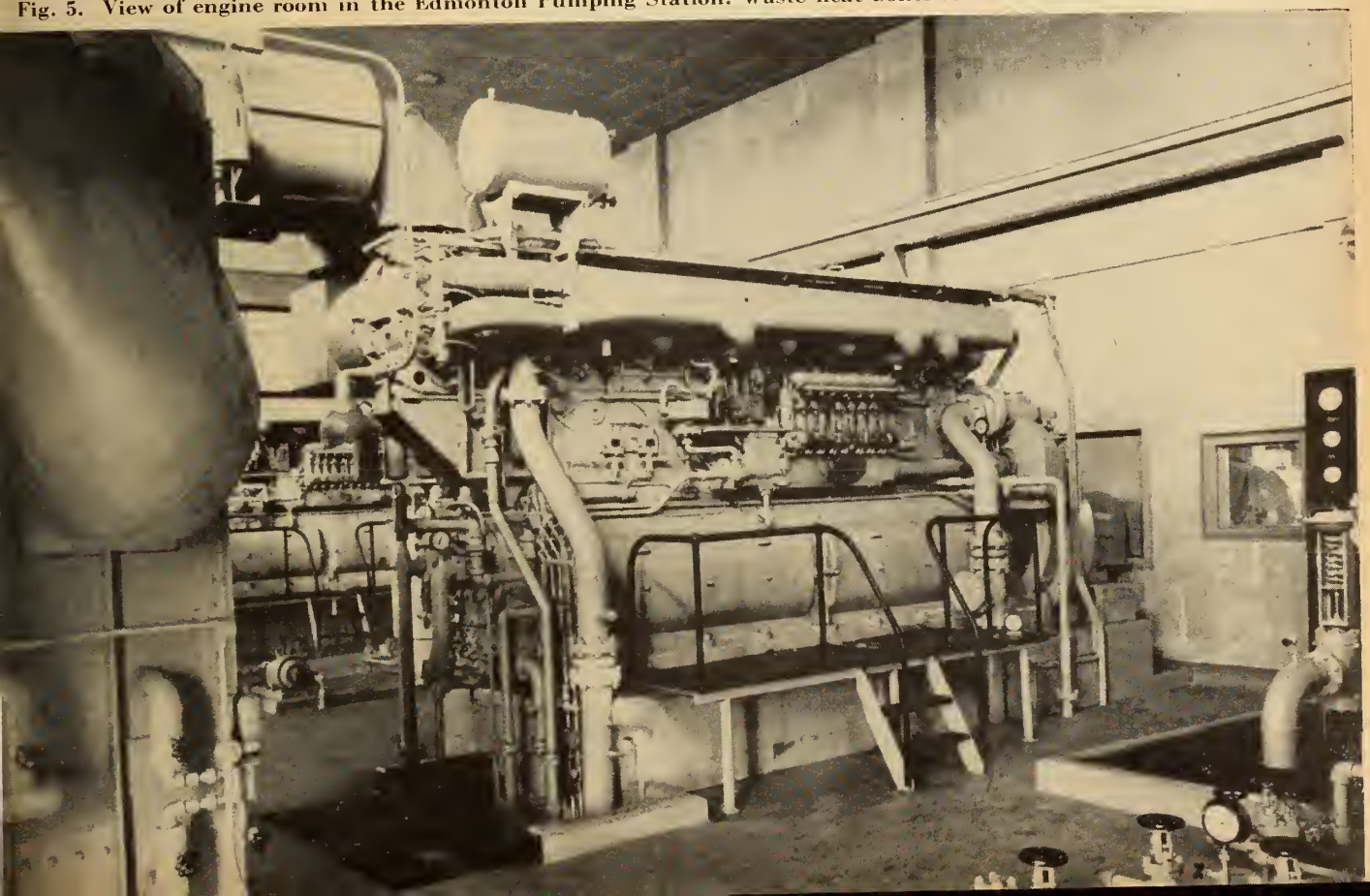
It is a basic philosophy of pipeline engineering that the system must be as independent as possible of external services and sources of supply. A major line such as the Interprovincial, which stretches across three provinces and an international border, must operate all its twelve stations as an integral system. Failure of any one station to carry its share of the load interrupts or slows the operation of the entire line.

The diesel engine is uniquely suitable for this service. It meets the requirements of the pumps, in that it can operate over a wide range of speeds and loads with a very high thermal efficiency. It allows exact control of the pump speed, because it gives practically instantaneous response to control signals.

Its ability to use the crude oil from the line both as its fuel and as its coolant is a particularly valuable characteristic. Supplementary advantages are its ability to use low cost natural gas as fuel, where it is available, without impairing its ability to resume operation on crude oil instantly. Heat recovery from the engine exhaust by means of steam boilers improves the overall thermal efficiency of the station, and provides a reliable and capacious heating system to meet the rigorous conditions of the prairie winter.

A diesel-powered pumping station properly stocked with lubricating oil and renewal parts is

Fig. 5. View of engine room in the Edmonton Pumping Station. Waste heat boiler is shown in the left foreground.



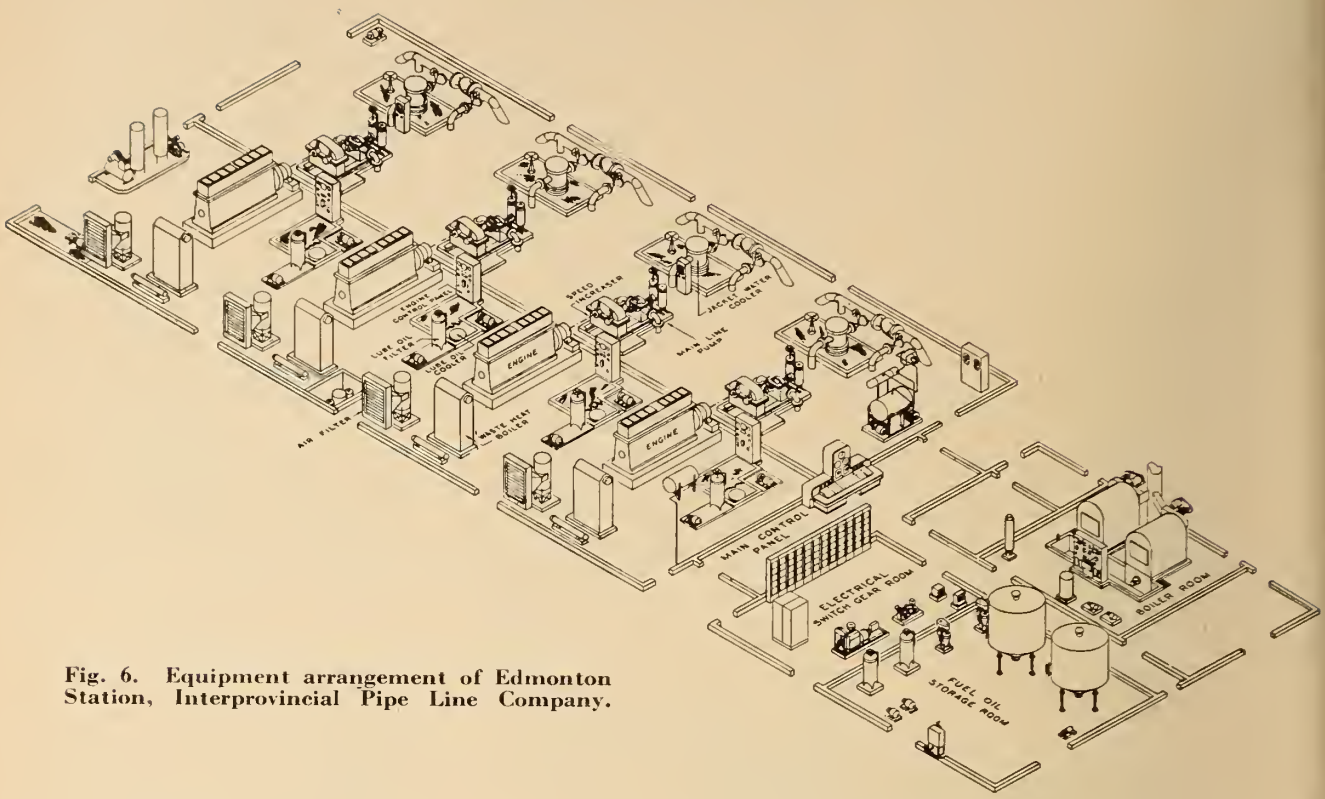


Fig. 6. Equipment arrangement of Edmonton Station, Interprovincial Pipe Line Company.

limited in its ability to operate independently of outside services far more by its personnel and their requirements than by its mechanical equipment, whether it be located in northwestern Canada or the Arabian Desert.

The engines selected by Interprovincial are of the 4-cycle type, 12½ in. bore by 13 in. stroke. Two sizes are used, the eight cylinder rated at 1,080 hp. at 600 r.p.m. and capable of developing up to 1,170 hp. continuously at 650 r.p.m., and the six cylinder rated at 810 hp.

All of the engines in the Canadian stations are turbocharged, and operate at a maximum BMEP of 112, except those at Gretna Station where the duty requirements presently permit employment of six cylinder naturally aspirated engines developing 540 hp. at 600 r.p.m. With minor modification these engines may be turbocharged, when the duty becomes more severe, to develop 810 hp. each.

This moderate speed, short stroke type of engine has proved particularly suitable for pipeline service, in that it is compact, permitting it to be shipped to the site fully assembled and requiring minimum foundation and building space. Yet it is highly reliable, being capable of operating for at least a full season and in many applications for two seasons, between major overhauls. The rotative speed of 600 r.p.m. well suits the pump's requirement of 3,600 r.p.m., in that the step-up ratio of 6-1 is met by a standard design of single stage speed increaser.

Pumping Set

Figure 3 is a shop view of an eight cylinder pumping set showing the engine, the floating shaft drive through the fire wall, the speed increaser and pump on a common base. The latter permits shop alignment of the high speed shafting, and in service protects it against movement of the foundation. The flexible couplings on the low speed shaft are of the simple flexible steel disc type. The high-speed coupling is of the gear type with a spacer, to give room for removal and application of the pump bearing and seal.

Figure 4 shows a cross-section through the engine. It is quite conventional in design, with many well thought out features to it. The frame is designed in two parts of approximately equal height, to provide maximum rigidity of each part separately, and to bring the joint face near to the neutral axis of longitudinal bending. Individual rigidity is important, to provide accurate machining and retention of dimensional accuracy. The upper part forms the cylinder block, and contains the liners and valve camshaft. The base contains the main bearings and oil sump. The two are joined together by long studs, forming a direct stress path from the cylinder head down to the main bearings.

The high base permits of large base doors, giving good accessibility for maintenance. The oil sump is separated from the crank chamber by screens, and eliminates a separate tank. A cast-in suction pipe leads to the oil pressure pump. The oil is distributed to all the bearings through a welded steel header and a simple system of branch piping. Lubrication of the valve gear is all accomplished through drilled passages and hollow push rods.

The crankshaft is of forged steel, and runs in calcium hardened lead bearing. The connecting rod is a steel drop forging, drilled to carry

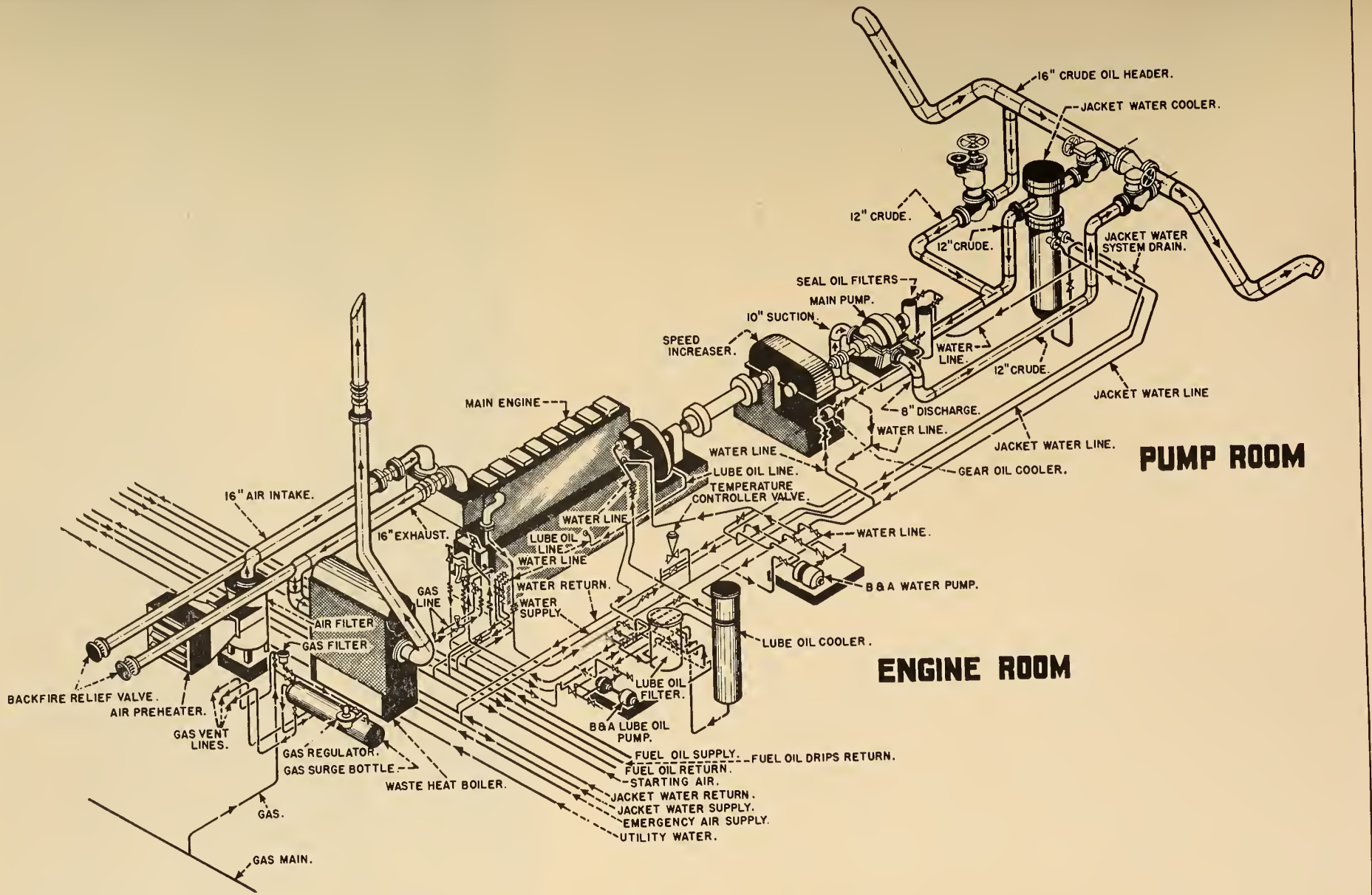


Fig. 7. Schematic arrangement of pumping unit.

oil to the floating wrist pin and oil cooled east iron piston. Aluminum pistons may be used in this engine for operation on refined fuel, but for pipeline serviee east iron is preferred because it gives longer wear life, partieularly of the ring grooves.

The cylinder head is of the four valve type, with the injector in the centre. The inlet and exhaust manifolds are arranged on opposite sides of the head and eonnect to the turbocharger at the free end of the engine. The fuel pumps are mounted on a separate camshaft housing on the exhaust side of the engine. The turbine is driven at a speed of approximately 10,000 r.p.m. by the exhaust gases, and in turn drives the air compressor. The compressor raises the pressure of the air in the intake manifold by about 5 lb. per square ineh, resulting in a 40 per cent increase in the engine's output.

The main portion of a pumping station is divided longitudinally by a fire wall, with the engine room containing the engines and their auxiliaries extending along one side and the pump room on the other (Fig. 6). The only crude oil which comes into the engine room is the small quantity in the engine fuel system. Crude oil is a eomplex, and in some cases dangerous, substanee. It contains light fractions more volatile than ordinary gasoline. Some of these vapours are so toxic that the operating personnel may not be exposed to them without gas masks. Consequently it is desirable to limit the area in whieh an escape of crude is possible to the minimum, and to prevent its tying up station operation as far as possible.

Heat Exchangers and Preheaters

The line proper does not enter the station. A by-pass line looping around the line stop valve and scraper traps enters the pump room and passes through the four pumps in series, and returns the flow to the line. Beyond the pumps are the heat exchangers, in which the engine eooling water gives up its heat to the crude oil. The temperature rise of the crude in passing through the station is trivial, though beneficial. The real objective of the design is to obtain independenee of outside water supplies which might be interrupted, or eooling towers whieh might be frozen up in winter or prove inadequate at peak summer temperatures. The temperature of the erude does not vary very greatly through the year, and thus provides a partieularly stable cooling medium.

Loeated across the end of the engine and pump rooms, the control room eontains the master control panel and communieations equipment. It also provides a quiet working space for the operators. Large windows of explosion-proof glass enable the operators to see into both the engine and pump rooms. It will be noted that the arrangement of the doors through the open air vestibules prevents fire or explosion from reaching the control room.

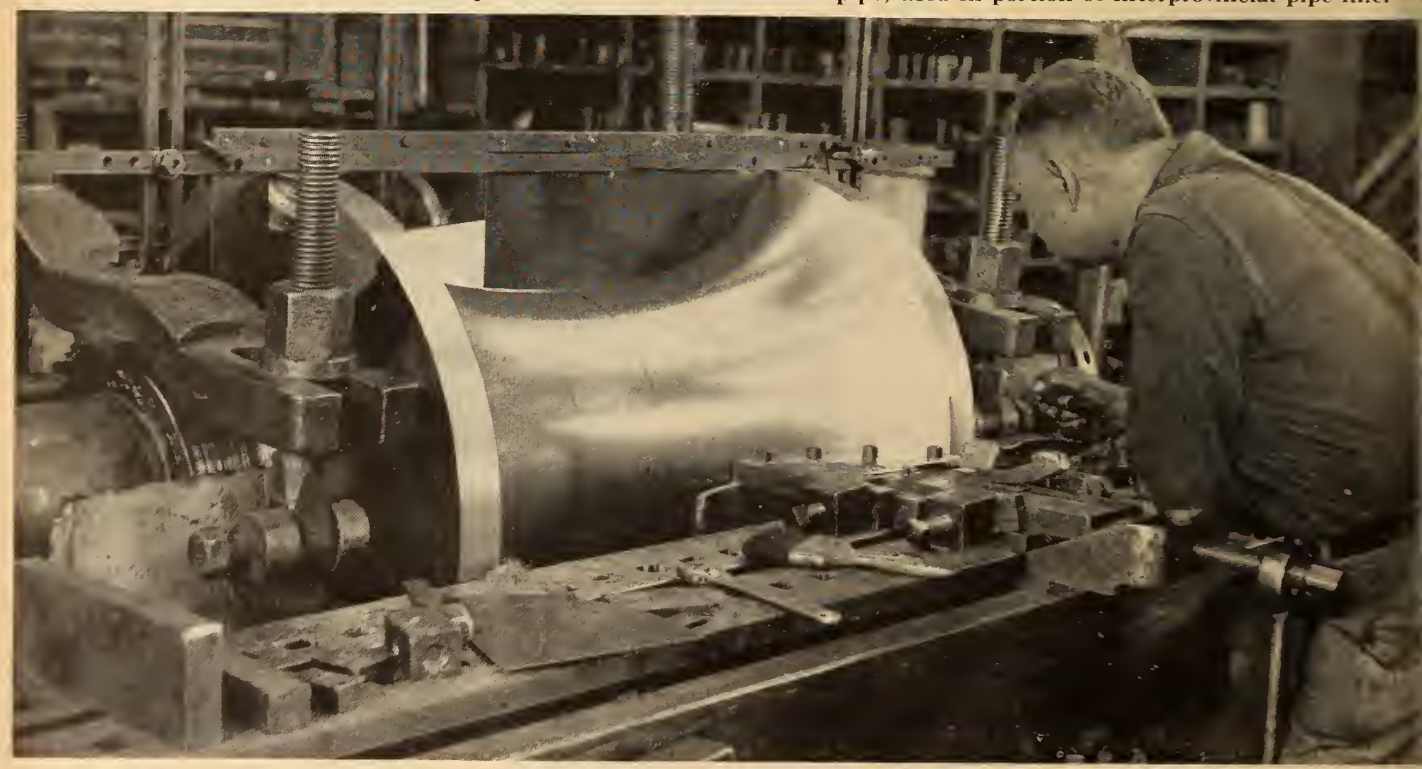
Beyond the eontrol room are the switch gear room with emergency electric generator, boiler room and fuel room, together with the stores and staff locker room.

Figure 7 shows a sehematic arrangement of a diesel pumping unit. At the left we see the two baekfire relief valves. These fittings are peculiar to dual fuel engines. Diesels do not baekfire, but when the engines are adapted to burn gas as the prineipal fuel there is always a possibility of aeeumulating unburned gas in the air or exhaust piping.

The air preheater is also provided prineipally for gas operation, since the weak gas mixture on which the engines operate does not ignite readily if the intake air temperature drops much below 60 deg. F. The gas surge bottle and a gas regulator form part of the fuel system, and proteet the engines against speed variations due to pressure ehanges in the gas supply line. The waste heat boiler is a quite straightforward, single drum, tubular design.

The lubricating oil system loeated beside the engine eonsists of a prim-

Fig. 8. Shop view showing roll for production of 16-inch diameter pipe, used in portion of interprovincial pipe line.



ing pump for flooding the bearings before starting and for cooling out the pistons after shutting down, together with a by-pass type filter and cooler. The priming pump can be valved for filling or draining the engine sump. The cooling water system circulates treated water by means of an engine driven pump through the water jacket and the oil coolers, for both the engine and speed increaser to the heat exchanger. It is regulated by a single thermostatic valve.

In the pump room an extremely heavy construction of the heat exchanger shells is required to enable them to stand the full line pressure. Duplex oil seal filters remove abrasive material from the crude oil before it is circulated through the seals to cool and lubricate them.

Use of Gas Fuel

In the engine room the installation may be arranged for dual fuel operation, in which approximately 90 per cent of the fuel is natural gas from the oil fields. This gas is available at an extraordinary low cost, somewhere between one third and one quarter of the equivalent amount of crude oil. The solid fuel injection system provides the remaining 10 per cent of the fuel and acts as the igniter for the gas, controlling the timing of its ignition and the flame pattern in the combustion chamber. The gas piping passes through a safety shut-down valve, which closes automatically when the fuel pumps are tripped off, and then through the throttle valve which is controlled by the governor. It then passes up to a distributing manifold running along the cylinder heads, from which it is valved to the individual cylinders through a patented metering system.

The gas metering valve is operated from the lever of the air admission valves. During the period of the cycle in which the metering valve is closed, gas is allowed to flow into the metering chamber, whose volume is adjustable to suit the heat value of any gas. During the admission period of the turbo-charged engine, the air valves open before the exhaust valves have closed, to allow the inlet air to scavenge and cool the combustion space. Simultaneously with the closing of the exhaust valves, the gas metering valve closes off the connection to the gas manifold. This allows the gas in the metering chamber to pass into the air port and mix with the incoming air charge.

In such a system the maximum amount of gas which can enter the engine is that contained in the metering chamber. Even if the engines should be stopped with one or more of the gas metering valves in the open position, flooding of gas into the manifolds is positively prevented. Its other special feature is that, in the event of a back-fire in one cylinder, the flame cannot travel through the metering valve to reach the gas piping. Safety controls protect the engine against high jacket water temperature, low lubricating oil pressure and low fuel oil pressure. They are arranged so that the gas is always shut off before the fuel oil.

Using Oil Fuel

The fuel injection system for operation on crude oil is entirely special. Crude oil as tapped from the line contains abrasive particles, wax, corrosive sulphur and hydrogen disulphide gas. The abrasive particles, principally sand and iron scale from the line, are removed by settling in a storage tank followed by heating and centrifuging. The centrifuge is operated as a separator dividing the crude into two streams. The clean oil stream passes into the clean fuel oil tank, and the dirty oil stream carries off the mechanical dirt, water and some of the wax. This stream is returned to the pipeline.

The cleaned and heated fuel is drawn from the clean oil tank and forced through a large main filter around a circulating system in the engine room, then returned to the clean oil tank. The engine transfer pumps draw the fuel from the main circulating system, pass it through two final stages of filtration, and supply it at controlled pressure to the fuel injection pumps, returning the excess fuel to the main circulating system. The continual circulation of the fuel keeps it at a uniform temperature all through the filters, and prevents the formation of wax crystals which would rapidly plug the filter elements.

The effect of the sulphur compounds is minimized by the use of non-corrosive materials in the system. For example, all springs have to be plated or made of special alloys, and the internal parts of the fuel pumps and injectors where corrosive action is most intense on account of the high temperatures and pressures in these parts, are constructed throughout of stainless steel. The injectors, in addition to their stainless construction, are provided with special cooling jackets extending right down to the nozzle tip through which lubricating oil is circulated.

The control of the nozzle temperature minimizes the chemical breakdown of the crude which leaves tarry deposits on the nozzle valve, eventually causing it to stick. These deposits also build up on the nozzle tip and interfere with the spray formation in the combustion space.

The fuel pumps are provided with special helices and long stroke racks, to give accurate metering of the small quantity of fuel delivered in dual operation. The fuel supply is circulated through the pump body before returning to the clean oil tank to cool the pumps.

Controls

Special governors control the engine speed in proportion to the control air pressure transmitted from the station master controller. The air pressure acts on a diaphragm motor, which in turn loads the speeder spring and determines the setting of the engine driven flyweights. A hydraulic relay system translates the small movements of the flyweights into accurate and powerful movement of the terminal shaft, which controls both the gas throttle valve and the fuel pump racks through a proportioning linkage. The engine driven flyweight system enables the governors to be operated on hand control during starting and stopping, or in the event of trouble with the master control system.

The control room contains the main console housing the master controller and line, instruments, pumping set instruments, and light signals indicating the operation of all station emergency controls and alarms. The master controller at the first terminal station indicates and sets the speed of the pumping sets to maintain a constant discharge pressure to the line. It has a suction override, however, which will reduce the speed of the pumping sets if the suction pressure falls below 50 p.s.i., to prevent the pumps from starving and overheating if the supply is interrupted.

In all the line stations the master controller is set to maintain a constant suction pressure of 50 p.s.i. thus the pump speed varies with the flow of crude received at the station intake, while a discharge pressure override protects against any restriction of flow downstream. The teletype instruments convey the dispatcher's signals to all the stations and give warning of all planned changes in operating conditions. √

STABILIZATION OF CLAY GRAVEL ROAD SURFACES WITH RESINOUS MATERIALS

by

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In Sweden, as in the whole of Scandinavia and Finland, where gravel road dressing plays an important role, systematic research on the grading and the chemical treatment of gravel and binding soil mixtures has been carried out since the late 20's. In 1941 the Geological Department of the Swedish State Road Institute started research on and field testing of alkaline extractions of humic acids, the practical aim being the treatment of airfield runways and graded gravel road surfaces. The excellent results obtained from plant-mixed clay-gravel combinations emphasized the value of really good chemical agents, such as the group of resinous substances referred to above.

Laboratory research started in the winter of 1946-47 and the first practical tests were made in the summer of 1947, principally with clay-gravel plant-mix. The tests covered the common proprietary resins. Following is a summary of the results based on observations of the experimental highway sections over the past five years.

The Principle of Chemical Stabilization

Absorption of liquid in a capillary system depends upon the surface tension (α) and the density (δ) of the liquid, upon the radius of the capillary passages (r), and upon the adhesive force between the liquid and the walls of these passages, which can be measured by the contact angle (ϕ) between liquid and solid. The rise of a liquid in a capillary tube can be obtained from the following equation:

$$h = \frac{2\,\alpha}{\delta\, r} \cos\,\phi$$

there h is the height of the rise. With help of surface-active substances, i.e., with substances, which can change the tension between the surfaces of different phases in a system of several phases, e.g., mineral-water-air, it is possible to change the values of the factors α and δ in the equation, thus diminishing the water absorption of soils.

Much research has been undertaken in America and in England to make soils hydrophobic with the help of surface-active substances. The result is that during the last ten years many proprietary products, e.g. "Vinsolresin", "NSP-25-2", "Stabinol", "Vinsol NVX", "321-Resin", "XP 54", have appeared with the statement that they can prohibit or diminish the water absorption of soils.

It has been found that resinous materials are the most effective and cheapest surface-active substances for this purpose. The effectiveness of such a substance depends largely upon the quality of the soil used. Its acidity, electrolyte content, humus content, and particle size are consequently important factors. Soils containing less than 25 per cent of clay seem to be most suitable for chemical stabilization with resins. Stiff clays and cohesionless soils, like sand, have, on the contrary, proved to be difficult to make waterproof with this type of substance.

Laboratory Tests

To try the possibilities of using imported surface-active substances for the stabilization of quaternary soils, a series of tests was conducted in the laboratory. It appeared that relatively large amounts of stabilizer had to be used to obtain satisfactory results. Later work was conducted entirely with native materials. Using the wastes and by-products of the paper pulp industry, a substance was produced which gave promising results in the laboratory.

The main ingredient in this substance is a resin, which is derived from sulphate raw soap by distillation, not by extraction, as are some American resins used for soil stabilization. The crystalline resin thus obtained is dissolved in sodium hydroxide and solution may be used so prepared, but if still better results are desired, small amounts of sulphite liquor may be added; this addition causes the formation of a fine colloidic suspension. The product is a liquid, its concentration can be varied according to need, and it may be made on the job. Most of the American resins are mixed directly into wet soil masses.

The effect of this resin mixture in the stabilization of a clay-gravel surfacing was tried in the laboratory in the following manner. The resin solution was mixed with the clay-gravel mass, which was composed of lime-free crushed gravel and lime-free stiff clay mixed so that its particle size distribution curve was as nearly as possible like that of the highest density curve, with a maximum particle size of 20 mm. Cubes having 7-cm. (1¾-in.) sides, were compacted with a drop hammer at optimal moisture content. These were dried at room temperature, weighed and placed with their under sides in contact with water. The capillary absorption of water was determined by weighing. From the results (Fig. 1) it was found that as little as 0.05 per cent of resin (in per cent of weight of dry soil) lessened the capillary absorption of water to one-quarter that of untreated material. In a test with a clay-gravel mixture with a somewhat lighter clay, the capillary water absorption decreased to one-ninth when 0.10 per cent of resin was used. In Fig. 2 the results of tests with this Swedish resin and with some American resins are shown.

It was established by laboratory test, that water will not wash this resin away from fine-silt samples. It was also further ascertained that the resin lessens the compression strength of the dry clay-gravel mixture somewhat from about 64 kg./cm.² (909 p.s.i.) to about 58 kg./cm.² (824 p.s.i.). Tests were made to discover how different soils absorb the resinous substances from the solution, and it was found that a clay-gravel road surface cannot be successfully stabilized by spraying the liquid on the road. The liquid and the clay-gravel mass must be mixed mechanically.

Field Tests

This Swedish resin stabilizer has been tried on roads. The trial material was plant-mixed clay-gravel. The aim was to observe its behaviour in a stabilized road with variations of thickness of surfacing of particle size of gravel, of clay type and of amount of resin. Continuous observations were also made of the condition of the test roads in varying weather, of needed maintenance, etc.

The resin liquid was made on the job by dissolving 140 kg. (308 lb.) of resin crystals in two cubic metres (470 Imp. gal.) of 0.17N NaOH solution. The solution was fed at a measured rate into the clay-gravel mixer. The amount of resin liquid fed produced a concentration of 0.07 to 0.12 per cent dry weight in the clay-gravel mass.

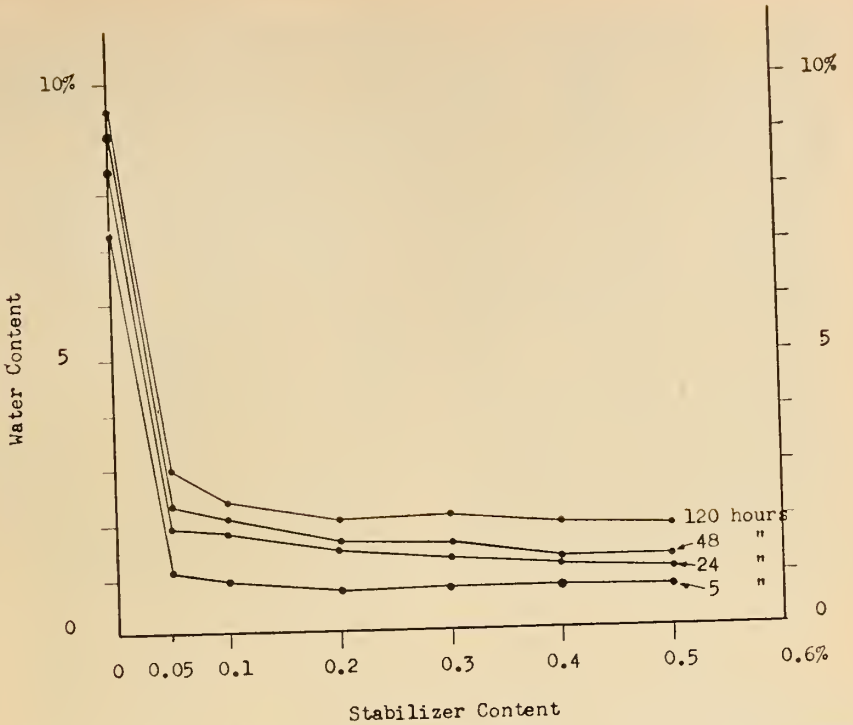


Fig. 1. Capillary water absorption in clay-gravel mixtures with varying content of Swedish resin stabilizer.

Clay-gravel mixture with the optimal moisture content was spread on the road to a thickness of 5 to

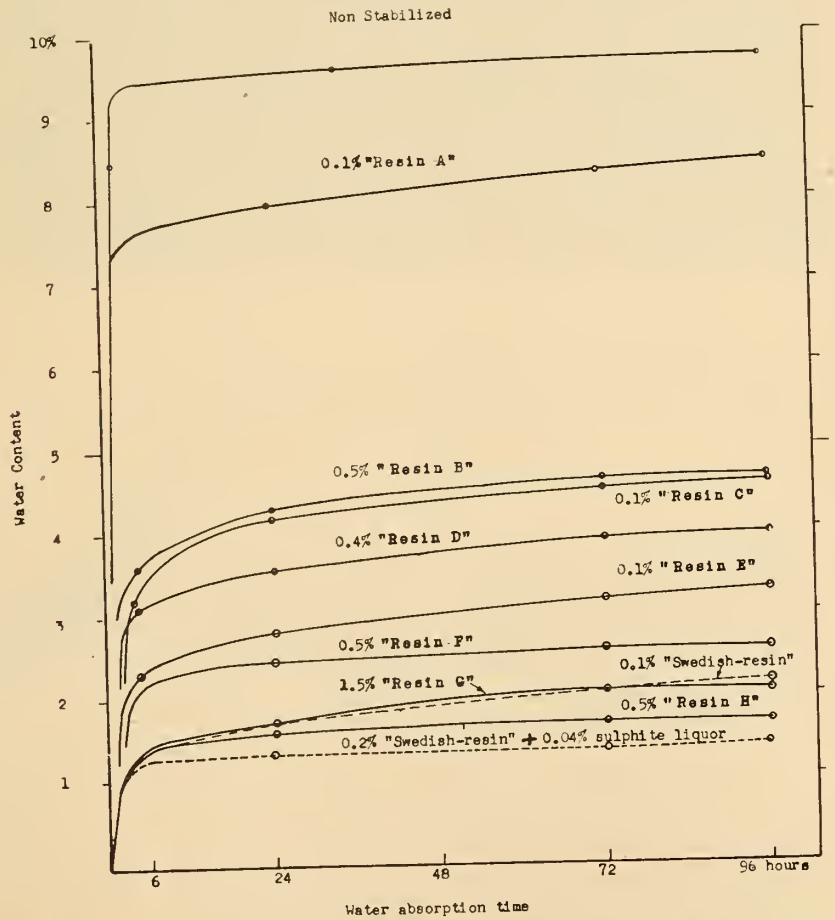
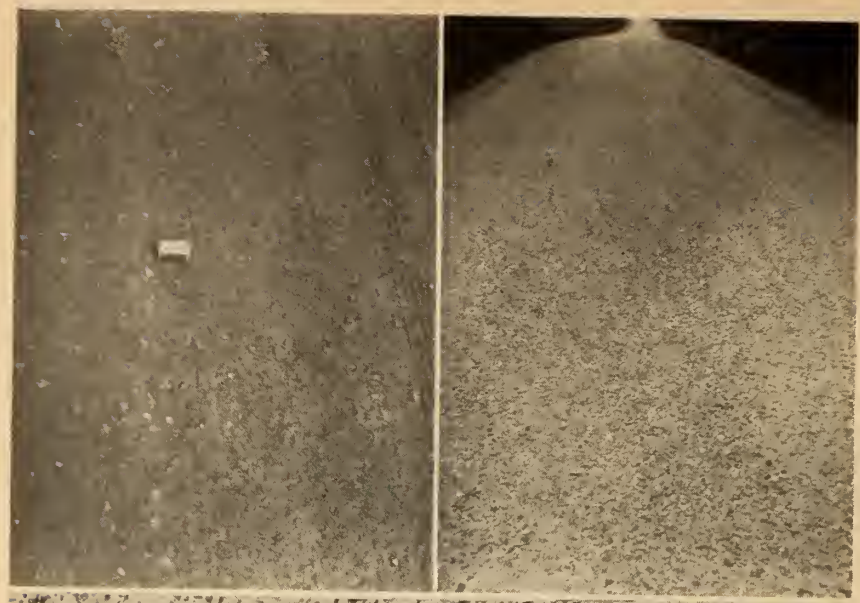


Fig. 2. Capillary water absorption in clay-gravel specimens with different stabilizing agents.



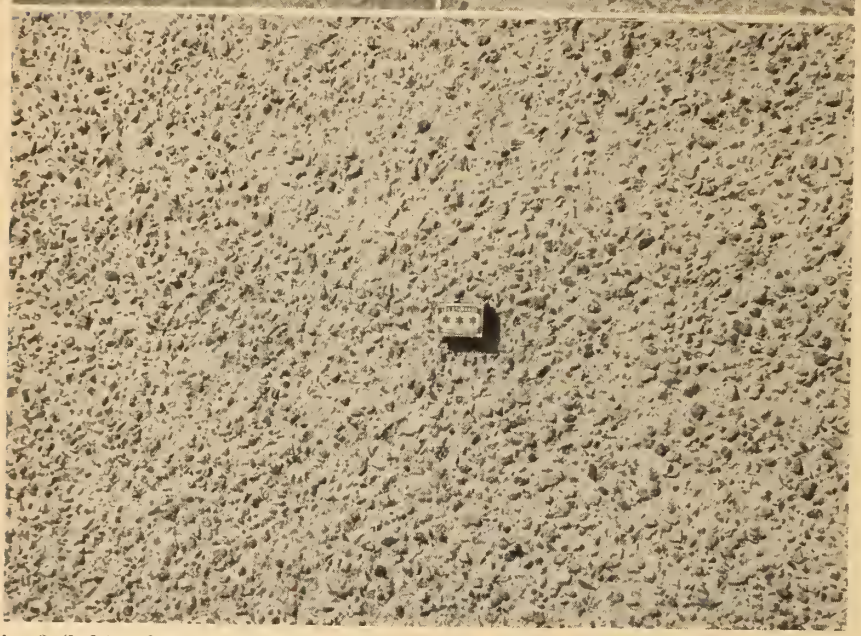


Fig. 3 (left). Clay-gravel surface, just finished. The object in the centre is a match-box.

Fig. 4 (right). Resin stabilized clay-gravel road.

Fig. 5 (bottom). Good surface of a resin stabilized clay-gravel road; note the match-box.

6.5 cm. (1¼ to 1⅝ in.) depending on the maximum particle size of the gravel. The road was rolled immediately, before the surface dried. For fast and even compaction by traffic, the road surface must be kept damp for a few days after laying.

Results of Field Tests

Tests of the stabilization of clay-gravel roads with resins have given many important results. First, they have proved that it is possible to make a surfacing of clay-gravel of excellent stability by means of resin. Some surfacings have shown a high stability during unfavourable weather conditions over a long period. Even five years after the laying of the surfacing the stabilizing effect remains, but perhaps in a somewhat reduced degree.

After laying and compaction on the road, the surfacing has a dense and smooth surface, with the larger particles covered with the fine-grained material (see Fig. 3). Under the influence of traffic and the weather, there will be, after a short time, a more or less rapid wearing away of the fine-grained material and then the larger particles will appear in relief. The final structure of the road surface is then reached. It is rough and not slippery and has good traffic resistance (see Figs. 4 and 5).

There are great differences between a resin stabilized and a nonstabilized surface. After a rain there is the very distinct difference that water does not enter the resin stabilized surfacing but runs off quickly, whereas it will be absorbed by the nonstabilized surface. The stabilized surface will dry rapidly and will be light in colour, whereas the nonstabilized surface will hold its darker colour for a longer time, owing to its higher water content. The differences between the two types therefore appear sharply (see Fig. 6).

As to wear there is a marked difference between resin stabilized and nonstabilized surfaces: on the former there is a considerably smaller amount of loose particles than on the latter. This condition, which can easily be observed on the road, was measured approximately by the test now described. On areas of 8m.^{2} (10 sq. yd.) on resin stabilized and nonstabilized surfaces the loose material was swept up and weighed. On the resin stabilized roadway there was an amount of 200 gr. (½ lb.) of loose particles and on the nonstabilized surface 1,390 gr. (3 lb.) or nearly seven times as much.

The clay-gravel used in the field had a composition as shown by the grading curve of Fig. 7.

Experience shows that coarse-grained surfacing seems to be the best in regard to the amount of surfacing loosened by traffic. This seems to be largest with small (18-mm., ¾-in.) gravel and smallest with 26-mm. (1-in.) gravel. It is to

Table I

	Amount of accumulated material on a width of 1 m. along one side of the road	Percentage by weight of particles > 11.3 mm. (40.45 in.) the accumulated material
Maximum size 18 mm.	9.6 kg. (21 lb.)	9.0
Maximum size 22 mm.	5.1 kg. (11 lb.)	4.5
Maximum size 26 mm.	3.5 kg. (8 lb.)	3.0

Fig. 6 (left). Resin stabilized (foreground) and nonstabilized (background) clay-gravel surfaces after a rain.

Fig. 8 (right). Hole in a clay-gravel road carefully repaired the year before this photograph was taken. The object in the centre is a pencil.

be observed that the amount of particles with a grain size lying near the maximum size of the gravel used seems to be larger in the first case than in the second.

In order to get an objective proof, that these observations are right, samples were taken of the loose gravel which had been accumulated along the road sides. In this case the amount of loose material was determined which had accumulated over a width of 1 m. (3 ft. 3 in.) along the one side of the road and its grading determined. The results of these determinations are given in Table I.

The results of the determinations show that the observations mentioned above are right, namely, that the wear has been smallest on the most coarse-grained stretch and that the larger particles are not detached so easily from the surface by traffic. This is probably because the coarser grains are deep-rooted in the stable surfacing. Thus, in order to decrease wear, it seems to be important that the amount of coarser grains be great enough so that these fixed coarse grains will carry the traffic. If there are parts of the road with fewer coarse grains, these points may be weak spots, which traffic can more easily attack with greater risks of damage to the road.

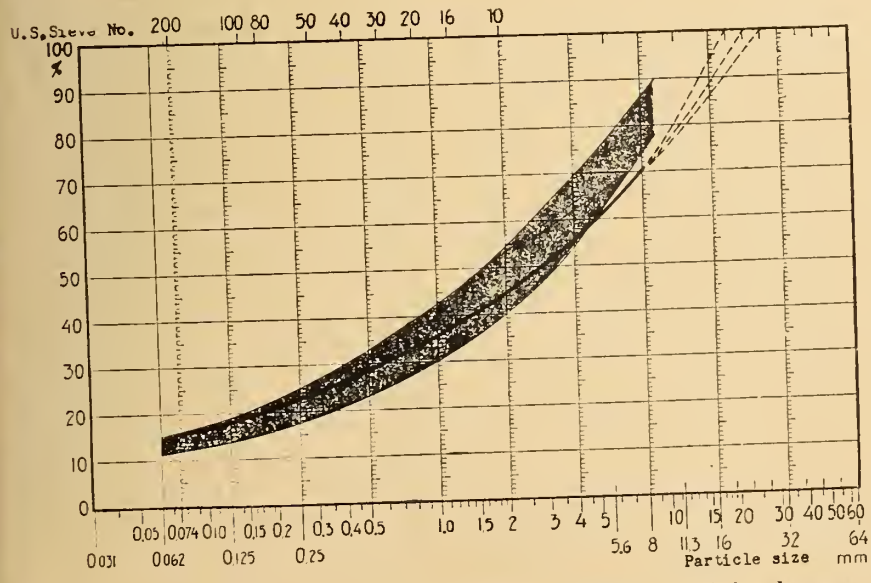


Fig. 7. Grading curve showing the approximate composition of the clay-gravel used.

Earlier investigations have proved that the character of the clay in the clay-gravel mixture, especially its density, but also its mineralogical composition, is of importance. In these tests a heavy medium clay (hygroscopicity = 6.7 per cent) and a very heavy clay (hygroscopicity = 10.4 per cent), were both used. Some tests have been made with clays containing lime. These tests seem to show that the stabilizing effect of the resin is reduced with such clays.

In order to investigate the influence of different dust laying agents upon stabilization tests were made using both calcium chloride and sulphite liquor in the mix. It is to be noted that the resin must be mixed in the mass before the dust laying agents, otherwise the agents cause precipitation of the resin, which prevents its homogenous distribution throughout the mass.

The dust-laying agents used did not diminish the stabilizing effect of the resin appreciably.

Regarding maintenance of resin stabilized surfaces of clay-gravel experience indicates that it can be decreased as compared to the maintenance of nonstabilized surfaces. Holes in the road surface must be repaired with resin stabilized clay-gravel. Such repairs carefully made (see Fig. 8) have shown a high power of resistance under traffic.

Tests with resin stabilized clay-gravel have given promising results. If good results are to be obtained, however, suitable materials must be used and the laying of the surface must be done carefully. Even the weather during laying is of importance. Best results will be obtained in dry weather; in rainy weather it is difficult to maintain the right water content in the clay-gravel, and therefore rolling will be more difficult. Furthermore, high natural water content in wet weather means that a sufficient amount of resin solution cannot be mixed with the clay-gravel without giving it too soft a consistency. Then the stabilizing effect will be diminished, shown by high wear on those stretches which have been laid in wet weather. √

Analysis of Building Frames by Limit Design

by

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This paper describes a method of applying the principles of limit design to the analysis of building frames. The assumption is made that the limit moment of resistance of an I-section is the same as the conventional maximum moment of resistance of the section. The moments due to the loads acting on the structure are distributed by any convenient method. The load factor by which the system of loads has to be multiplied to produce the limit moment of resistance at the first critical section is calculated. Next, the moments due to the original loading are re-distributed with the first critical section acting as a hinge and the new load factor is calculated so that the ultimate moment of resistance is reached at the next critical section. The procedure is continued until the whole structure or part of it is a mechanism. The original loading, multiplied by the sum of all the load factors, is the ultimate loading which the structure can carry.

With most of the present methods of analysis of building frames, a structure is considered to have failed when the yield point stress is reached in any beam or column, and factors of safety are based on this criterion of failure. It is not customary, however, to take account of the effect of stress concentrations such as are likely to occur in the regions of rivet holes or in beam-to-column connections. It is probable, therefore, that there are in many buildings giving satisfactory service today localities where yield point conditions exist under working loads. This will not be news to designers; localized and limited plastic deformation in structures is accepted and in some types of beam-to-column connections is even desirable. The practice of identifying the advent of yield point conditions in the extreme fibres of a beam or column with complete failure of the structure seems somewhat arbitrary, since at this stage uncontrolled deformation does not normally commence. It is suggested that for a structure subject to static loading, the ultimate load capacity is more truly indicative of its strength than the load at which yield point stress is reached in some part of the structure.

Relating the working loads of structures to the ultimate or limit loads would not always mean higher working stresses. In the light of experience, factors of safety based on ultimate load capacity will no doubt be higher than the factors used in connection with the elastic method of analysis, and will result in upward or downward adjustments of the working loads. However, in most cases the more equitable distribution of materials produced by limit design considerations will permit higher working stresses with consequent savings.

A method for determining the ultimate load capacity of building frames was developed by the writer at the University of Toronto in 1949-50 under a fellowship of the Canadian Institute of Steel Construction. The method is based on the theory of limit design[1] as propounded by Van den Broek.

Limit Design Applied to a Building Frame

It has been shown by Van den Broek[1] that, assuming the idealized stress-strain relationship shown in Fig. 1, the ultimate moment of resistance of a rectangular section approaches 1.5 Sf_y, where S = section modulus of the section as normally defined and f_y = yield-point stress. Figure 2 shows the stress distribution at the stage when yield-point stress is first reached at the extreme fibres and at the stage of the ultimate moment of resistance. In the case of an I-section the difference between the conventional maximum moment of resistance and the limit moment of resistance is less than for a rectangular section, because the flanges contribute more to the bending strength than does the web. Figure 3 shows the stress distribution in an I-section for the two stages of loading, the stresses being corrected for the width of the section. For example, the limit moment of resistance of a 12*WF*50 section is 1.09 Sf_y. In general, an error of less than 10 per cent is introduced by assuming that the

[1] "Theory of Limit Design", J. A. Van den Broek, John Wiley & Sons, New York, N.Y.

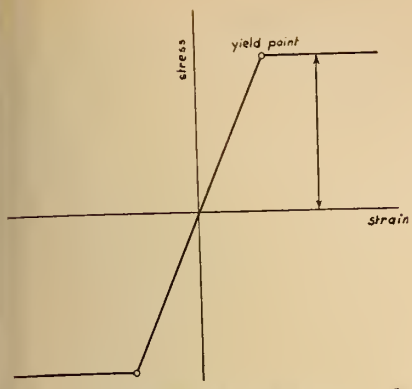

Fig. 1. Idealized stress-strain relationship for mild steel.

limit moment of resistance of an I-section is equal to the conventional maximum moment Sf_y, the error being on the side of safety.

Figure 4 shows a simple building frame subject to a system of loading W. The procedure for determining the ultimate load capacity of the frame is as follows. Moments due to the system of loads are distributed at all joints using any convenient method. The moments are then multiplied by a load factor s_1, such that yield-point stress is produced at the most highly stressed section. Under loads greater than s_1W, the critical section at which yield-point conditions were first reached is assumed to act like a hinge. A second moment distribution due to the original load system is now made, differing from the first distribution only in respect of the new hinge at the first critical section. The moments from the second distribution are multiplied by a factor s_2 so that under a total load $s_1W + s_2W$ yield-point conditions

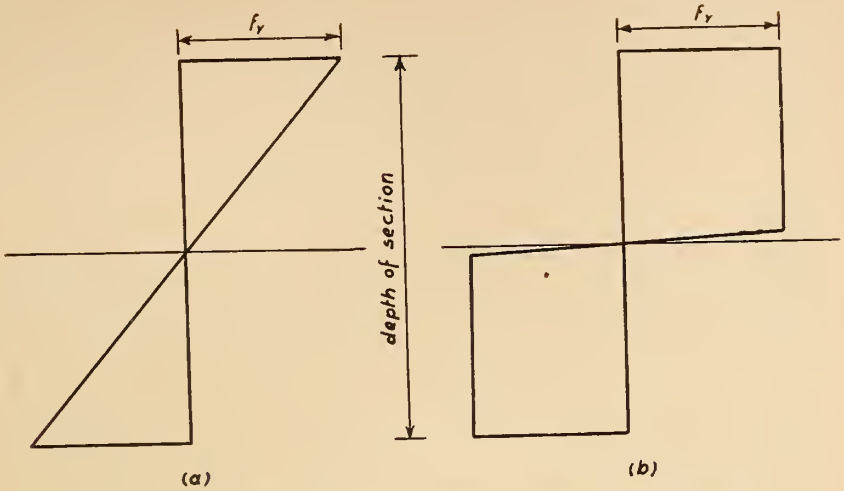

Fig. 2. Stress distribution across a rectangular section. (a) Under the conventional maximum moment of resistance. (b) Under the ultimate moment of resistance.

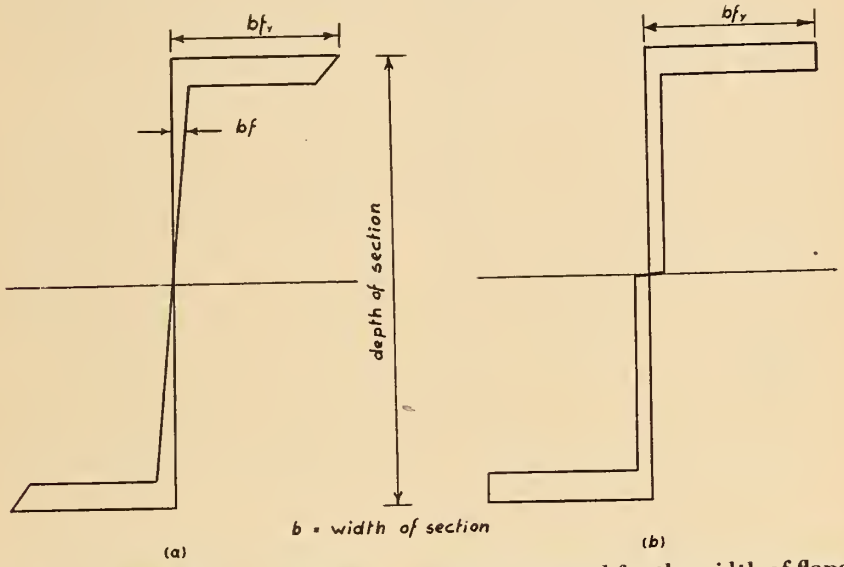

Fig. 3. Stress distribution across an I-section corrected for the width of flange and web. (a) Maximum elastic moment. (b) Limit moment.

Table I. Table of Moments

1.	2. Moments after first distribution	3. Moments with Hinge at G	4. $s_2 = 51.6\%$	5. Total Moments after Second distribution	6. Moments with Hinge added at H	7. $s_3 = 5.35\%$	8. Total Moments after Third distribution	9. Moments with Hinge added at A	10. $s_4 = 9.82\%$	11. Total Moments after Fourth distribution	12. Moments with Hinge added at B	13. $s_5 = 10.76\%$	14. Total Moments after Fifth distribution	15. as Percentage of Limit Moment
M_{AB}	−.1081	−.2329	−.1203	−.2284	−.4780	−.0256	−.2540	0	0	−.2540	0	0	−.2540	100%
M_{BA}	−.0914	−.1784	−.0920	−.1834	−.3650	−.0195	−.2029	−.5200	−.0511	−.2540	0	0	−.2540	100%
M_{BC}	+.0914	+.1784	+.0920	+.1834	+.3650	+.0195	+.2029	+.5200	+.0511	+.2540	0	0	+.2540	100%
M_{CB}	+.0085	+.0698	+.0360	+.0445	+.2620	+.0140	+.0585	+.4620	+.0455	+.1040	+.6040	+.0649	+.1689	67%
M_{CD}	−.0377	−.1025	−.0529	−.0906	−.1540	−.0082	−.0988	−.4780	−.0469	−.1464	−1.0000	−.1076	−.2540	100%
M_{DC}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M_{CF}	+.0292	+.0328	+.0169	+.0461	−.1070	−.0058	+.0403	+.0160	+.0016	+.0419	+.3950	+.0426	−.0845	33%
M_{FC}	+.0083	−.0133	−.0069	+.0014	−.5000	−.0268	−.0254	−.5000	−.0481	−.0735	−.5000	−.0538	−.1273	50%
M_{FG}	−.0083	+.0133	+.0069	−.0014	+.5000	+.0268	+.0254	+.5000	+.0481	+.0735	+.5000	+.0538	+.1273	50%
M_{GF}	−.2540	0	0	−.2540	0	0	−.2540	0	0	−.2540	0	0	−.2540	100%
M_H	.1271	.2459	.1269	.2540	0	0	.2540	0	0	.2540	0	0	.2540	100%

Note: All Moments in the Table are expressed as Coefficients of WL.

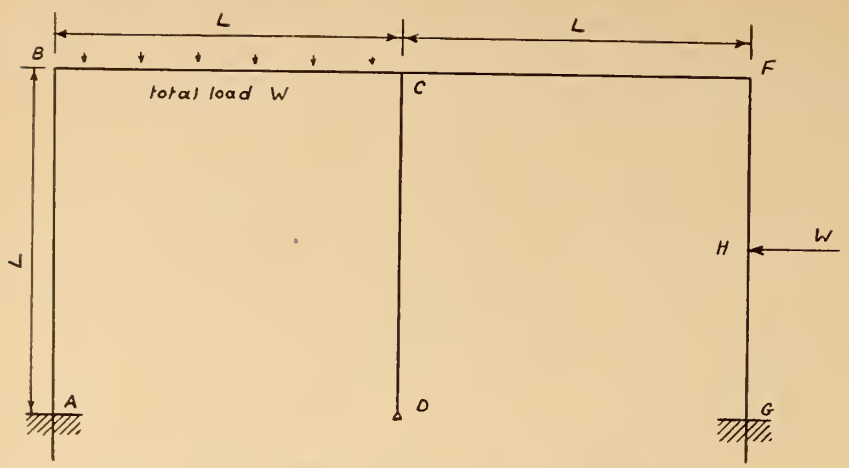

Fig. 4. Two-bay frame.

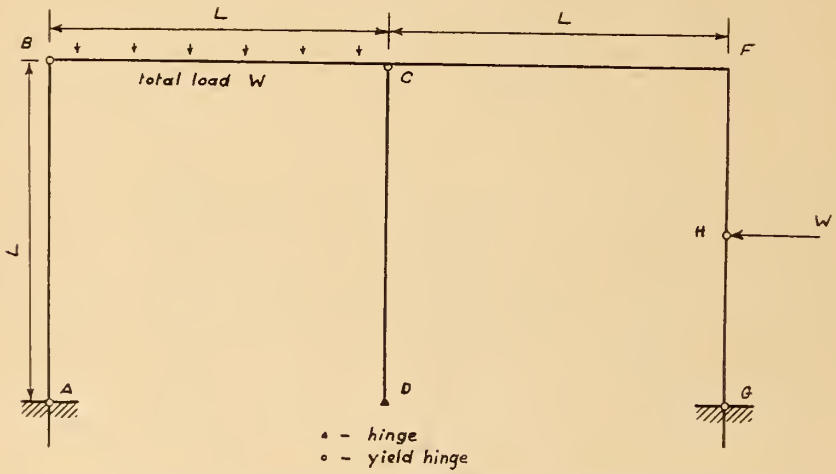

Fig. 5. Location of yield hinges after second moment distribution.

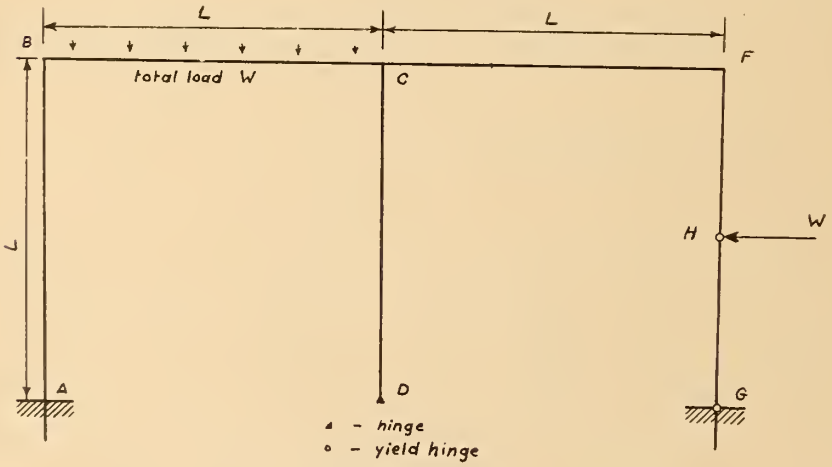

Fig. 6. Location of yield hinges prior to collapse.

are reached at a second critical section. At this stage the moment at the first critical section is still only the yield-point moment, since a hinge cannot assume any moment. The process is continued until the structure or part of it becomes a mechanism. The slightest increase in loading would then produce uncontrolled deformation.

Limit Load of a Two-Bay Frame

As a numerical example of the method the limit load of the frame in Fig. 4 under the loading shown will be worked out. For simplicity it is assumed that all the members are of the same length and cross-section. The slope-deflection method is used here to distribute moments and the equations for all joints can be written down. Anticlockwise moments are positive. Terms such as M_{AB} refer to the moment in member AB at the end A. The letters A, B, C represent the angles of rotation of the joints A, B, C, etc.

$$M_{AB}=2EK\ (2A + B - 3\alpha)$$
$$M_{BA}=2EK\ (2B + A - 3\alpha)$$
$$M_{BC}=2EK\ (2B + C) + \frac{WL}{24}$$
$$M_{CB}=2EK\ (2C + B) - \frac{WL}{24}$$
$$M_{CD}=2EK\left(\frac{3C}{2} - \frac{3\alpha}{2}\right)$$
$$M_{DC}=0$$
$$M_{CF}=2EK\ (2C + F)$$
$$M_{FC}=2EK\ (2F + C)$$
$$M_{FG}=2EK\ (2F + G - 3\alpha) + \frac{WL}{8}$$
$$M_{GF}=2EK\ (2G + F - 3\alpha) - \frac{WL}{8}$$

For equilibrium

$$M_{DC} + M_{AB} + M_{BA} + M_{CD} + M_{FG} + M_{GF} = -\frac{WL}{2}$$
$$M_{BA} + M_{BC} = 0$$
$$M_{CB} + M_{CD} + M_{CF} = 0$$
$$M_{FC} + M_{FG} = 0$$

The last four equations have to be solved for B, C, F and α, remembering that $A=0$ and $G=0$. The results of this first distribution are shown in Column 2 of Table I. The maximum bending moment is 0.2540 WL at G. If M_L is the limit moment of resistance of the section chosen, then $s_1=\dfrac{M_L}{0.2540\ WL}$. By multiplying the whole system of loads by a factor s_1 the limit moment is produced at G. In this example no numerical values have been chosen for M_L, W or L and their relationship may be assumed to be such as to make the value of $s_1=1$. This would imply that the limit moment of the section is 0.2540 WL.

A second distribution can now be made, but this time a hinge at G is assumed. The new slope-deflection equations are the same as for the first distribution except for

$$M_{FG}=2EK\left(\frac{3F}{2} - \frac{3\alpha}{2}\right) + \frac{3WL}{16}$$
$$M_{GF}=0$$

The equilibrium conditions are also slightly modified:

$$M_{AB} + M_{BA} + M_{CD} + M_{FG} = -\frac{WL}{2}$$

$$M_{BA} + M_{BC} = 0$$

$$M_{CB} + M_{CD} + M_{CF} = 0$$

$$M_{FC} + M_{FG} = 0$$

The moments resulting from the second distribution are shown in Column 5 of Table I. It is seen that the load factor $s_2 = 0.516$. Hence 51.6 per cent of the moments resulting from the second distribution can be added to the moments from the first distribution before the limit moment of $0.2540\ WL$ is attained at the next critical section, which is at H, the centre of column FG (Fig. 5).

Another distribution is made with a hinge added at H and the process is continued. The next section to yield is A, then B and finally C at the upper end of column CD. Figure 6 shows the frame at this stage; it is evident that collapse must occur because no joint remains at which the shear imposed by the transverse loading can be resisted. The structure is now a mechanism.

The total moments under limit loading are listed in Column 15 of Table I. The limit loading is $(s_1 + s_2 + s_3 + s_4 + s_5)\ W = 1.77\ W$. The frame has therefore a plastic reserve of strength of 77 per cent of the load which is considered the ultimate load in the conventional elastic analysis. There is at present very little evidence on which to base a value for the limit factor of safety, but a value of three may be suggested. This would make the working load of the frame $0.59\ W$.

Conclusion

A design can be only as accurate as the assumption on which it is based. The elastic theory is in good agreement with the actual behaviour of steel structures up to the stage when the yield-point condition is reached at a critical section. It is an over-simplification of the problem to ignore the plastic reserve strength of a structure. Although the error introduced by identifying yielding at the first critical section with failure of the whole structure is on the safe side, such thinking results in an inconsistency with regard to the actual factor of safety against collapse. Two similar structures with the same load capacity based on the elastic theory, but with considerably different plastic reserves are conceivable. To consider two such structures as equally strong may at times result in a waste of steel. √

Huge, New Transformer Station Dedicated Recently

Honours Hydro Founder

On February 17, Ontario Hydro Chairman, Robert H. Saunders, C.B.E., Q.C., dedicated a giant new Hydro transformer station and laid a wreath to the memory of a great Canadian and citizen of Ontario.

Chairman Saunders, with civic, provincial and federal government officials also marked the fiftieth anniversary of the meeting in Kitchener (then Berlin), February 17, 1903, which ultimately led to the formation of the Ontario Hydro. Joining in commemorating the event were representatives of the municipalities, boards of trade and other organizations which participated in that original meeting.

Hosts for the historic occasion were the Ontario Municipal Electric Association, headed by Loftus H. Reid, president, in co-operation with the Association of Municipal Electrical Utilities, headed by Rex H. Martindale, president, and Ontario Hydro.

Ontario Hydro's new Petersburg Transformer Station — built to service Western Ontario's future power needs — was renamed the Detweiler Transformer Station, in memory of Daniel B. Detweiler, who was born a few miles from Kitchener in the village of Rosedale.

Power for Western Ontario

Mr. Detweiler devoted his life to the service of the people of Ontario, and his vision helped found the great public utility, Ontario Hydro.

The huge new transformer station will, for the first time, permit Hydro to transmit 230,000-volt electric power directly into the heart of the growing industrial area of Kitchener and district.

Detweiler Transformer Station has been designed to provide adequate supplies of 60-cycle power and to meet future load growth in the north loop area bounded by Guelph, Galt, Kitchener, Stratford and St. Marys. The station will receive power directly from Hydro's 230,000-volt network, and step down the voltage for distribution to neighbouring municipalities. Previously, Hydro could only service this portion of the province with a 115,000-volt transmission network. To date, Stratford, Goderich, Seaforth, St. Marys and district have been standardized to 60-cycle operation in Hydro's huge frequency change-over program and New Hamburg is planned for this August. In Kitchener, advance standardization has already taken place in certain industries, with the city itself scheduled for March, 1954.

An $11 Million Station

Ontario Hydro broke ground on the Detweiler Transformer Station in August, 1951. It is located three miles west of Kitchener on Highway No. 7 and, when completed a few years hence, will be one of the largest in the Hydro system.

First bank of transformers of the ultimate four-bank station will be placed in initial service this July to receive power at 230,000 volts and step it down to 115,000 volts. Sub-transmission lines supplying this area will be tied in to the station. In September, a 26,400-volt supply will also be available from this station. Further additions are planned in succeeding months to take care of the expected growth in this highly-industrialized area. To the end of 1952, Hydro has expended some $2 million on the station. Ultimate cost, when it reaches full capacity, is estimated at $11 million. Its growth will be keyed with the mounting power needs of the region.

The station will obtain power from Hydro's 230,000-volt network which, in 1954, will be augmented by power from the 1,200,000-horsepower Niagara development, the Sir Adam Beck - Niagara Generating Station No. 2. A closely-knit network of transmission lines and facilities to transmit power from generating stations has been an integral part of Hydro's current expansion program which has seen 13 or 14 new power sources placed in service since 1945. With the exception of the current Sir Adam Beck - Niagara No. 2 development, nearly all are contributing their full quota of power into the Hydro systems.

Hydro's current program of expansion has boosted the dependable peak capacity of all systems from 2,597,200 horsepower in 1945 to the registered high of 4,495,100 horsepower in 1952. By 1956, the figure will be raised to 5,807,600 horsepower — an increase over an 11-year period of intense work of approximately 124 per cent.

Training Engineers for Line Management

by

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In the present period of industrial mobilization, the question of in-employment training of graduate engineers seems academic at first glance. Industry is so eager to obtain the few graduate engineers available, and the shortage is so acute, that procurement of engineers comes first on the agenda. It is only when the role which engineers actually play in industry is examined that the significance of post-graduate industrial training appears in complete perspective. A great proportion of engineering graduates do not function as pure engineers, that is, as technical specialists in staff organizations. Many, instead, enter industry to occupy positions of direct line responsibility in production management. There is a striking difference in the function of an engineer as a staff specialist and as a line manager. This creates different demands for in-employment training.

The graduate engineer who enters industry as a staff specialist is reasonably well prepared by his university training to meet the demands placed upon him. To be sure, additional technical training is necessary, but ordinarily this need for additional training creates no extraordinary stress. On the other hand, university undergraduate curriculae for engineers usually offer no training in the art of management. In consequence, it is the problem of training engineers to become line managers, to deal with men and to enlist the collaboration of subordinates, that creates the really acute problem for post-graduate training.

To begin with, some consideration of the trend for engineers to enter industrial management is called for. Production management is becoming increasingly complex at the technical level. This increase in technical complexity requires that technically qualified engineers be called upon to fill the posts of line management responsibility to a greater and greater extent. Thus the role of the engineer has been extended over the years beyond the limits of staff specialist and into the domain of management itself. Paradoxically, the increase in technological complexity, which necessitates the absorption of engineers into line management, was produced by earlier engineers who created new processes, machines and products while working as staff specialists. The engineer as a technical staff specialist has thus, perhaps unwittingly, produced a demand for himself as a line manager. This is the fundamental fact behind the need for post-graduate training of engineers in the present period of mobilization.

With the shortage of engineers so acute, the problem of training engineers to become effective leaders of men constitutes a challenge of the first magnitude. Upon industry's solution to this challenge, hangs the answer to one of the questions of full utilization of its human resources in an era of full employment and industrial expansion. How can the challenge be met ? Perhaps it can best be analyzed if we consider the nature of the equipment which the neophyte engineer carries with him into industry, and the equipment he must possess when he becomes a functioning member of line management.

It is necessary to make some assumptions about the characteristics of the young graduate engineer, realizing at the same time that these assumptions do not apply to all cases. For one thing, we have assumed that he is fairly well qualified from a technical point of view, even though additional training may be called for. Generally, however, he has had rather limited industrial experience, and what experience he has had has rarely been in an administrative or supervisory capacity. Consequently, he is

The trend in engineering employment away from the technical and toward the executive is not new, but the shift from one kind of work to the other is largely unplanned. The authors of this paper describe in a general way how one company recruits from among its young engineers those of "line promise" and some of the methods it uses in their training.

not very familiar with the complex issues of human relations which form so much of the day to day concern of managers. Problems of grievance procedures, discipline, morale, absenteeism, merit ratings, promotion, resolving conflicts, and so on through the whole gamut of supervisory and human relations, introduce him to unfamiliar territory. Depending on the curriculum of his university, he may or may not have a nodding familiarity with such issues; rarely indeed has he had any practical experience in meeting and dealing with them face-to-face. Yet these are some of the very issues upon whose effective handling he is doomed to stand or fall as a line manager. Again, on the positive side of the management ledger, he will be required to enlist the full-hearted support of his subordinates in the task of getting out production. He has to evoke from them the will to work for him and with him. These are concrete skills for which his formal training has ordinarily not equipped him, even though his native aptitudes may help him to a greater or lesser degree. In the last analysis, management does consist, as has been said often enough, in getting things done through and with people. In other words, it hangs upon leadership skills or, to adopt another terminology, upon "effective human relations". How can the young engineer be taught skills in leadership and human relations, if such skills can be taught?

Some preliminary investigations by the Aluminum Company of Canada, Limited, suggest that two approaches, case-studies and role-playing, may be useful media for training young engineers, or any management personnel, in administrative leadership. Both of these approaches have been widely exploited in schools of business administration and in industry, yet surprisingly little information about them seems to have been presented in business journals.

A "case" in human relations consists of a factual, uninterpreted account of a problem situation which has arisen in some organization. Such problems may involve only two individuals, or may be problems so pervasive as to extend throughout an entire enterprise. The students' job is to isolate the problem or problems involved in the case, to analyze the usually intricate network of causes and effects, to diagnose the forces at work and, finally, to propose a detailed and explicit course of action to remedy the problem situation. Because this process takes place in group discussion under the guidance of a leader who asks questions but provides no answers, students are forced to rely on their own intellectual resources. In expressing judgments and opinions individual students are exposed to challenges from the group. By having their opinions challenged, students find themselves forced to re-examine their often unconscious assumptions about human nature and organizations, to work out assumptions better tested and more tentative, and to develop problem-solving attitudes toward human administrative problems. Experience seems to show that the case-study method of training does produce better administrators.

The "role-playing" technique used is to present to a group a problem that concerns only two individuals. For example, a typical problem in industry is for a superior to interview his subordinate in order to discuss strong points and weaknesses in the latter's performance. Such situations are often loaded with emotional elements and require tact, skill and sensitivity, especially if, during the course of the interview, superior and subordinate are supposed to work out together practical ways for improving the subordinate's performance. Experience with the role-playing method shows that students, by working out a pattern for the interview and then by acting out the pattern, detect weak points and make improvements in their approach to these delicate areas of interpersonal relationships.

Case-studies and role-playing are two complementary techniques based on one underlying philosophy. The case-study approach seeks to help management trainees *develop* increased skills in diagnosing and solving concrete problems in human relations. The role-playing technique seeks to help trainees to acquire the social skills necessary for *executing* the solutions arrived at by this process of analysis and diagnosis. Any attempt to execute will require that the administrator talk with one or more persons in order to alter attitudes, enlist co-operation or support, counsel, advise, persuade or discipline. Thus, the case-study and role-playing approaches are inseparable twins: in order to act effectively one must first understand, but understanding without effective action is not helpful. The best administrators from the analytic or diagnostic point of view are often ineffectual leaders, because they lack the skills for translating decisions into results, i.e., they cannot deal effectively with people at the face-to-face level. By the same token, persons who are most natural and skillful in face-to-face relations with others, are often ineffectual administrators, because of undeveloped faculties for analysis, diagnosis and decision-making.

Some account of the Aluminum Company of Canada's training program for young engineers might be of interest. Newly employed engineers usually spend several months in a training program which consists of two parts. The first part covers visits and temporary job assignments to the various company plants in Quebec and Ontario. These provide the basic knowledge of company organization, operations, practices and personnel which is useful for any career line in the organization. It has also the advantage of permitting more careful placement of the trainee in a regular job for which he is felt to be suited. Another factor involved in this placement process, incidentally, is the frequent change of occupational preference which takes place during his training period. This change of preference is related to newly-acquired perceptions of the industrial world. The second part of the training program consists of a three-week period at the Montreal head office. It is during this period that case-study and role-playing training is provided.

The one striking appeal common to these two approaches, case-studies and role-playing, is that they apparently make such uncommonly good common sense. They are based on the concept of "learning by doing", on the idea of learning by experience. Case-studies and role-playing are certainly not elixirs which can make managers out of engineers overnight.* They are, however, practical methods which do effect significant improvements in the administrative know-how of the engineer. In a rapidly expanding economy, they offer some means for helping young engineers face the heavy loads of management responsibilities which they are called upon to meet by the challenge of the times.

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*A more detailed account of the philosophy and technique of the case-study approach can be obtained from an article written by F. J. Roethlisberger in the Harvard Business Review, September, 1951, entitled "Training Supervisors in Human Relations".

For an explanation and discussion of role-playing one of the best sources is the article in "Sociatry", June, 1947, by Prof. Alex Bavelas of M.I.T. entitled "Role-playing in Management Training".

Experimental Determination of Strains in Prestressed Concrete Pipe as a Proof of Theory

by

S. Woinowsky-Krieger and R. J. A. Potvin

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Strains were determined during a hydraulic pressure trial on an experimental prestressed concrete pipe by means of electric strain gauges, and were found to fit into the general picture of stresses as calculated by theory. Apparent abnormalities in the stress curves obtained are explained by a mechanical hysteresis phenomenon observed in concrete. The data recorded show furthermore that the prestressed concrete pipe cannot be destroyed by exceeding the maximum hydraulic pressure it can normally withstand, because it acts somewhat like a safety valve to release any unwanted excess pressure. Even after this maximum pressure is exceeded, it will still have a useful life although at a slightly lower maximum pressure.

Even though this safety valve action would prevent the collapse of the pipe, it would inevitably lead to leakage and hence to possible corrosion and failure of the steel reinforcing, hence in practice such pipes should not be stressed repeatedly to the point where cracks may be expected.

Description of Set-up and Results Observed

Very little data have been published in the current literature (1, 3) on the experimental determination of strains and stresses in prestressed concrete pipes and cylindrical tanks. One of the major reasons is the technical difficulty of measuring deformation in concrete. In the present work experimental data were obtained with sufficient accuracy by means of electric strain gauges to verify closely the values derived from theoretical calculations.

The experimental set-up consisted of a pressure chamber formed by the prestressed concrete pipe, of a pumping unit equipped with a manometer and finally of a strain gauge arrangement for following the deformation at various points of the prestressed pipe.

This paper should be read by all those concerned with the design of reinforced concrete pipe of the prestressed type. To some its appearance may be somewhat formidable, but the equations presented are in reality simple and, even without them, there is much to be learned by following this account of the author's experiments.

Prestressed concrete pipes are made of a vibrated concrete cylinder over which is tightly wound a high carbon steel wire in such a way that the underlying concrete is kept safely under compression during normal service conditions. In the present case, the pressure chamber was composed of a 42-in. interior diameter prestressed concrete pipe, *P*, Fig. 1, about 48 inches high and of a concentric internal pipe, *B*, arranged by means of rubber gaskets, *G*, to hold the water under pressure within a confined space. Steel bars were embedded in the prestressed concrete pipe in order to facilitate the setting up of the pressure chamber. These bars are not shown in Fig. 1.

Water was introduced by means of a small pipe connected to a manual pumping unit equipped with a shut-off valve. A large scale pressure gauge served to measure the pressures inside the pipe to be tested within an accuracy of ± 2 lb./sq. in.

The deformation of the concrete pipe was followed by means of electric resistance strain-gauges to an accuracy of 4 millionth of an inch per inch. The strain gauges were cemented in place by a technique illustrated in Fig. 2. To measure the strains on the prestressing steel wire, four gauges numbered 1 to 4 were cemented on the steel wire at half-height of the pipe, as indicated in Fig. 3. Another strain gauge, numbered 5, was placed in the same direction as the first four gauges, but on the concrete outer surface. A sixth gauge was fixed on the outer surface of the concrete in the axial direction, to detect any possible longitudinal strain in the pipe as seen in Fig. 2.

After the system was made watertight, the pressure was gradually raised to 300 lb./sq. in., while the corresponding strains were recorded as given in the first part of Table I. When the pressure was released, the gauges returned practically to their initial values. Three hours later, the pressure was increased again in steps up to the maximum of 425-430 lb./sq. in. When this pressure was exceeded, the prestressed pipe did not burst, as would be expected in the case of a steel or an ordinary reinforced concrete pipe, but developed longitudinal microcracks at a few places in the vicinity of Gauge No. 3, through which water started to seep while the pressure fell to a few pounds below 365 lb./sq. in. The surface of the pipe was then partially dried with a blower to make sure that the seepage had actually ceased. After releasing the pressure, the gauge readings came back to normal, denoting the absence of any signifi-

cant permanent set in the material of the pipe.

When pressure was raised again it was observed that seepage started at about 365 lb./sq. in. and at strains exactly corresponding to those recorded for this pressure during the initial testing. After several repetitions of the same procedure, no apparent change in the behaviour of the prestressed pipe was noticeable.

Before removing the pumping unit, the pressure was raised to 200 lb./sq. in. At the end of eight days, it had fallen to 155 lb./sq. in., corresponding to a seepage of 1.5 cubic centimeters per hour. This relatively small leak of the *entire system* is evidence that the serviceability of the prestressed pipe was not seriously altered after the above overloading trial even for this concrete, which had been aged but one month.

Interpretation of the Results

A general idea of the dimensional changes occurring in the prestressing wires and the concrete pipe is given by the curves in the diagram of Fig. 3. It should be noted that there is a divergence in the curves corresponding to Gauges 1 and 3 placed in opposition, as compared to Gauges 2 and 4, also placed in opposition but at 90° to the other pair. As may be shown mathematically, this divergence is due to the slight initial ellipticity of the concrete pipe: in fact, actual measurements showed a difference of some $\frac{3}{8}$ in. between the two diameters corresponding to the locations of these gauges; this value is of the same order of magnitude as the figure derived from the observed strains (see Appendix I). The location of Curve *A*, representing the average, is therefore justified and this curve is taken as the basis of the subsequent analysis.

Since Gauge No. 5, placed between Nos. 1 and 4 was much nearer to No. 4 than to No. 1, the data recorded from this gauge follow closely those of Gauge No. 4, but necessarily cannot be used in an exact calculation because they do not represent an average value of the strain in the concrete, as the other four strain gauges do in measuring the deformation of the steel wire. No curve is shown for Gauge No. 6 because the longitudinal deformations in the concrete pipe are small, as would be expected from the mechanical standpoint, and correspond to a slight contraction. It is therefore evident that longitudinal reinforcement is not necessary to resist the water pressure although it may be desirable for other reasons. For instance, such reinforcement will provide increased resistance against mishandling during transportation and laying, and also against any stresses from thermal contraction and from the reaction of the foundation.

Let us compute the stresses from Curve *A* in Fig. 3, corresponding to a pipe of perfect axial symmetry. As all initial stresses in a prestressed

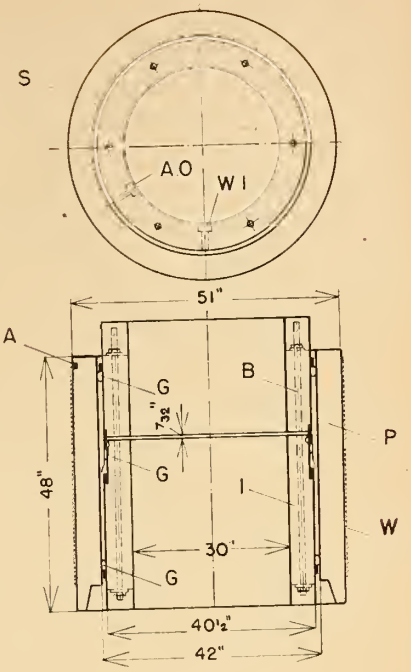

Fig. 1.

pipe are in equilibrium with one another, one needs only to consider the equilibrium of the additional stresses, σ_o, σ_i, and σ_s, due to the water pressure, p, where σ_o is the tension in the outer fibre of the concrete, σ_i the tension in the inner fibre of the concrete and σ_s the tension in the wire. Since the pitch of the prestressing wire is 0.3 in., the area of the wire per unit length of pipe is $A_s = 0.0158/0.3 = 0.0527$ in.^{2} and the total tensile force in the corresponding section of the

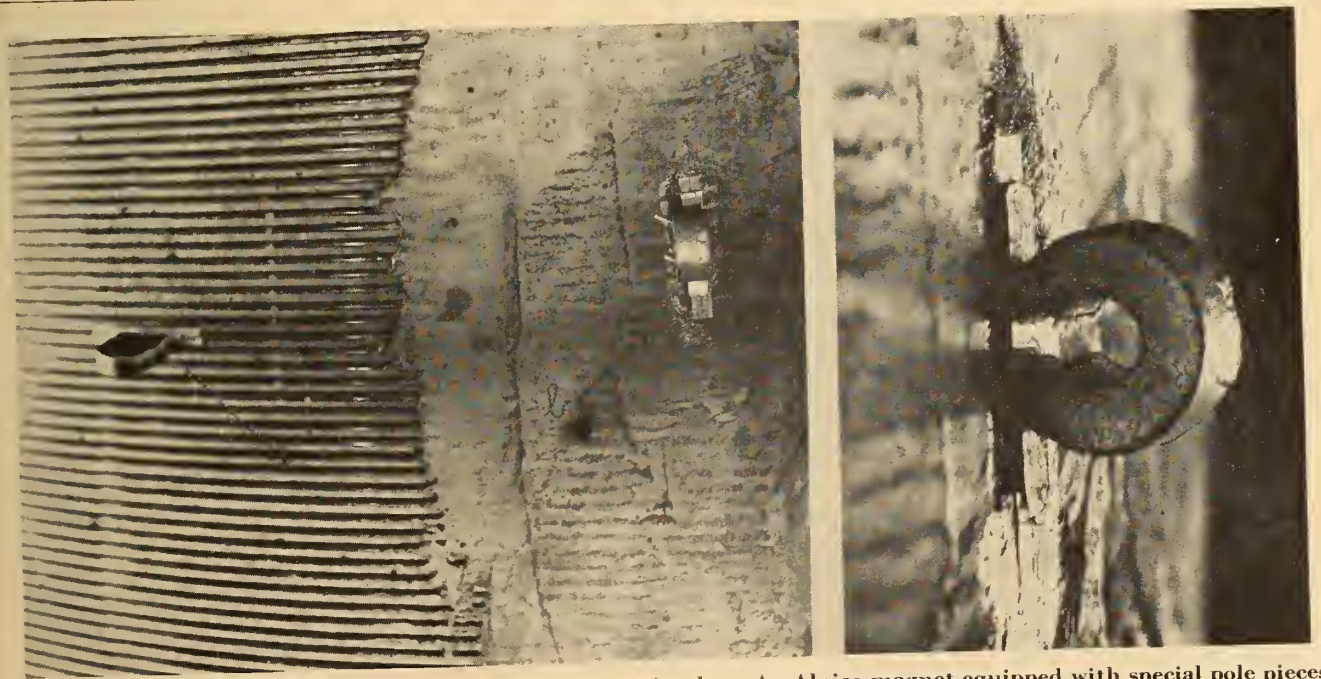

Fig. 2. Showing the procedure used to mount the gauges in place. An Alnico magnet equipped with special pole pieces made to the contour of the gauge, holds the gauge in place while the cement is setting. At left, a gauge cemented tangentially to the pipe; at right, a gauge cemented longitudinally to the pipe.

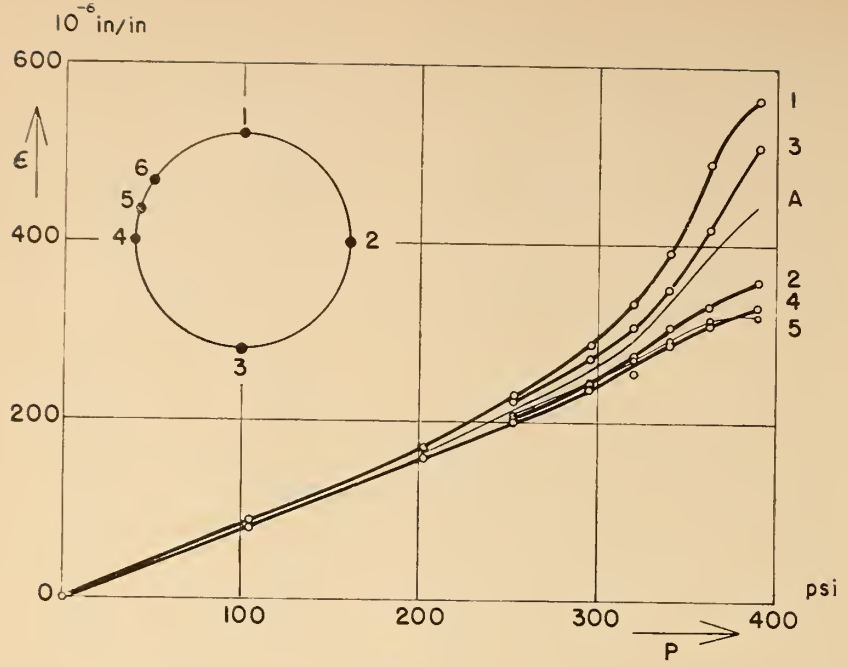

Fig. 3.

shell (Fig. 4) is $21p$, 21 in. being the inner radius of the pipe. Thus, the condition of equilibrium is attained when

$$21p = 4.50 \times \frac{\sigma_o + \sigma_i}{2} + 0.0527\ \sigma_s \quad \ldots (1)$$

Introducing now

$$n = \frac{E_s}{E_o} \quad \ldots (2)$$

for the ratio of Young's moduli of the steel and the concrete we have

$$\sigma_s = n\ \sigma_o \quad \ldots (3)$$

The relation between the σ_i and σ_o can readily be obtained by means of the well-known formulae of Lamé for thick-walled cylinders. Referring to Fig. 4:

$$\frac{\sigma_i}{\sigma} = \frac{25.5^2 + 21.0^2}{2 \times 21.0^2} = 1.23 \quad \ldots (4)$$

This ratio does not include the effect of the external pressure of the wire against the concrete, but investigation shows that this effect is, in fact, less than 1 per cent and therefore negligible. Substituting relations (3) and (4) in Eq. (1):

$$\sigma_s = \frac{100\ pn}{24.0 + 0.25n} \quad \ldots (5)$$

Taking 32×10^6 lb./sq. in. for E_s (see Appendix II) and replacing σ_s by $\epsilon E_s = 32\epsilon \times 10^6$ where the elongation of the wire ϵ is expressed in inches per inch, Eq. (5) yields

$$n = \frac{7.68}{\frac{p}{\epsilon} 10^{-6} - 0.08} \quad \ldots (6)$$

All the stresses and the value n were therefore computed from the strain ϵ, given by Curve A in Fig. 3, in the following order

$$\sigma_s = 32\epsilon \times 10^6,\ n = \frac{7.68}{\frac{p}{\epsilon} 10^{-6} - 0.08},$$

$$\sigma_o = \frac{\sigma_s}{n},\ \sigma_i = 1.23\ \sigma_o \quad \ldots (7)$$

and these are presented in Table II.

The values of n and of the additional stresses, σ_s, due to the water pressure, p, are plotted against p in Fig. 5.

The limiting value of 365 lb./sq. in. which causes re-opening of the cracks on subsequent increases of pressure, corresponds to the state in which the concrete has just lost all compression due to prestressing. The curve σ, Fig. 5, which represents the total stress in the outer fibre of the concrete must therefore pass through the zero compression axis at this limiting value of 365 lb. sq. in. Once this starting point is fixed, the curve σ may be plotted from the data obtained in Table II.

The intersection of curve σ with the zero pressure axis falls on the point corresponding to 1,390 lb. sq. in. which determines the magnitude of prestressing in the concrete. This value of σ is in close agreement with the theoretical compression calculated from the known winding tension in the wire, about 150,000 lb. sq. in, due allowance being made for the losses of tension caused by shrinkage, creep and other plastic phenomena.

If tensile stresses in the concrete are considered, the part of the curve below the abscissa axis in Fig. 5 is obtained. It should be noted that the initial tensile strength of the concrete, i.e., the strength before the cracks occurred, corresponds to the highest recorded pressure of 425-430 lb./sq. in. and is equivalent to a tensile value of about 200 lb./sq. in. in the concrete. This figure is relatively low compared to the usual tensile strength found in such high strength concrete, having a compressive strength of the order of 4,000 lb./sq. in. in 28 days. The overall apparent tensile limit is below the true limit of the concrete, because the theoretical inner stresses are about 23 per cent higher than the outer stresses according to Equation (4) and also there is some weakening of the pipe due to the slight ellipticity of the cylinder and to the presence of steel bars embedded in the concrete.

On the other hand, Curve σ_s shows the variation of stresses in the wire up to the maximum pressure limit. This variation was calculated

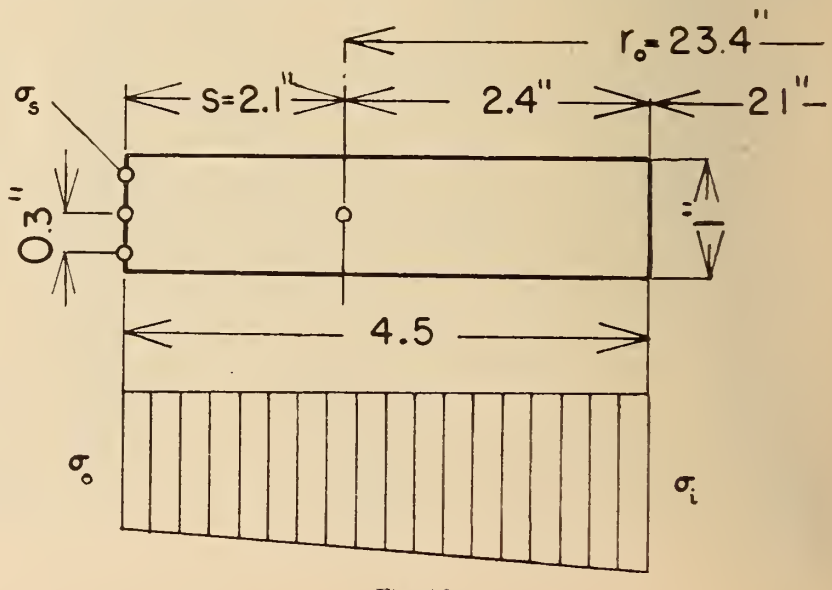

Fig. 4.

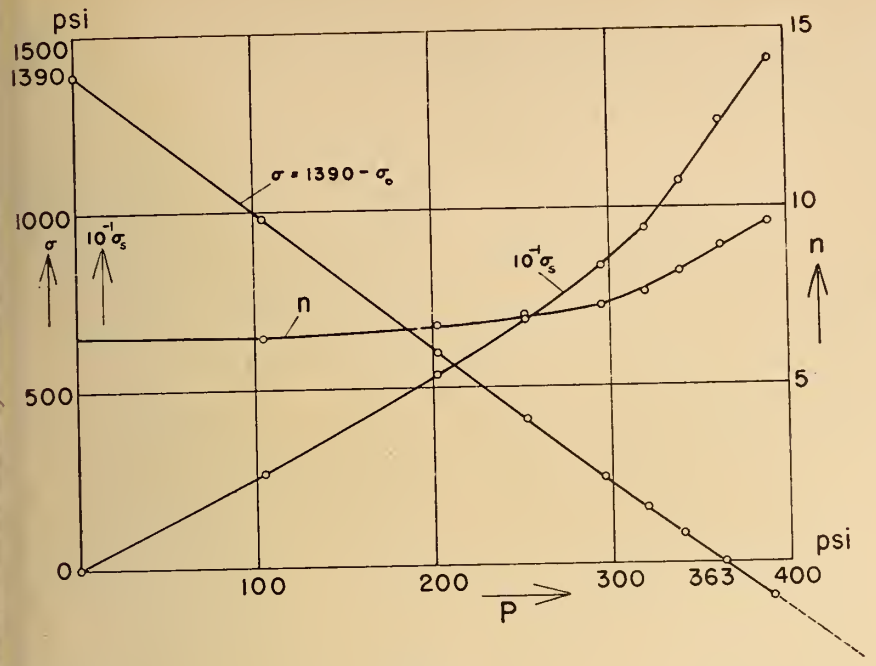

Fig. 5.

from the *average strain curve* given in Fig. 3 and found to be 14,140 lb./sq. in., which was not sufficient to cause any significant permanent deformation of the wire as shown by the gauge readings, and was consequently far from bringing it to its ultimate tensile strength, which is of the order of 200,000 lb./sq. in. It is therefore obvious that when the maximum pressure of 430 lb./sq. in. in the concrete pipe was exceeded, the wire, which could sustain much greater loads without breaking, prevented the concrete pipe from being destroyed. Furthermore, the elasticity of the stressed wire caused the longitudinal microcracks allowing seepage to close when, due to the release of some water, the pressure reached a value of 360-365 lb./sq. in. This pressure is practically that corresponding to zero strain in the concrete according to the results plotted in Fig. 5. Under this critical limit the concrete is held tightly in place by the steel wire and there is no seepage. An excess of pressure beyond 360-365 lb./sq. in. will eventually reopen these microcracks and seepage will be experienced again. In other words, these microcracks will act somewhat like a safety valve, letting off excess pressure when the actual force exerted on the inside of the pipe exceeds that arising from the prestressing wire. Moreover, the strain values recorded in Table I show that, after a sufficient lapse of time, the original conditions of stressing are restored in the concrete pipe.

At a pressure of about 300 lb./sq. in., Curve σ_s reveals a marked inflection although the gauge readings on the steel wire do not indicate any significant permanent deformation upon release of pressure (see Table I). This inflection can be ascribed a priori to hysteresis phenomena (4) occurring in the steel in the vicinity of its elastic limit and in the concrete itself upon returning to the initial no-load condition. It would correspond in both cases to marked changes in the moduli of elasticity of these materials. It seems more probable, however, from the lack of permanent deformation in the stressing wire and from theoretical considerations based on the very small area of the steel compared to concrete, that the hysteresis phenomenon in the concrete would be the major contributory factor explaining the sudden change in proportionality between the recorded strain and the pressure in the pipe and, also, the sharp increase in the n values shown in Fig. 5. This point was further proved by determining the hysteresis cycle on loading and unloading a high-strength concrete block 6 in. in diameter by 12 in. in height, on which the strain readings were recorded by means of two electric strain gauges placed in diametrically opposite positions. Fig. 6 gives the actual average stress-strain curve obtained during the first stressing cycle which was completed in 37 minutes. It should be noted that there is a sharp decrease in the modulus of elasticity upon release of the load towards the origin. Since there was no appreciable permanent deformation observed in the steel wire, the large variation in the n value must necessarily come from this sudden change which is found in the modulus of elasticity of the concrete upon release of the pre-load and which is of the same order of magnitude, as shown by the n curve of Fig. 6. This hysteresis phenomenon, however, becomes less evident upon subsequent loading and unloading cycles. Further work is being carried out on this subject.

Table I

Sample poured on July 14, 1950; tested on August 10, 1950.
Strains in millionth of inch/inch.

Time	Water pressure p.s.i.	Gauge No. 1	2	3	4	5	6
Aug. 10							
11:40 a.m.	10	0	0	0	0	0	0
11:48 "	105	88	72	80	80	64	−20
11:56 "	203	176	148	160	152	144	−16
12:17 "	300	300	240	268	240	232	−32
12:30 "	0	12	−4	0	0	−4	−28
3:07 p.m.	0	0	0	0	0	0	0
3:22 "	203	172	160	176	160	172	−80
3:33 "	253	232	204	224	200	208	−12
3:43 "	296	288	244	272	240	248	−12
3:54 "	320	336	276	308	256	272	−8
4:12 "	340	392	308	352	288	292	−4
4:24 "	363	492	332	420	312	316	4
4:32 "	390	564	360	512	332	320	−8
4:40 "	425–430	Seeping of water with a corresponding loss in pressure.					
5:00 "	205	192	188	284	180	184	−8
5:20 "	365	—	—	—	—	—	—
5:45 "	0	−8	16	44	12	8	−8
Aug. 25							
12:30 p.m.	0	−9	6	3	−11	5	0

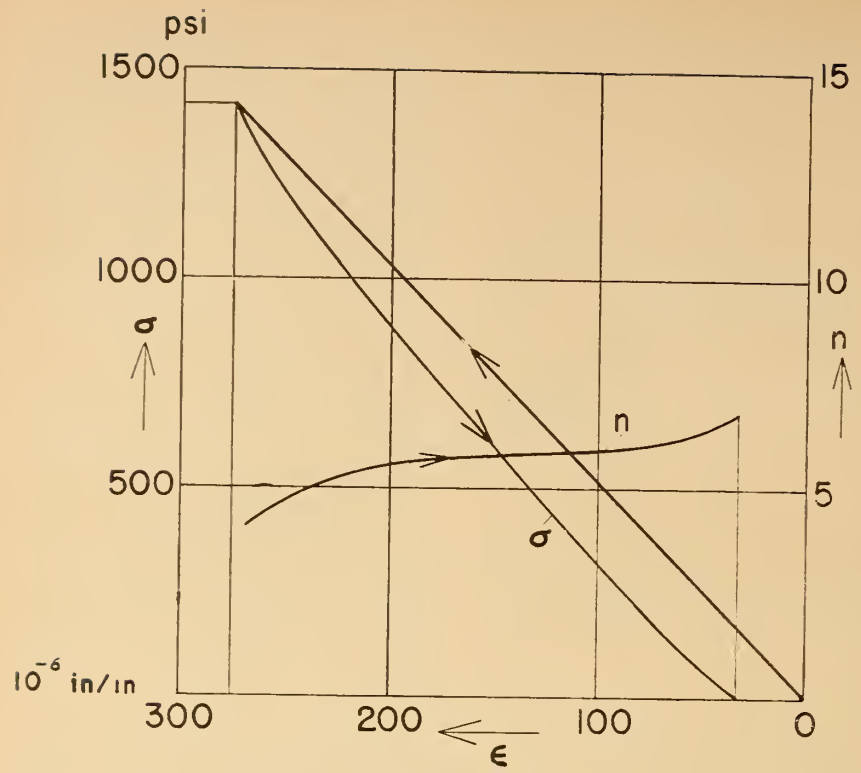

Fig. 6.

Appendix I

Effect of the Initial Ellipticity of the Pipe

The divergence of the strain curves corresponding to Gauges No. 1 to No. 4 and appearing in the diagram of Fig. 3 suggests the existence of some deviation from axial symmetry in the shape of the pipe. Assuming this shape to be of double symmetry, the theoretical strains caused by such an ellipticity can be obtained in the following manner.

The circle $r=r_o$ in Fig. 7 may represent the ideal shape of the pipe; let us express the initial deviation of the prestressed pipe from this ideal shape in the form

$$w_1 = f \cos 2\theta \quad \ldots\ldots (8)$$

where f is an unknown constant.

The problem of a slightly elliptical pipe subjected to a uniform external pressure has been discussed by S. Timoshenko (5). However, as we have to deal with an internal pressure, the sign of the load, q, denoting the external pressure in the formulae of Timoshenko, must be reversed. The bending moment, positive if the inner fibre is in tension, is then given by

$$M = pr_o (w + f \cos 2\theta) \quad \ldots\ldots (9)$$

in which w is the radial displacement, positive in the direction towards the center of the pipe section. This displacement can be written:

$$w = -\frac{pf}{p+q_{cr}} \cos 2\theta \quad \ldots\ldots (10)$$

The "critical" external pressure

$$q_{cr} = \frac{3EI}{(1-\nu^2) r_o^3} \quad \ldots\ldots (11)$$

contained in Equation (10) depends on the moment of inertia, I, of the shell section per unit width (Fig. 4), on the radius, r_o, and also on the elastic constants, E and ν, of the concrete. By substituting (10) in expression (9), we obtain

$$M = -\frac{pr_o f}{1+\frac{p}{q_{cr}}} \cos 2\theta \quad \ldots\ldots (12)$$

Now, in considering a given section of the pipe shell and taking for instance $n=8$, the area of this section represented in Fig. 4 becomes

$$A = 4.50 + (8 \times 0.0527) = 4.50 + 0.42 = 4.92 \text{ in}^2$$

and accordingly

$$I = \frac{1 \times 4.5^3}{12} + \frac{4.5 \times 0.42 \times 2.25^2}{4.92} = 9.53 \text{ in}^4$$

The position of the center of gravity of the section is given by

$$s = \frac{4.50 \times 2.25}{4.92} = 2.1 \text{ in}$$

Taking once more $n=8$ and, furthermore, $\nu=0.3$ for Poisson's ratio, Equation (11) yields $q_{cr}=12{,}400$ lb./sq. in. As p does not exceed 400 lb./sq. in. the fraction p/q_{cr} of the denominator of Equation (12) can be neglected since it is small compared to unity and this equation may be simplified to

$$M = -pr_o f \cos 2\theta \quad \ldots\ldots (13)$$

According to measurements made at the butt of the pipe the position of the axes of the ellipse with respect to the gauges is assumed to be as shown in Fig. 7. Since, according to Fig. 4, $r_o=23.4$ in., we obtain

$$\max M = \pm 23.4\, pf \quad \ldots\ldots (14)$$

the upper sign being valid for Points 2 and 4, the lower sign for Points 1 and 3.

The recorded strains are due partly to the pure tension, which may produce a strain ϵ_t, partly to bending with a maximum strain value of $\pm \epsilon_b$

Therefore we have

$$\epsilon_t + \epsilon_b = \frac{\epsilon_1 + \epsilon_3}{2},$$

$$\epsilon_t - \epsilon_b = \frac{\epsilon_2 + \epsilon_4}{2} \quad \ldots\ldots (15)$$

where ϵ_1 to ϵ_4 are the strains observed at Points 1 to 4 respectively. Consequently

$$\epsilon_b = \frac{\epsilon_1 - \epsilon_2 + \epsilon_3 - \epsilon_4}{4} \quad \ldots\ldots (16)$$

On the other hand, it follows from Equation (14) that the maximum bending strain at the outer side of the shell is given by the formula

$$\epsilon_b = \frac{Msn}{E_s I} = \pm \frac{23.4\, pfns}{32 \times 10^6 I} \quad \ldots\ldots (17)$$

where the plus sign holds for the outer fibre at Points 1 and 3 which are in tension, and the minus sign for the outer fibre at Points 2 and 4 which are in compression. Now, it is

Table II

p lb./sq. in.	ϵ 10^{-6} in./in.	σ_s lb./sq. in.	n	σ_o lb./sq. in.	σ_i lb. sq. in
0	0	0	—	0	0
105	83	2,656	6.48	410	504
203	167	5,344	6.76	790	972
253	215	6,880	7.01	982	1,208
296	261	8,352	7.29	1,146	1,410
320	294	9,408	7.62	1,235	1,520
340	335	10,720	8.21	1,306	1,606
365	389	12,450	8.95	1,390	1,710
390	442	14,140	9.58	1,476	1,815

easy to verify that for the section represented in Fig. 4 and for any value of n

$$s = \frac{10.1}{4.50 + 0.0527\,n};$$

$$I = \frac{34.2 + 1.60\,n}{4.50 + 0.0527} \quad \ldots\ldots\ldots\ldots (18)$$

Using these expressions Equation (17) can be rewritten in the form

$$\epsilon_b = \pm 74 \times 10^{-7} \times \frac{pfn}{34.2 + 1.60\,n} \quad (19)$$

which yields

$$f = \frac{4.61 + 0.21\,n}{p\,n} \times 10^6 \epsilon_b \quad \ldots\ldots (20)$$

From Fig. 7 the difference of the diameters 1-3 and 2-4 is $\Delta D = 4f$, i.e.

$$\Delta D = \left(\frac{18.5}{n} + 0.84\right) 10^6 \frac{\epsilon_b}{p} \quad \ldots (21)$$

The values ΔD computed from the recorded strains ϵ of Table I and from the values n of Table II are summarized in the following table:

Table III

p lb./sq. in.	ϵ_b 10^{-6} in./in.	n	ΔD in.
253	13	7.01	0.18
296	19	7.29	0.22
320	28	7.62	0.29
340	37	8.21	0.34

The theory used as a basis for this table obviously cannot be regarded as rigorous, since the actual shape of the pipe is far from being an exact ellipse. Yet the values of ΔD corresponding to the higher pressures are in fairly good agreement with the measured difference of 0.37 in. These results show in any case that the divergence of the strain curves given in Fig. 3 can actually be explained by the initial ellipticity in the shape of the pipe.

Appendix II

Modulus of Elasticity of the Hard Drawn Steel Wire

The modulus of elasticity of hard drawn steel wire was determined by means of the static method, by following the elastic deformation under tension on a sample taken from the wire which had been wound around the concrete pipe. The surface of the sample was carefully polished to a very smooth finish. Microscopic examination of the polished surface revealed no significant defect. The diameter of the polished wire varied from 0.1425 in. to a maximum of 0.1432 in. and averaged 0.1429 in. The maximum excentricity was within 0.001 in. and the average area of the section was 0.0160_{58} sq. in.

The strain was measured on a 2.00 inch gauge length with a Lindley extensometer reading to ± 0.00001 in. and the variations of strain were recorded for loads between 500 lb. and 1,100 lb. on the wire both on increasing and decreasing loads, using a slow rate of loading and unloading. All measurements were made at 70°F. The accuracy of the loading was within ± 2 lb. as determined by the direct weighing method.

Results and Discussion. Four sets of determinations on both increasing and decreasing loadings gave an average of 7.8×10^{-6} in./in. strain per lb., corresponding to a modulus of elasticity of $31.9_9 \times 10^6 \pm 0.2 \times 10^6$ lb./sq. in.

This value is slightly greater than those recorded by H. H. Abram (6) for annealed high carbon steels. The values of modulus of elasticity which have been reported for cold worked steel are higher than those for annealed steel and, according to Jeffries and Archer, this would arise from the fact that the moduli for the annealed metal were computed for stresses exceeding the elastic limit. According to our views, a major error in determining the moduli would come from the poor preparation of the surface of the sample which often shows relatively large defects after cold drawing. It has also been shown by A. T. Adam (7) that even for low carbon steel the effect of aging on cold drawn wire was to increase the yield strength and the modulus of elasticity, this latter by a value of from 780,000 to 2,350,000 lb./sq. in. This aging effect was found to take place relatively rapidly during the first two weeks of standing at room temperature.

Acknowledgments

The authors take pleasure in acknowledging their indebtedness to the Preload Co. of Canada, Limited, and to Les Tuyaux Vibrés, Inc., who made this work possible. They wish particularly to express their appreciation to Mr. G. M. Demarque and Mr. T. J. Chiverton, for their suggestions and co-operation in preparing this paper. They are also indebted to Mr. A. Woinowsky-Krieger for his assistance.

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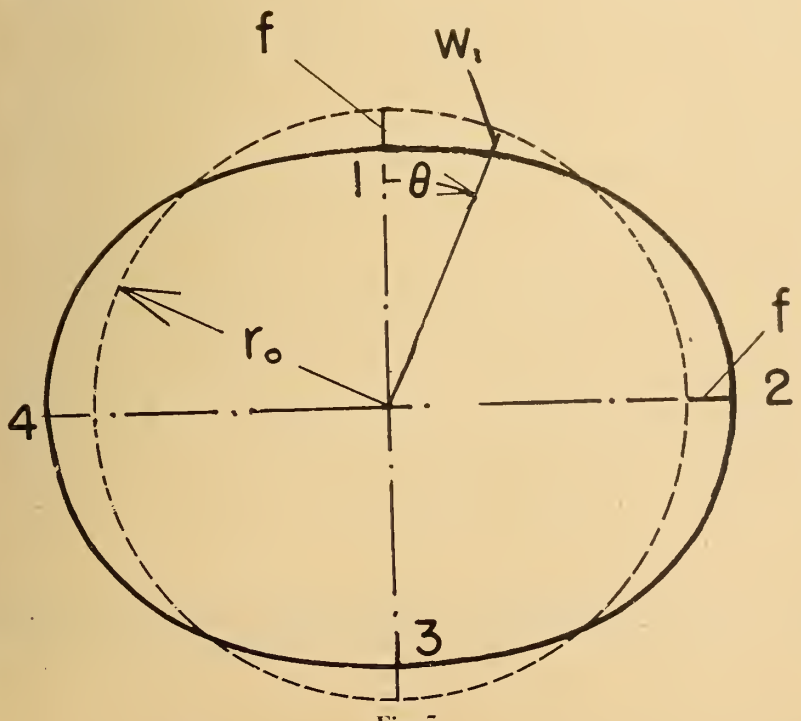

Fig. 7.

67th Annual General and Professional Meeting

HOSPITABLE NOVA SCOTIA will be our host at the 67th Annual General and Professional Meeting—May 20, 21, 22, 1953.

The business and professional meetings will be held in Dalhousie University—Halifax. The University authorities have placed at our disposal accommodation on the campus for 100 people—and dining arrangements for 125. The leading hotels in Halifax have reserved large blocks of rooms for us. The hotels are but a short journey from the University.

The papers and the discussions will cover phases of engineering development and achievements which are of paramount importance to Canada and her engineers. In three short days at the meeting it will be possible to gain the latest engineering information and data from the leading authorities on their subjects.

Her Majesty's Royal Canadian Navy has arranged for sea trips and harbour cruises in modern warships and for the inspection of the engineering departments of H.M.C. Dockyard, Halifax, and H.M.C. vessels.

Through the kindness of the naval authorities, the annual banquet and ball will be held in the vast gymnasium of H.M.C.S. Stadacona.

Trips to Nova Scotia's scenic spots have been arranged for the ladies, and tours of the city—teas—shopping expeditions, and social gatherings will round out a well-balanced program.

See pages 238 and 239, this issue of the Journal, *for more complete information on what promises to be "the best yet" of our 67 annual get-togethers.*

Halifax - Nova Scotia

Three Days of Important Presentations and Discussions

▶ **STEAM GENERATION OF POWER AT NOVA SCOTIA LIGHT & POWER CO. LTD.**
J. W. MacDonald, M.E.I.C., Assistant Engineer at Nova Scotia Light & Power Co., Ltd., Halifax.

▶ **MODERN INSTRUMENTS OF PHYSICAL OCEANOGRAPHY AND THEIR USE IN WATERS OF INTEREST TO CANADA**
J. R. Longard, Naval Research Establishment, Dartmouth, N.S.

▶ **THE NEW EDMONTON PLANT OF THE CANADIAN CHEMICAL CO. LTD.**
D. R. Keck, Plant Engineer, Canadian Chemical Co. Ltd., Edmonton.

▶ **REFRIGERATION AND STORAGE OF FISH IN TRAWLERS**
W. A. McCallum, M.E.I.C., Development Engineer, Fisheries Experimental Station, Halifax.

▶ **MECHANIZATION OF THE WABANA MINE**
C. M. Anson, M.E.I.C., Vice-president and General Manager, Dominion Iron & Steel Co., Ltd., Sydney, N.S.

▶ **FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF EXTERIOR WALLS FOR BUILDINGS**
N. B. Hutcheon, M.E.I.C., Professor of Mechanical Engineering, University of Saskatchewan.

▶ **IMPROVEMENTS IN ELECTRODE BOILERS**
Milton Eaton, M.E.I.C., Electrical Engineer, Shawinigan Chemicals Limited.

▶ **SYDNEY FOAMED SLAG AS A LIGHTWEIGHT AGGREGATE**
M. R. Foran, M.E.I.C., Professor, Chemical Engineering, Nova Scotia Technical College and
Spencer Ball, M.E.I.C., Professor, Civil Engineering, Nova Scotia Technical College, and
R. E. Johnston, Technical Director, L. E. Shaw Limited, Halifax, N.S., and
J. R. Wallace, M.E.I.C., Director of Research & Development, Dominion Iron & Steel Ltd., Sydney, N.S.

▶ **COMPACTED EARTH FILL DAM FOR MARITIME HYDRO PROJECT**
D. F. Coates, Jr.E.I.C., and
J. V. Daniliauskas, M.E.I.C., Power Corporation of Canada Ltd., Montreal.

▶ **NATURAL RESOURCES OF THE NORTHWEST TERRITORIES AND YUKON**
H. A. Young, M.E.I.C., Deputy Minister of Resources & Development, Ottawa.

▶ **GAS DYNAMICS**
D. L. Mordell, M.E.I.C., Director, Gas Dynamics Laboratory of McGill University.

▶ **THE HALIFAX-DARTMOUTH BRIDGE**
Dr. P. L. Pratley, M.E.I.C., Consulting Engineer, Montreal.

▶ **THE DEVELOPMENT OF POWER FROM NUCLEAR ENERGY IN CANADA**
I. N. MacKay, M.E.I.C., Head, Plant Design Branch, Chemistry and Engineering Division, Atomic Energy of Canada Limited, Chalk River, Ont.

▶ **INDUSTRIAL RADIOGRAPHY**
R. E. MacDonald, M.E.I.C., Naval Research—Dockyard Laboratory, H.M.C. Dockyard, Halifax, N.S.

▶ **PREVENTION OF SHIPS CORROSION**
K. N. Barnard, Group leader, Physical Chemistry Group, Naval Research Establishment, Dartmouth, N.S.

▶ **PRESTRESSED CONCRETE BUILDINGS**
P. A. Benn, General Manager, Precompressed Concrete Engineering Co. Ltd., Montreal.

▶ **THE ATMOSPHERIC CORROSION OF METALS USED IN CONSTRUCTION**
Hugh P. Godard, Head of Chemical Division, Aluminium Laboratories Limited, Kingston, Ont.

▶ **PRECAST CONCRETE BRIDGES IN ALBERTA**
L. G. Grimble, M.E.I.C., Chief Bridge Engineer, Department of Highways, Province of Alberta.

▶ **CANADA'S AIR DEFENCE**
Air Vice Marshal A. L. James, M.E.I.C., Air Officer Commanding, Air Defence Command.

▶ **A 100% CANADIAN ACCOMPLISHMENT. THE PRESTRESSED CONCRETE GRANDSTAND AT THE BASEBALL STADIUM OF SHERBROOKE, P.Q.**
G. M. Demarque, M.E.I.C., Chief Engineer, The Preload Company of Canada Ltd., Montreal.

MANAGEMENT PANEL DISCUSSION

May 20 - 21 - 22

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

More About the Annual Meeting

Things at Halifax are moving rapidly towards the completion of all plans for the 67th Annual General and Professional Meeting of the Institute. From February 11 to 13 the general secretary was in Halifax to tie in the work being done at Headquarters to the work of the local committee. All parts of the program have been fitted together nicely and the result gives promise of making this meeting an outstanding one from every point of view.

Dalhousie University

As stated before in the *Journal*, the meeting is to centre around the new Administration Building of Dalhousie University. The beautiful structure in its entirety will be turned over to the Institute. Never before have such ideal facilities been available. There are lecture rooms and auditoriums that will hold any number of people from twenty-five to four-hundred, with perfect acoustical properties and lighting arrangements. There are beautiful rooms for Council meetings, Branch Officers' Conference, Students' Conference, offices, registration, exhibits, and so on.

The building itself is a show piece. All visitors should make a point of looking it over carefully. It is doubtful if there is any single university building in Canada that has a better setting or better facilities combined with beauty and utility.

Living accommodation on the campus for 100 people is afforded by Shirreff Hall, the ladies' residence. As would be expected, the bedrooms are not large, but they are comfortably furnished and plenty large enough for the members' needs. There is a splendid dining room that seats 125 people and meals will be available to all who are housed in the building.

On the ground floor there is a large, nicely furnished lounge and a library. The building is situated well back from the street in a park-like section of the university grounds. The whole effect is that of a comfortable private club.

For those who want quiet comfort in beautiful surroundings, with easy access to the Administration Building and all parts of the city, Shirreff Hall is the ready answer.

The rates are startlingly low. Room with breakfast and lunch will run about five dollars per day per person, but the actual charge will be for the whole period starting either on Tuesday or Wednesday and running through until Saturday morning. It is all American plan. There are 16 double rooms available.

Lower Costs

In an endeavour to reduce the overall cost of the meeting, it has been decided to have no fixed or formal luncheons and only two dinners. The technical sessions in the morning will conclude at noon and the afternoon sessions will not start until two o'clock, in order to provide ample time for persons to go downtown for lunch. At certain hours transportation will be provided from hotels to the University and vice versa, but at all times there is good electric bus service to the campus. As a matter of fact the distances are not so great but that almost anyone could do it by walking.

Diversion

As usual, Thursday afternoon will be devoted to plant visits, sightseeing, etc. Thursday evening everyone is to be the guest of the Navy on a boat trip around the harbour. Efforts are being made to have a ship launching as part of the day's program.

Cover Picture

A machinist at the Consolidated Mining and Smelting Company's central machine shop at Trail, B.C., uses a large horizontal boring mill to cut an outer edge for a bolted tooth drive sprocket. The sprocket was cast in Cominco's foundry. When finished, it will have a 14 ft. 7 in. diameter and weigh 12,600 pounds. It will provide the main drive for one of the three, new 10 by 6-ft. sintering machines being installed as part of their $15,000,000 smelter revision program. —*Cominco Photo.*

"Warmer Upper"

The local committee is arranging an informal gathering for persons arriving Tuesday evening. They do not want any visitors to be neglected so the party will afford an opportunity for them all to get to know each other before the big show starts on Wednesday.

Housing Accommodation

Rooms are available at the Lord Nelson and the Nova Scotian hotels, and also at Shirreff Hall, so everyone can be taken care of nicely. The only function taking place at a hotel is the dinner Wednesday which is to be at the Nova Scotian. Thus there is little advantage in staying in one hotel as opposed to the other.

Advance Registration

The necessary forms will be mailed early in April, and room allotments will be made in the order in which the reservation cards are received at Headquarters. This is particularly important in the case of Shirreff Hall. Please do not write to the hotels or the Halifax committee for rooms as all advance registration will be handled through Headquarters.

The Banquet and Ball

As usual, Friday night is the big night. Through the kindness of the Navy the excellent facilities of the gymnasium at Stadacona are available for this occasion. The co-operation of the Navy is particularly important at this time because there is no other suitable accommodation in the city that can handle the crowd. The gymnasium is an ideal setting, with its vast floor space, high ceiling and attractive arrangements.

For the Ladies

There will be a full program for the ladies which will include motor trips to some of Nova Scotia's world famous scenic spots. There will be the Coffee Hour each morning, receptions, tea and other events sufficient to suit everyone's taste and endurance.

Muriel's Room

Yes, Muriel's hospitality will be dispensed on many occasions, as in the past. There is little that needs to be said beyond that.

This sketchy account is far from complete. Many interesting features are just in the process of being arranged, and so are not reported on. However, there is no doubt but this will be an outstanding meeting. The full program backed by Nova Scotia's scenic beauty and Nova Scotians' hospitality, makes an attractive opportunity which will be enjoyed by a substantial number of members, ladies and their friends.

New Canadians in the Institute

It is interesting to examine the record of new members in the Institute. There are a lot of strange sounding names there, and no wonder. Within the last two years, 250 engineers from 28 different countries have come into the membership. Most of the countries are within the European group but as well the list contains United States, India, China, Australia, South Africa and Tasmania.

As will be seen, the numbers from one country are not great. United Kingdom tops the list, as would be expected, with 94, and Poland comes next with 28. The Latvian group has 21, Germany 19, and France 10. It is interesting to note that in the same period of time almost 400,000 people migrated to Canada. The number of engineers included in the total is indeed but the proverbial "drop in the bucket".

This great mixture of people of different origins, different languages, but with the same professional allegiance, will be a great thing for the profession and for Canada. Different academic backgrounds and different forms of experience should add much to the technical and social development of this young country.

As the new citizens take their places in the various branches of the Institute, they are being welcomed by the membership. Several have contributed papers and even greater numbers are participating in the discussions. Two have been invited to give papers at the forthcoming annual meeting in Halifax.

It is likely that as the years pass there will be more engineers in the new Canadian group. They too will be welcomed into the Institute and into other engineering organizations as well. The flow is not so great but that all should be assimilated easily, to join with older Canadians in advancing the welfare of Canada and Canadians. They too will become "builders of Canada".

Here is the list in detail—

The Engineering Institute of Canada

New Canadians

Applications received in 1951-1952.

Australia	3
Austria	5
Belgium	3
China	2
Czechoslovakia	8
Denmark	2
France	10
Germany	19
Greece	2
Holland	5
Hungary	6
Italy	2
India	2
Yugoslavia	8
Latvia, Lithuania and Estonia	21
Norway	3
Poland	28
Rumania	2
Silesia	1
South Africa	1
Sweden	2
Switzerland	7
Turkey	1
Tasmania	1
United Kingdom	94
U.S.S.R.	4

Correspondence

Senior members of the profession will read this letter with interest. Retirement holds no terrors for a resourceful person like this correspondent.—Editor.

West Palm Beach, Fla.
February 3, 1953.

The General Secretary,
Engineering Institute of Canada.

Dear Dr. Wright:

I am answering your letter of January 7, to Life Members from here, where I am spending a week between semesters, but my present address is in Gainesville where I am a student of horticulture in the Department of Agriculture at the University of Florida. It is truly something to write home about, what I am doing now, back to

school at 65 after these many years and in a field which is quite different from electrical engineering. I find the whole experience exceedingly interesting, refreshing and rewarding. In engineering we apply the laws of nature to build and construct man-made things and devices, which contribute so much to the present high standard of living, but in horticulture and the growing of plants we watch nature build its own structures by the fantastic continuous process of cellular division to make and produce things without which no life could exist. Every leaf of everything that grows, when seen through the microscope is a huge power house where photosynthesis with the help of the sun manufactures food which is sent down to the roots which in turn obtain water from the soil and pump it up to the leaves.

For an engineer, the whole mechanism of a plant is fascinating. Now that I am studying botany, when I look at a tree my eyes see clear through it as if they were x-rays. Soil and mud have ceased to be dirt. The content and formation of these 12 inches of top soil with its organic matter and complicated structures that hold hygroscopic water at more than 31 atmospheres and the capillary actions which contribute so much to the supply of water to the root hairs, all of which is so small and tiny that it is just as fascinating as the splitting of the atom.

You can judge from the above that I am genuinely enthusiastic about my studies and newly acquired knowledge. Frankly, I can think of no better way of retirement than to throw oneself into an entirely new field and get away from the single-track mindedness which engineers are sometimes prone to have. To get so close to nature in its natural form by becoming better acquainted with it, is a truly invigorating experience. It is a sort of "fountain of youth" which helps to spend the mellowing years of life at a high degree of contentment.

All of this does not answer your query about an organization of oldsters within the Institute. Yes, I definitely think that it would be a fine thing, especially for those who live near section headquarters. And the emphasis should probably be placed on activities that can be closely related to the work of young engineers, those whose whole life is yet to come, so that their usefulness can be at the highest level of accomplishment.

EUGENE VINET, M.E.I.C.

E.U.S.E.C. Conference on Engineering Education

The conference of representatives from the engineering societies of the United States and Western Europe was held in London, January 12-17, 1953.

European countries represented were Norway, Sweden, Denmark, Western Germany, Holland, Belgium, France, Switzerland, Italy, and the United Kingdom. Finland was not represented, but a memorandum was received from that country. The United States delegation which was sponsored by the Engineers' Council for Professional Development was made up of Dean Thorndike Saville of New York University, chairman of the E.C.P.D. Education Committee; Dean W. R. Woolrich of the University of Texas, and president of the American Society for Engineering Education, and Dr. L. F. Grant, chairman of Engineers' Council for Professional Development.

The conference was for the exchange of ideas on engineering education and no attempt was made to reach conclusions. The discussions were extremely valuable in clarifying the different systems and in developing a mutual understanding of the principal methods of engineering education in the several countries.

The procedure adopted was for a representative of each country concerned to send in advance a description of the method of education and training of professional engineers in his country to the honorary secretary of the conference, Mr. E. Graham-Clark, who is also secretary of the Institution of Civil Engineers of Great Britain. These were then translated into English, if necessary, printed, and circulated well in advance to all the delegates. The American report was written by Dean Saville, and because of the previously expressed interest by some of the European societies in American engineering education, was rather longer than most of the others.

All meetings, or working sessions, were held at the headquarters of the Institution of Civil Engineers in Great George Street, the Institution of Mechanical Engineers in Storey's Gate, St. James Park, or the Institution of Electrical Engineers in Savoy Place, and various officers of the three Institutions acted as chairmen.

At the first session, an opportunity was given to a delegate from each country, in alphabetical order, to comment on the report from his own country, following which there was a period in which the previous speakers were questioned by delegates from the other countries. These two periods lasted through both sessions on January 12.

From the outset, a difficulty arose from the different meanings attached to certain expressions in common use. Such terms as "professional engineers", "practical training", "basic science", to mention only three, caused some misapprehension, but as the conference progressed, the delegates rapidly learned to comprehend each other.

The third session was given over to "Standards and Criteria of Entry", which opened with full and detailed description of the system in the United Kingdom which in turn led to a period of general questioning and discussion during which a fairly clear picture of the situation in all of the countries was presented. Some of the standards for entry to formal engineering education seemed rather surprising to those accustomed to the American procedure. For instance, in Britain the standard of entry into a university is a year higher than that generally required here, but on the other hand the university course lasts for only three years, so that the end result is probably not much different.

In the course of this discussion a great deal of interest was aroused by the statement of one of the Swiss representatives, that students who had taken a classical course in the schools did better on an average in the University than those who had taken a mathematical type of course. One of the British delegates commented on this by saying that the experience in Britain was much the same but explained it by saying that the headmaster of a school had told him: "We make every effort to put the best boys in the classical course of our schools, and then we claim that the classics produce the best boys".

This discussion also brought about the fact that in some of the European countries—notably Holland and Switzerland—a university is obliged to accept any student who

qualifies, as do some publicly supported colleges in the United States. This, however, is not the case in Britain.

The next discussion was on: "The Place of Basic Science and Technological Studies in the Education of the Engineer".

On this the United Kingdom delegates emphasized their view that an undergraduate course in engineering cannot produce an engineer. While all of the delegates agreed with the general philosophy, there was a somewhat wide divergence of opinion as to the significance and interpretation of "practical training". The delegates were in general agreement that the undergraduate course in engineering merely produces someone who has a broad understanding of engineering principles, and they expect the advanced technological aspects of engineering to be in a postgraduate course or else be acquired during the period of employment following graduation when a man is undergoing his practical training. In general the delegates agreed that it was not possible to produce a competent design engineer by university work alone. Several representatives suggested that unless a good deal of engineering (technological) work is given at the university, students become rather bored with studying broad principles only. In some cases it was even said that engineering was being taught by professors of mathematics and physics, a remark which led some of the delegates to say: "What is sauce for the goose, should be sauce for the gander", and that it might be advantageous if mechanical and pure science subjects were taught by engineers.

The next subject for discussion was: "The Place of General Studies with Special Reference to the Humanities in the Education of the Engineer".

For the purpose of this session the chairman suggested that such subjects should be considered as labour management, human relations, social science, economics, administration, law, legislation, aesthetics, philosophy, commerce, organization, and finance. As the discussion continued literature, music, art and architecture were also talked about and readers of this report will not be surprised to learn that the differences here were very great. One interesting experiment mentioned which apparently has been very successful, is on one afternoon a week to postpone all afternoon periods one hour, thus allowing a free hour after lunch, during which a lecture on one of these subjects is given. Attendance, although voluntary, is more than can be accommodated.

The French delegates agreed emphatically with the American point of view that there is little value in lectures on such subjects unless there is an examination. The Italians, on the other hand, thought that such subjects were out of place in an engineering course, and that what is more important are technical subjects. As their spokesman said, "We think that a course on electrical machinery and hydraulics, for instance, can be given in a humanistic rather than an exaggeratedly technical manner." Possibly the Italians take this view because of the artistic background of Italy. The Scandinavians deprecated formal courses but did have a number of lectures on cultural and other subjects arranged by the students. Holland seemed to occupy an intermediate position between the United States and Switzerland, on one side, and the Scandinavian countries on the other.

"The Practical Training Necessary for Qualification as a Professional Engineer."

The practical training here discussed did not deal with practical work within universities, such as surveying, drafting, and so on, but

Representatives in attendance at the European and United States Engineers Conference on Engineering Education, held in London, England, January 12-17, 1953.

with training in industry. For instance, the British require two years of training under a member of one of the Institutions, plus one year of general experience before a man can apply for admission to one of the Institutions. It should here be noted that there is in none of the other countries the legal system of examining and licensing engineers such as is carried on in the various states of the United States and the provinces of Canada. In Britain, membership in one of the three Institutions in effect confers the right to professional standing. In some of the continental countries graduation from one of the engineering colleges confers the legal right to practice.

In Belgium and Sweden, practical training is done before the student enters the university. In Holland and Canada it is carried out during vacations and the student is required to submit at the beginning of his second, third, and fourth years a report on the work he has done in the preceding summer. In general, it may be said that the British place a higher value on practical work (often of a sub-professional character) than do the other countries. The situation as regards training schemes by industries is as varied in Europe as on this continent. It seems that many of the bigger industries give formal courses to young engineers, but not many of the smaller ones. In Switzerland, where there is no legal protection for the title of engineer, no practical work is required.

"The Full Requirements for Conferment of Professional Status".

This, of course, led to a discussion of the definition of a professional engineer, but the one quoted below seemed to find general acceptance (Section 5, page 9):

> "A professional engineer is competent by virtue of his fundamental education and training to apply the scientific method and outlook to the solution of problems and to assume personal responsibility for the development and application of engineering science and techniques, especially in research, designing, manufacturing, superintending, and managing."

Professional status in the United States and Canada is achieved by a variety of means, but these countries are unique in the legal recognition of professional practice through examination and registration. In Sweden, Switzerland, Belgium, Norway, France, Holland, and Germany, there is required a diploma from a college recognized by the government, and in the United Kingdom professional status depends on corporate membership in a professional Institution. Denmark falls under all three headings. All countries seem to provide written examinations for those engineers who have not graduated from a recognized university and who through practical experience and private study have fitted themselves for professional status.

A briefer description of accreditation as carried out in the United States by E.C.P.D. was given by Dean Saville at the end of this session.

The final session was devoted to the consideration of plans for the future and it was the unanimous wish that E.U.S.E.C. should be asked to authorize another conference in another country in 1954, and that in the interim a committee be asked to prepare a glossary of terms in common use so that they would have the same meaning for all the delegates.

Besides the working sessions described above, the delegates visited the Imperial College of Science in London, Brighton Technical College, Rugby Technical College, and Cambridge University. The system at Cambridge is, perhaps, closer to the North American practice than at the other institutions visited. The delegates were also shown training methods for both technicians and engineers in the British Thomson Houston works, and the English Electric Company at Rugby.

The hospitality of our British hosts was unlimited, luncheon, tea, dinner (and other refreshment of a less academic nature) was provided as well as special railway carriages for the visits to Brighton, Rugby, and Cambridge. The delegates were also entertained at dinner by Viscount Falmouth, Chairman of the Board of Directors of the Imperial College, and the Mayor and Corporation of Brighton, and at luncheon by the Master of Emmanuel College, Cambridge.

NEXT ISSUE

will contain 9 important papers

1. **STEAM GENERATION OF POWER AT NOVA SCOTIA LIGHT AND POWER COMPANY,**
   By J. W. MacDonald, M.E.I.C., Nova Scotia Power Co. Ltd., Halifax.
2. **COMPACTED EARTH FILL DAM FOR MARITIME HYDRO PROJECT,**
   By D. F. Coates, Jr.E.I.C., and J. V. Daniliauskas, M.E.I.C., Power Corporation of Canada Limited, Montreal.
3. **ELECTRICAL ENGINEERING AND OPERATING ASPECTS OF ALCAN'S B.C. PROJECT,**
   By J. T. Madill, M.E.I.C., Aluminum Company of Canada Limited.
4. **THE PROPANE UNIT OF THE ROYALITE OIL COMPANY,**
   By A. G. A. Piercy, M.E.I.C., Chief Chemical Engineer, Madison Natural Gas Company, Turner Valley, Alta.
5. **CONSTRUCTION AND OPERATION OF ROYALITE'S SULPHUR RECOVERY PLANT,**
   By D. D. Dunbar, Asst. Civil Engineer, Royalite Oil Company Limited, Turner Valley, Alta.
6. **ENGINEERING FEATURES OF THE ELK FALLS PAPER MILL,**
   By E. C. Cooley, Resident Engineer, Elk Falls Company Limited, Campbell River, B.C.
7. **THE CAPACITY, PRODUCTS AND FUTURE OF THE STEEL INDUSTRY IN CANADA,**
   By R. D. Hindson, Works Metallurgist, The Steel Company of Canada, Hamilton, Ont.
8. **INVESTIGATION OF FLUID-BORNE SOLID PARTICLES WITH PARTICULAR REFERENCE TO SOLID FUEL FOR INTERNAL COMBUSTION ENGINES,**
   By John S. Maloney, Gas Dynamics Laboratory, McGill University, Ste. Anne de Bellevue, Que.
9. **CANADA'S LONG TERM ECONOMIC OUTLOOK,**
   By O. J. Firestone, Economic Advisor to the Department of Trade and Commerce.

Canadian International Trade Fair - 1953

One of the most interesting developments in post-war Canada has been the Canadian International Trade Fair which will be held this year between June 1st and 12th at the Canadian National Exhibition grounds in Toronto.

As of late January, space bookings were reported as more than four times those for the same time last year. At the 1952 fair five exhibit halls were required in addition to outside grounds space and exhibitors from 29 different countries occupied a total of 191,000 square feet of space.

During the early years of the fair, most of the exhibitors were from countries other than Canada. Now this position is reversed and already this year, Canadian exhibitors have taken 100,000 square feet, more than the total occupied by them at any previous show.

Most of the exhibits will be of special interest to engineers and practically half of the space already reserved for this year's fair is in the machinery section. Other sections which should interest our Institute members will be those for electrical equipment and products, materials handling, equipment construction and road building equipment and building materials.

Besides the large Canadian exhibit, many manufacturers from England, France, Germany, United States, Belgium, Italy and Holland will also have representative products on display.

A further point of special interest to Institute members is that the Canadian International Trade Fair is sponsored by the Government of Canada through the Department of Trade and Commerce under the direction of the Rt. Hon. C. D. Howe, Hon. M.E.I.C.

News of Other Societies

The annual meeting for 1953 of the **Engineers' Council for Professional Development** will be held in New York on October 30 and 31.

The fifth national **Materials Handling Exposition** will be held at Convention Hall, Philadelphia, May 18 to 22, 1953. Information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

The American Welding Society (33 West 39th St., New York, N.Y.) will conduct a national spring technical meeting at the Shamrock Hotel in Houston, Texas, June 16 to 19, 1953. Concurrently, a four-day Welding and Allied Industry Exposition will take place.

Dr. H. L. Keenleyside will be the guest speaker at the evening banquet which will be a part of the Tuesday program of the joint conference of the **American Institute of Chemical Engineers** and the Chemical Engineering Division of **The Chemical Institute of Canada** being held in Toronto, April 26, 27, 28 and 29. Dr. Keenleyside, director of the United Nations Technical Assistance Program, will cover the technical assistance program and the role of the chemical engineer in it. The office of the Chemical Institute is at 18 Rideau Street, Ottawa 2, Ont.

The 1953 annual meeting of the **National Society of Professional Engineers** (1121 15th Street, N.W., Washington, D.C.) is announced for June 18-20, at Daytona Beach, Florida.

The 1953 annual meeting of the **American Society for Engineering Education** will take place at the University of Florida, Gainesville, June 22 to June 26. It will comprise more than 100 conferences, general and divisional sessions, and luncheons and dinners.

General chairman of the arrangements committees appointed by the host institution is Prof. John C. Reed, head of mechanical engineering at Florida.

The Society for Experimental Stress Analysis (Central Square Station, Cambridge 39, Mass.) will hold its spring meeting at the Hotel Schroeder, Milwaukee, Wis., May 20, 21, 22, 1953.

A joint conference of the **Royal Aeronautical Society** and the **Institute of the Aeronautical Sciences** (2 East 64th St., New York 21, N.Y.) will take place from September 15 to 17, at London, England.

The Society of Automotive Engineers (29 West 39th St., New York 18, N.Y.) announces meetings as follows: the National Aeronautical meeting and aircraft engineering display, Hotel Statler, New York, April 20-23, and the summer meeting, June 7-12, at the Ambassador and Ritz-Carlton Hotels, Atlantic City, N.J.

Future meetings of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) are as follows: The spring meeting, April 28-30, at the Deshler-Wallick Hotel, Columbus, Ohio; and the oil and gas power division conference, May 24-28, at the Hotel Schroeder, Milwaukee, Wis.

For details about the

ANNUAL MEETING

HALIFAX, MAY 20, 21, 22

Turn to pages 236, 237, 238
of this issue

The Field Secretary's Report

In April, 1949, Mr. C. E. Sisson, M.E.I.C., was appointed field secretary with the office at 350 Bay St., Toronto. Unfortunately for the Institute, and to the grief of his many friends, Mr. Sisson died a few months after taking office and for some time the work was kept going by his assistant, Mrs. M. J. Wardle, who still manages the office.

Visits to Orphans

In February, 1950, the writer succeeded to the post, and at once decided that a most urgent task was to provide some service to the non-resident members of branches herein referred to as orphans. Council cordially approved the suggestion that the field secretary should visit the orphans and entertain them as guests of the Institute.

The first of such visits was made to Brantford in May, 1950. Here a good deal was learned; first of all that a good many members do not notify headquarters of change of address; secondly that even in small places many of the members do not know each other, and finally that invitations must be carefully worded. As an indication of the need for the last precaution, the field secretary was somewhat tardy in making it clear that the party was 'on the Institute' much to the annoyance of one of the guests who had just ordered a sandwich and a glass of milk in the expectation of having to pick up his own check. To avoid a repetition of this embarrassing incident a system of formal invitations was introduced which is used except when it seems more suitable to ask some local member to send "the fiery cross through the heather" to call the clansmen. Altogether, this first meeting was a lesson and an inspiration, and plans were laid for a program of such visits in the autumn when the meeting season should arrive.

New Branches

The first eastern trip was made in October and November, 1950, and this took in all the Atlantic Provinces, starting at Rimouski, P.Q., going as far as St. John's, Nfld., and ending at Edmundston, N.B. Sixteen orphan groups, five branch executives, one branch section and five universities were visited, and at Rimouski (with the help of Mr. Huet Massue, M.E.I.C.) and at Bathurst, Amherst, New Glasgow and Charlottetown foundations were laid for new branches which have since come into existence.

The Prince Edward Island Branch is one which gives the field secretary's office particular satisfaction. At the time of the visit there were only four recorded members of the Institute on The Island (apologies to British Columbians and Cape Bretoners), but thirty-one engineers attended the dinner, and now there is a flourishing branch there with some forty members and a high professional feeling. Side by side in the field secretary's office hang pictures of this first gathering of engineers in Charlottetown, and of the first meeting of the Fathers of Confederation in the same historic city in 1864. These two pictures together may suggest some useful reflections to Canadian engineers.

Other Duties

By this time other tasks demanded attention, establishing courses for young engineers in implementation of the training program of the Engineers' Council for Professional Development, employment services, and visits to branch executives and orphan groups in other parts of Canada.

Second Western Visit

The second trip to the West was made in February and March, 1951, and included visits to Brandon, Man., Moosejaw and Swift Current, Sask., Medicine Hat and Blairmore, Alta., and Fernie, Cranbrook and Prince Rupert, B.C., besides most of the branches in the West. Altogether fourteen orphan groups, six branches and two universities were visited. Again the appreciation of the members was most flattering. One of the guests said that because of illness he had not taken a meal out of his house for four years, but nevertheless, he came to the Institute luncheon. And again the field secretary was impressed with the value of such meetings in making engineers acquainted with each other.

Young Engineers Courses

Meanwhile, an experimental Professional Development Course had been started in Toronto, requests for assistance in finding employment for engineers were becoming increasingly frequent, and numerous orphan groups and branches in Quebec and Ontario had to be visited.

North Central Canada

1951-52 followed generally the pattern set by the previous year. The eastern trip unfortunately had to be shortened, but new territory was visited in Northern Ontario, from Iroquois Falls to Kenora, Western Quebec and such places as Dauphin and the Pas in Manitoba, North Battleford, Prince Albert and Saskatoon in Saskatchewan, and Flin Flon which is in both. Lloydminster, another two-province town was also included. During this trip and the week preceding it, three new branches were established.

The professional development courses had grown from one in Toronto to eight, from Halifax in the East to Saskatoon in the West. The field secretary's office played a small part in organizing all of these except in Saskatoon, where with characteristic mid-western initiative the course was organized locally long before the field secretary appeared in those parts. This year three branches have gone on to advanced courses, and the remaining five of last year's lot are being repeated for different men. Four new courses are already operating (Quebec, Sherbrooke, Belleville and Kootenay) and arrangements for six more were made during the eastern trip in November, 1952.

Employment

Employment work which began in 1951 has become a major activity. The applicants may be from Canada, Britain, Australia, India, Africa, Eire, and continental Europe, even a few from behind the Iron Curtain. It is standing practice that only work of the greatest urgency is to take priority over an employment seeker, whether he is a member of the Institute or not. No attempt has been made to keep an exact record of what has been accomplished in this field, and indeed the time to make such a record is lacking. However, a rough check from September, 1951, to September, 1952, showed 230 applicants, of whom 95 reported that they secured employment through information received or appointments made at the field secretary's office. As all the others were told to come back for further help if they were unsuccessful, it may be assumed that most of them found suitable positions.

New Branches

Of the new branches which have been established during the past three years, or which are in process of being formed, the field secretary's office has had a minor share in eight or nine. The field secretary has visited all of the forty-four branches of the Institute, and about eighty orphan groups from Grand Falls, Nfld., to Prince Rupert, B.C., some of them twice. In all cases, one member of the group is requested to become a correspondent, and his name reported to his branch secretary.

The office also does the record work for the Toronto Branch and gives as well some stenographic and general service, for which the branch pays a fee to the Institute.

Conclusions

In October, 1950, the office was moved to the Professional Engineers' Building, 236 Avenue Road, a very convenient arrangement for the many engineers having business with both organizations.

Following the example of the itinerant clergy, the field secretary sometimes takes with him an engineering paper which may be given before an orphan group or a branch.

The field secretary cannot resist giving a few opinions that have been formed as a result of his experiences. He believes that the orphan engineer is one of the most valuable Canadian citizens. Well-trained, competent and with high ideals of professional service, he is everywhere relied upon and respected. As a group, the orphans are among the most loyal and enthusiastic members of the Institute, and the field secretary only regrets that he cannot do more for them. In his opinion, every branch executive should have one member (or more than one if necessary) charged with the duty of arranging occasional calls on orphans, perhaps inviting them to lunch, and in the case of larger groups, arranging a meeting and providing a speaker from the branch. All branches derive some of their revenue from the non-resident membership, and wherever possible this should be spent for the benefit of the men from whom it came.

For its size, the Institute is a most important factor in developing a common feeling between Canadians. Interest in their professional work, discussion of one another's problems, exchange of information, pride in the Institute and in the achievements of its members in every part of Canada are all conducive to real Canadianism. The E.I.C. member in Sydney is much the same fellow as the Winnipegger, and the "Oilbertan" would feel at home in a meeting of the Lower St. Lawrence branch. By and large the members of the Institute are engineers and Canadians first, and provincials a long way after. The field secretary is proud to work with them.

L. F. Grant, M.E.I.C.,
Field Secretary.

A Metallurgist Visits a Library

The writer, as a metallurgist not as a librarian, recently attended a session of a symposium under the auspices of the Special Libraries Association, of which F. M. Ethridge of the Consolidated Mining and Smelting Company, Limited, was chairman.

The metallurgist had intended merely to hear the first paper, but he became so entranced with developments as the meeting proceeded and so impressed with the possibilities of the new memory machines that he remained to the end.

In early times the passing on of experience was difficult. Before writing was invented, the only way was by word of mouth. Such transmission depended on memory, and here time and repetition gradually modified the story so that it became anything but an accurate record. Writing enormously increased the facilities for recording events. Until lately one desiring to develop by experiment a new idea could, in a reasonable time, acquaint himself with all that had been recorded in his special field.

As time went on and the number of books, publications, and monographs increased, it became no longer practicable to cover the whole field of the past by reading. This led to the establishment of the position of librarian and of the card index system to enable both librarian and enquirer to secure abstracts of pertinent recorded history. In recent years the number of references in any given area of scientific investigation has grown to such an extent that even to supply the space required for card indices has become a serious matter.

We have progressed in our research methods to the point where it is imperative that a thorough search of past information should precede practical laboratory experiment, if repetition, costly both in time, money and effort, is to be avoided. We are therefore faced with two problems. On the one hand, the bibliography of any subject has become unwieldy, and yet the necessity for acquainting ourselves with past history is more and more necessary.

Man's inventiveness, given time, seems able to solve almost any problem and so now we find that we have electronic machines to assist the librarian to supply information to the enquiring researcher, with as complete a coverage as possible and with the least loss of time.

The average operator in metals, whether metallurgist, chemist or superintendent, gives far too little credit to the value of bibliographic research as the forerunner to practical experiment. Further, much greater recognition should be given to the importance of the abstractor and the librarian.

At the meeting referred to one learned of the punched card system in which, by "needling", information can be collected on any given subject in the library files, up to, say, about ten thousand items.

The latest contribution to the art of search and classification is made possible by the use of electronics. This has resulted, in the case of card indices, in raising the number of cards that can be handled from 450 to 6,000 per minute. Of so great a size are some collections of data, that it will be only a few years until over a million references may have to be scanned. Here the magnetic tape enters the field which will perhaps cover the search of a million references in four hours or so at a cost of $500, or if five or six questions are put to the machine at once, then at a cost of $60 or so. It is true that such a sorting machine will cost over a million dollars, but even this is justified by the results which are expected. When the cost and time are compared with those which would be required if it were even possible to make such searches "by hand", it becomes obvious that the memory machine will shortly become a necessity.

By this time, your metallurgist was getting a little out of his depth although his respect for bibliographic researchers and the electronic engineer was going up by leaps and bounds. Finally, to swamp him, he heard that all this development would mean the reproduction of written matter on micro-film, and that then, wonder of wonders, the aid of television might be invoked, so that the results of a search of a million references in New York could be instantly transferred in visual form to the enquirer in San Francisco.

We live in an ever-expanding age.

H. J. R.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, February 20, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

G. W. Ames, *Sarnia.*
P. Andrews, *Toronto.*
E. G. Arens, *Orillia.*
K. H. Arnott, *Calgary.*
F. D. Begley, *Toronto.*
E. L. Cavena, *Orillia.*
A. Chmielenski, *Montreal.*
M. W. Clark, *Calgary.*
H. H. Darling, *Toronto.*
E. A. Donovan, *Montreal.*
W. J. Fletcher, *Peterborough.*
W. N. Hall, *Montreal.*
F Hughes, *Montreal.*
W. C. R. Jones, *Prince Rupert.*
M. R. Kelton, *Montreal.*
J. S. Kennedy, *Vancouver.*
D. Leah, *Montreal.*
J. W. Lello, *Ottawa.*
J. Los, *Kingston.*
J. C. McDonald, *Belleville.*
L. J. MacKay, *Montreal.*
R. MacKay, *Orillia.*
C. C. Marshall, *London, Eng.*
J. R. Meadowcroft, *Montreal.*
G. E. Morrison, *Hamilton.*
S. J. Naginionis, *Montreal.*
E. Parrag, *Montreal.*
J. Pitts, *Montreal.*
A. E. Rankine, *Montreal.*
L. V. Roberts, *Toronto.*
A. J. Scott, *Camp Borden.*
K. A. Skjaevestad, *Montreal.*
R. D. Slaniceanu, *St. Catharines.*
P. J. Slattery, *Sherbrooke.*
J. Tanski, *Montreal.*
S. R. Walkinshaw, *Orillia.*
R. H. Winters, *Ottawa.*
G. A. Whitlock, *Edmonton.*
W. Wojcik, *Weston.*
J. P. Zemelka, *Toronto.*

Juniors:

C. S. Brown, *Lethbridge.*
F. H. B. Chisholm, *Dalhousie.*
D. W. Coward, *Montreal.*
J. Daniels, *Toronto.*
E. de Haas, *Toronto.*
B. V. Donnelly, *Shawinigan Falls.*
K. J. Ellis, *Edmonton.*
W. R. Ferris, *Montreal.*
D. M. Foulds, *Toronto.*
O. A. Harrison, *Dalhousie.*
B. J. Keene, *Toronto.*
A. S. Klimes, *Montreal.*
Z. T. Kolodziej, *Toronto.*
N. A. Morrison, *Hamilton.*
J H. Moulds, *Vancouver.*
W. J. O'Reilly, *Niagara Falls.*
J. Radford, *Montreal.*
J. N. Robertson, *McMasterville.*
E. S. Salonen, *Toronto.*
G. R. Simpson, *Dalhousie.*
J. Stankiewicz, *Toronto.*
J. K. Wood, *Toronto.*
A. R. Zanatta, *Fort Erie.*

Affiliate:

D. F. Rhodes, *Montreal.*

Transferred from the class of Junior to that of Member:

C. E. Aumont, *Montreal.*

R. J. Blezard, *Guelph.*
N. W. Chinn, *Montreal.*
J. M. Clarke, *Montreal.*
V. S. Corbet, *Quebec.*
M. R. Delisle, *Montreal.*
O. E. Enarson, *Calgary.*
B. E. Fortin, *Montreal.*
O. J. Gaffney, *Stratford.*
E. J. Dickie, *Stewiacke.*
D. M. Gibson, *Toronto.*
J. W. Gregg, *Edmonton.*
M. D. Gronlund, *Vancouver.*
G. A. Havers, *Regina.*
W. J. Horner, *Hespeler.*
N. D. Lea, *Montreal.*
R. L. McDougall, *Edmonton.*
C. W. MacEachern, *Montreal.*
T. H. McSorley, *Edmundston.*
R. F. Pearson.
J. J. Pichette, *Three Rivers.*
V. J. Pimenoff, *Montreal.*
T. A. Ramsey, *Montreal.*
W. J. Riley, *Montreal.*
D. H. Sands, *Edmonton.*
E. M. Scott, *Winnipeg.*
J. B. Scott, *Sherbrooke.*
L. C. Secord, *Toronto.*
D. B. Simpson, *St. Catharines.*
F. G. Smoke, *London.*
G. E. Thomas, *Montreal.*
M. A. Waghorne, *Sarnia.*
W. J. E. Wilson, *Ottawa.*

Transferred from the class of Student to that of Junior:

J. Collicutt, *Ocean Falls.*
H. W. Foot, *Montreal.*
D. E. Rudolph, *Halifax.*

The following Students were admitted:

ROYAL MILITARY COLLEGE

G. A. Aldworth
C. D. Brooks
W. M. Day
R. D. Gillespie
J. H. G. Howard
C. C. Jefferies
H. V. Jonas
B. W. Kelly
P. A. Kouri
J. A. F. Lalande
M. A. Lennox
G. P. Luke
G. D. Murphy
C. D. Parmelee
J. G. Pearsall
R. J. Rutherford
L. W. Shick
H. W. Walford
R. R. Wallace
J. F. Webster
P. H. H. Wright

UNIVERSITY OF TORONTO

C. W. J. Atkinson
J. B. Blanshard
R. G. Crawford
D. R. Gilley
G. Hayman
J. M. Plyley
M. Schultz
A. R. Scott
D. E. Waddell

ECOLE POLYTECHNIQUE

J. Bisson
R. Chevalier
M. Dupuis
J. G. Duranceau
L. Leclerc
R. Leclerc
R. Masse
J. Pasusis
J. P. Poitras

MCGILL UNIVERSITY

E. F. Christman
J. P. Desaulniers
J. A. A. Heroux
F. Jumis

UNIVERSITY OF ALBERTA

K. O. Anderson
E. L. Rogers
D. J. Sampson
W. V. Sawka

UNIVERSITY OF NEW BRUNSWICK

E. H. Allen
J. R. Cassidy
L. A. Coles
C. J. Lanteigne
D. A. Russell

MEMORIAL UNIVERSITY

R. A. Kieley
R. B. Moore
M. T. O'Brien
N. V. B. Pardy
C. I. Power

QUEEN'S UNIVERSITY

R. G. De Cecco
D. B. Murray

UNIVERSITY OF ALBERTA

W. Werenka

NOVA SCOTIA TECH. COLLEGE

F. G. Crouch

K. C. Brown, *Islington, Ont.*
J. H. Baker, *Longueuil, P.Q.*
B. D. Pullan, *Belleville, Ont.*
W. Donaldson, *Toronto.*
M. Berkes, *Montreal.*

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Member:
A. T. Robertson

Junior to Member:
R. F. Cummer
G. Hodge

Student to Member:
J. W. McCarthy

SASKATCHEWAN

Members:
S. Hegion
S. F. Lee
J. W. MacLeod
L. T. McNaughton
K. Mitsui
E. D. Wilson

Junior:
C. A. Braaten

Students:
E. R. Armstrong
V. A. Banevicius
A. W. Bell
R. S. Bennett
C.W. Blachford
W. Buryniuk
R. E. Eliason
D. R. Kennedy
D. W. Patterson
J. D. Rice
E. F. Schroeder
E. H. Stinson

Junior to Member:
D. F. Bond
S. N. Bugaresti
L. T. Johnson
W. A. Reed
L. H. Sproule

Student to Member:
D. A. Lane

Student to Junior:
M. E. Stadnyk

NOVA SCOTIA

Member:
J. M. MacNeil

Junior to Member:
M. C. Mosher
F. G. Murphy
W. J. Phillips

QUEBEC

Member:
P. F. Tremblay

Headquarters Records

Each time the *Journal* or other Institute mail is dispatched we are advised of undeliverable items due to incorrect addresses. Our records staff must follow up these changes and the regular service to members suffers thereby. *Please* advise headquarters when your address or occupation changes. The form below can be completed, clipped, and mailed to headquarters in a few moments.

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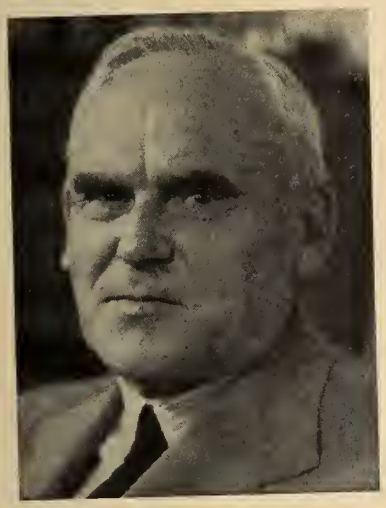
Advise Headquarters Promptly of Changes

Personals

News of the Personal Activities of Members of the Institute

Rt. Hon. C. D. Howe, P.C., HON. M.E.I.C., has been elected an honorary member of the Institution of Civil Engineers of Great Britain.

Mr. Howe's election was made "in recognition of his distinguished services to the Dominion of Canada. formerly as a civil engineer, and subsequently as one of its leading statesmen".



The Right Hon. C. D. Howe, Hon.M.E.I.C.

The Institution of Civil Engineers is the senior engineering institution in the world. It was established in 1818 and incorporated by Royal Charter in 1828. Among its honorary members, numbering 17 in all, are the Dukes of Edinburgh and Gloucester, the King of Sweden, Field Marshall, the Rt. Hon. Earl of Tunis, and Mr. Herbert Hoover.

In this connection it is interesting to note that in September last, Mr. Howe was awarded the Herbert Hoover Medal by the leading engineering societies of the United States on the occasion of the Centennial of the American Society of Civil Engineers. Mr. Howe was elected to honorary membership in the Engineering Institute of Canada in 1937.

Major General Howard Kennedy, C.B.E., M.C., M.E.I.C., chairman of the Federal District Commission, has been appointed honorary colonel of the 10th Field Engineer Regiment, it was announced recently by Defence Minister Claxton.

Major General Kennedy has a distinguished war record in two world wars. He served overseas with the Canadian Engineers in the First World War, being discharged with the rank of captain. At the beginning of the Second World War he went overseas again with Royal Canadian Engineers and rose from company commander to officer commanding the First Division Engineers. He afterwards filled various staff appointments at National Defence Headquarters including that of quartermaster general.

Maj.-Gen. Howard Kennedy, M.E.I.C.

In the years following the First World War, General Kennedy was employed by the E. B. Eddy Company and the Quebec Forest Industries as a forestry engineer and he returned to this profession after the Second World War. For a time he was vice-president in charge of woodlands for the Quebec North Shore and Ontario paper companies and in 1946 and 1947 he headed an Ontario Provincial Royal Commission to report on the conditions and needs of the forests of Ontario. Upon completion of the Royal Commission Report he entered practice as a consulting engineer.

From April, 1950, to June, 1951, he was in the Middle East as director of United Nations Relief and Works Agency for Palestine Refugees.

Henri Gaudefroy, M.E.I.C., has been appointed dean of Ecole Polytechnique in Montreal. The announcement was made recently by Hon. Gaspard Fauteux, Lieutenant-Governor of Quebec. He succeeds Ignace Brouillet, M.E.I.C., who has been named chairman of the corporation.

Dean Gaudefroy was born in Montreal, and studied at Mont Saint Louis College and at Ecole Polytechnique where he received his civil engineering degree in 1933. After post graduate work at the Massachusetts Institute of Technology, he obtained his electrical engineering degree in 1934.

During the next four years he served as engineer with the Bell Telephone Company, working on automatic central office equipment.

In 1939 he joined the staff of Ecole Polytechnique as assistant professor in mathematics and was named associate professor in 1943 and assistant to the dean and registrar. He became a full professor in 1947.

H. Gaudefroy, M.E.I.C.

A reserve officer of the R.C.A.F. with the rank of squadron leader, he is commanding officer of the University of Montreal reserve flight. He has also been secretary-treasurer of the Graduate Society of Ecole Polytchnique since 1940.

Dean Gaudefroy was appointed a councillor of the Engineering Institute in 1951 after service as chairman of the Montreal Branch in 1950. He is the chairman of the Publication Committee of the Engineering Journal.

Ira P. Macnab, M.E.I.C., general manager of the Public Service Commission of Halifax is president of the Halifax Board of Trade for 1953.

A past-president of the Engineering Institute and a member of the board of regents of Mount Allison University, I. P. Macnab was chairman of the 1945 committee which planned the post-war

development of Halifax, which has nearly doubled its population in the last 10 years.

Ashley & Crippen

Ira P. Macnab, M.E.I.C.

He is a past-president of the Dominion Council of Professional Engineers, and of the Association of Professional Engineers of Nova Scotia.

John N. Flood, M.E.I.C., of Saint John, N.B., president of the firm which is reported to be Canada's oldest construction company, John Flood & Sons Limited, has been named president of the Canadian Construction Association. As C.C.A. president, he will head 900 contractors, manufacturers, suppliers and road builders.

Mr. Flood has been a delegate three times to the International Labour Organization. He is a past-president of the Saint John Builders Exchange and past-chairman of the Saint John Town Planning Commission.

A. R. Chadwick, M.E.I.C., president and general manager of Construction Equipment Company Ltd., a subsidiary of Foundation Company of Canada Ltd., was recently appointed a director of the Foundation Company board.

Mr. Chadwick is also a director of Construction Equipment Co. Ltd., president and director of Gunite & Waterproofing Ltd., and Atlantic Tug & Equipment Co. Ltd., and director of Quebec Salvage & Wrecking Company Ltd.

Mr. Chadwick has been associated with Foundation Company of Canada Ltd., since 1924. He became manager of Construction Equipment Co. Ltd., in 1928, and was named general manager in 1940, becoming president and general manager in 1946.

Charles H. Jackson, M.E.I.C., formerly vice-president in charge of manufacturing of Atlas Asbestos Co. Ltd., of Montreal, has been appointed president of the Company.

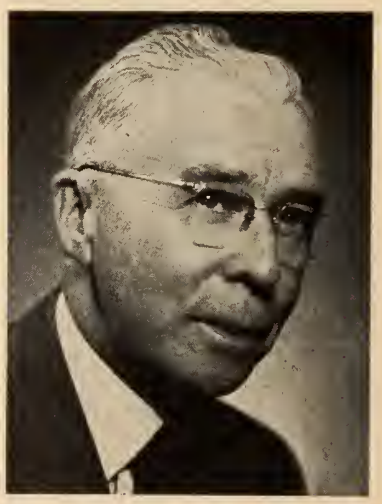
Mr. Jackson graduated from the University of Toronto in 1923 and, after a wide experience in the construction field, joined the engineering department of Canadian Industries Limited in 1929. In 1934 he was transferred to the ammunition division at Brownsburg, where he was made production manager, and in 1938, manager of the ammunition division with headquarters in Montreal. In 1946 he joined the organization of which he has recently been made president.

Charles H. Jackson, M.E.I.C.

F. J. Veale, M.E.I.C., Hamilton building commissioner, was recently selected to receive the annual distinguished citizenship award by the Advertising and Sales Club of Hamilton. The award is given to Mr. Veale in recognition of an "athletic record without parallel" and for years of untiring devotion to the young people of Hamilton. He is the coach of the Tiger-Cat Juniors.

E. V. Buchanan, M.E.I.C., has been named to the board of directors of Isotope Products Limited, Oakville, with the status of managing director.

He is a past president of the Association of Professional Engineers of Ontario, past vice-president of the Engineering Institute, and formerly general manager of the London Public Utilities Commission.



E. V. Buchanan, M.E.I.C.

G. N. Martin, M.E.I.C., combustion sales engineer of Dominion Bridge Company Limited, Lachine, Que., has been elected chairman of the Montreal Branch of the Engineering Institute.

Mr. Martin is a graduate of Ecole Polytechnique and has spent the greater part of his engineering career with the Dominion Bridge Company Limited which he joined in 1935.

From 1938 to 1940, however, he was in England, first with the International Combustion Limited, and then with Central Electricity Board, for the purpose of gaining experience in the boiler field. He was also released from Dominion Bridge for two years during the war for special work with the Aluminum Company of Canada Limited.

Mr. Martin is a member of the Corporation of Professional Engineers of Quebec, the Canadian Boiler Society, the American Boiler Manufacturers' Association, the American Society of Heating and Ventilating Engineers and the American Society of Mechanical Engineers.

G. N. Martin, M.E.I.C.

W. A. Dawson, M.E.I.C., president and manager of the newly formed sales agency of Dawson-Rhoades-Thibodeau Machinery Co. Ltd., has been elected chairman of the Hamilton Branch of the Institute.

Mr. Dawson was born at Barrie, Ont., where he received his elementary education. He graduated in mechanical engineering from Queen's University in 1923.

For the next 12 years he was associated with the Ford Motor Company of Canada in Windsor, Ont., joining the Company as a mechanical draughtsman and advancing to the position of chief tool engineer. Then followed successive appointments with Algoma Steel Corporation, Sault Ste. Marie, Ont., Chrysler Corporation of Canada Ltd., Windsor, Ont., E. Long Limited, Orillia, Ont., as superintendent of shops and foundries, plant engineer and plant manager.

W. A. Dawson, M.E.I.C.

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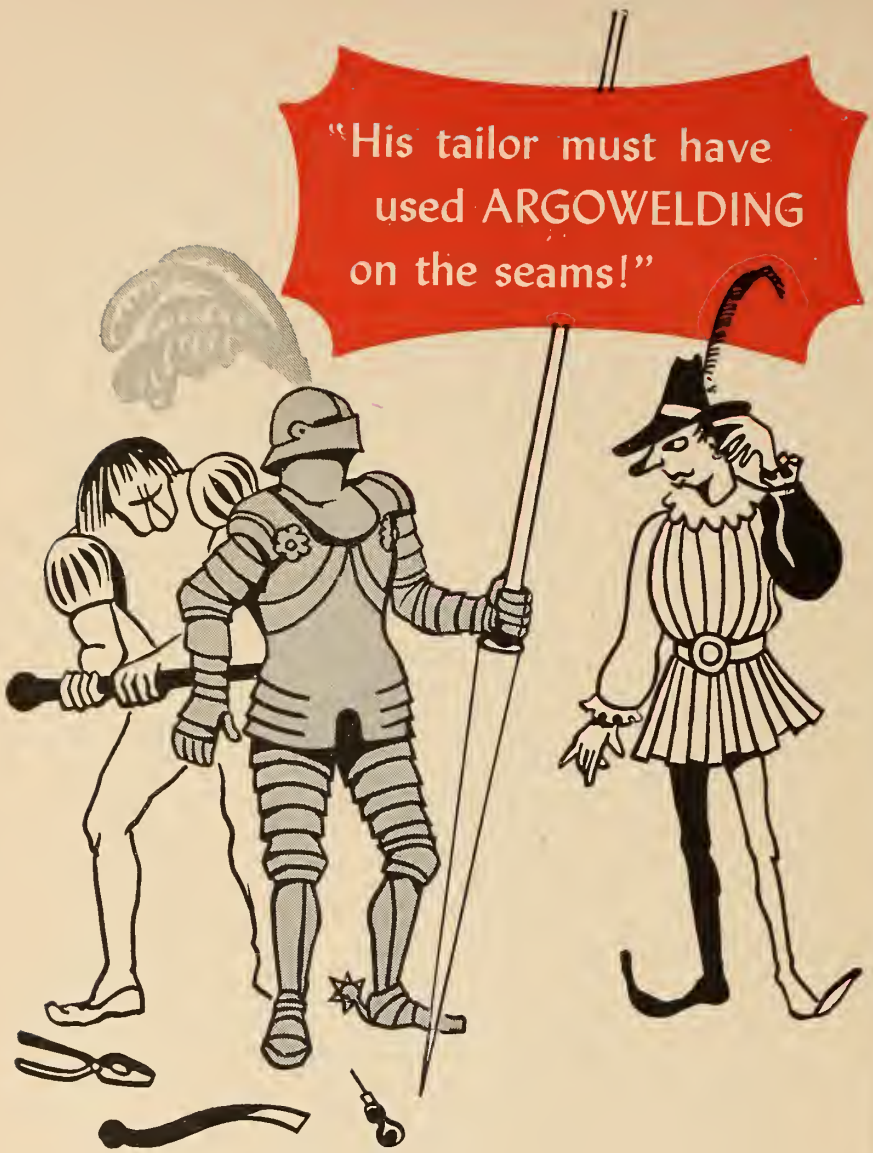

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During part of World War II he was engaged as chief planner of Bofors gun production at Otis Elevator Co., Hamilton, after studying gun manufacture during the "Battle of Britain" at a number of outstanding British ordnance works. In 1944 he was posted by the Department of Aircraft Production to de Havilland Aircraft Co. Ltd., Toronto, as tool controller, a position which terminated at the end of the war.

For the past seven years Mr. Dawson has been manager of the Hamilton Branch of F. F. Barber Machinery Division of Massey-Harris Co. Ltd. He has recently returned to Hamilton after having been on loan to the Guns Division, Department of Defence Production in Ottawa.

Mr. Dawson is an active director of the General Alumni Association of Queen's University.

H. T. Libby, M.E.I.C.

H. T. Libby, M.E.I.C., has been elected chairman of the Vancouver Branch of the Engineering Institute.

Mr. Libby was born in Kent, England, and arrived in Vancouver at an early age.

He joined the B.C. Electric Gas Division in 1923 and has held various positions before accepting his present appointment as superintendent of gas distribution seven years ago.

Mr. Libby became a member of the Association Professional Engineers of British Columbia in 1946 by examination as mechanical engineer.

In 1947 he joined the Engineering Institute as a Member. He was elected to the executive of the Vancouver Branch in 1951 and was appointed chairman of the publicity committee the same year. He served as vice-chairman and chairman of the program committee last year.

Mr. Libby is author of several technical articles, mostly concerning gas distribution, one of which was printed in Canada, United States and Great Britain.

He is a member of the British Columbia Engineering Society, National Association of Corrosion Engineers, the American Gas Association and the Vancouver Board of Trade.

E. B. Broadhurst, M.E.I.C., of Trail, B.C., has been elected chairman of the Kootenay Branch of the Engineering Institute.

Mr. Broadhurst was born at Salford, England. After receiving his elementary schooling at Trail, he attended the University of British Columbia.

He joined the Consolidated Mining and Smelting Company of Canada Limited in 1934 as an apprentice draughtsman. He became designing draughtsman in 1938 and in 1945 he was on loan to Defence Industries Limited. On his return to the Company he was appointed maintenance engineer for the lead smelting department.

E. B. Broadhurst, M.E.I.C.

Mr. Broadhurst has been an active member of the Kootenay Branch, serving as secretary-treasurer in 1947.

Lester McGillis, M.E.I.C., manager of purchasing, was recently appointed an assistant vice-president and manager of the purchasing department of the Shawinigan Water and Power Company. Mr. McGillis succeeds George Campbell, who has retired.

In 1924 he graduated from McGill University in electrical engineering, and began his career at Timmins, Ont., in the electrical division of the Hollinger gold mines. He went to Brazil as an electrical inspector with the Rio de Janeiro Tramway, Light and Power Company, a subsidiary of Brazilian Traction, and later joined another subsidiary as resident operating engineer of the Ilha dos Pombos hydro-electric development on the Paraiba River.

Lester McGillis, M.E.I.C.

In 1928 he returned to Canada and became superintendent of the North Shore Power Company at Three Rivers, and two years later, transferred to the parent Shawinigan Water and Power Company as assistant divisional manager of the commercial and distribution department at Three Rivers and, at the same time, superintendent of the Three Rivers Traction Company, where he remained until 1935.

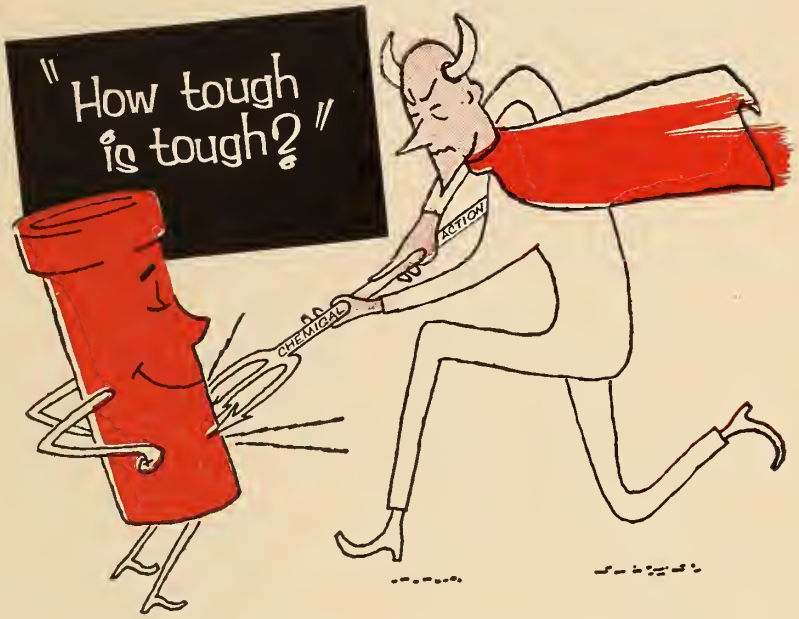
The next ten years Mr. McGillis spent at Valleyfield as division manager, after which he was transferred to Shawinigan's Montreal office as manager of the industrial development department. He was appointed manager of purchasing in 1950.

Stewart Young, M.E.I.C., former director of town planning in the Saskatchewan Government, was appointed in November by the Regina Collegiate Institute Board to make a survey of Regina to determine what kind of high school building is needed to meet the City's expansion.

He was asked to determine the areas from which students are attending each school and estimate what enrolment can be expected in high schools during the next 10 years or more.

Mr. Young is a Life Member of the Engineering Institute and is a past chairman and secretary-treasurer of the Saskatchewan Branch.

E. M. Stiles, M.E.I.C., has retired from his position of chief engineer of Consolidated Mining and Smelting Company of Canada Limited to become consulting engineer of the Engineering Division.



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Mr. Stiles was born in India and spent his youth in New England graduating with a civil engineering degree in 1914 from Dartmouth College, New Hampshire. During the next three years he served briefly with the United States

E. M. Stiles, M.E.I.C.

Reclamation Service Survey, the Anaconda Copper Mining Company and the Nevada Consolidated Copper Company.

He joined the Consolidated Mining and Smelting Company of Canada Limited as chief draughtsman in 1917. Following Army service he returned to the Company and in 1922 was appointed chief engineer. In this position he has supervised all of the Company's construction during the past 30 years.

Mr. Stiles has written a number of technical papers, the most recent being "The Kootenay Lake Span" which he presented to the annual meeting of the Engineering Institute in May, 1952.

J. V. Rogers, M.E.I.C., has been appointed to the newly created position of manager of the Engineering Division of Consolidated Mining and Smelting Company of Canada Limited.

Mr. Rogers graduated in electrical engineering from the University of British Columbia in 1933 and held engineering posts with the Churchill River Power Company, Flin Flon, Berens River Mines in Ontario, and the Privateer Mine in British Columbia.

He joined Consolidated Mining and Smelting Company of Canada Limited

J. V. Rogers, M.E.I.C.

in 1940 as a draughtsman. That year the Company undertook the building and operation of chemical plants for the Albertan Government in Calgary, and Mr. Rogers served there as chief draughtsman until 1942 and as plant engineer until 1944.

Mr. Rogers was then loaned to the Natural Gas Utilities Board of Alberta as construction engineer for a short time before returning to the Company's Trail operations late in the year of 1944. In 1945 he became superintendent of construction and maintenance of Trail operations, and in 1948, assistant chief engineer.

W. K. Gwyer, M.B.E., M.E.I.C., assistant superintendent of construction for Consolidated Mining and Smelting Company of Canada Limited, has been appointed assistant manager of the Company's Engineering Division.

W. K. Gwyer, M.E.I.C.

Mr. Gwyer graduated in civil engineering from the University of British Columbia in 1935. He then worked with the Northern Construction Company and E. J. Ryan on the B.C. Coast.

In 1940 he joined the R.C.A.F. serving in Canada and overseas and was awarded the M.B.E.

Between 1945 and 1950 he was employed by Stevenson and Kellogg Limited at several centres in the Pacific Northwest.

Mr. Gwyer joined the Company at Trail in 1950 as assistant superintendent of construction.

E. Mason, M.E.I.C., chief design engineer of Consolidated Mining and Smelting Company of Canada Limited, will take on additional responsibilities in the technical field.

Mr. Mason received his education at the Bolton Technical School and Manchester School of Technology, England, completing his studies in 1922. Before joining Consolidated Mining and Smelting, Mr. Mason gained experience in the field of tool and machine design, including work in Eastern Canada between 1913 and 1916, and until 1922, in England.

Shortly after returning to Canada to 1922, he entered Consolidated Mining and Smelting as a draughtsman. In 1928 he was made a checker in the design office and by 1935 he became chief draughtsman. In 1944 he was appointed assistant to the chief engineer and the following year became chief design engineer.

Mr. Mason has served as chairman of both the Kootenay Branch of the Engineering Institute and of the Eastern District Advisory Committee of the B.C. Association of Professional Engineers.

E. Mason, M.E.I.C.

R. E. Taylor, M.E.I.C., in resigning last year from his position as engineer of buildings for the Western region of Canadian National Railways, had completed 41 years' service with Canadian railways.

Mr. Taylor was born in South Shields, England, and served his articles in engineering with the Northeastern Railway at Newcastle-on-Tyne.

He came to Canada in 1911 and was employed in railway survey work in Saskatchewan. He transferred to draughting work in 1912 and served with the Hudson Bay Railway from 1913 until 1918 when he joined the Canadian Expeditionary Force. Late in 1919 he returned to Winnipeg and resumed his work as draughtsman in the Winnipeg office of C.N.R. In 1928 he became chief draughtsman of the architectural department. Ten years later he was appointed engineer of buildings, a position he held until retirement.

In the course of his railway career, Mr. Taylor developed designs for coaling plants that have served as standards until today. He personally carried out all structural design of the million dollar C.N.S.S. dock at Vancouver, all buildings at Jasper Park Lodge and Minaki.

As engineer of buildings in charge of design and construction, he has built many of the major buildings and facilities throughout the Western region, such as the freight shed and auxiliary office building and facilities at Edmonton: stores building powerhouse and roundhouse at Prince Albert; the new freight shed and office building at Fort William; and many others.

Lieut.-Colonel H. A. Davis, M.E.I.C., is superintendent of engineering and construction requirements in the office of the Deputy Minister of National Defence in Ottawa. He was previously located in Calgary, Alta.

R. A. Spencer, M.E.I.C., dean of the College of Engineering of the University of Saskatchewan will retire in June of this year according to a recent announcement by the University President, Dr. W. P. Thompson.

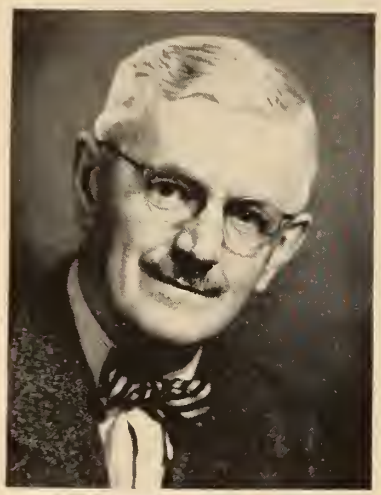
Dean Spencer was born in Sydney,

N.S., where he received his early education. He received his master's degree in civil engineering from McGill University in 1915.

After distinguished service in the First World War, he attended University College in London, England, in 1919, and the following year was professor of engineering at Dalhousie University. In 1921 he was appointed assistant professor of civil engineering at the University of Saskatchewan. He was named dean of the College of Engineering in 1944.

Dean Spencer did extensive work with the C.O.T.C. at the University, retiring in 1944 at his own request with the rank of lieutenant-colonel.

He has been a member of the Saskatchewan Research Council since its inception in 1947 and is chairman of several committees including soil mechanics, highway engineering and water studies. He has been vice-president of the Engineering Institute for two years as well as having served as chairman of the provincial branch.



I. M. Fraser, M.E.I.C.

R. A. Spencer, M.E.I.C.

I. M. Fraser, M.E.I.C., head of the department of mechanical engineering at the University of Saskatchewan, has been appointed to succeed R. A. Spencer, dean of the College of Engineering who will retire in June of this year.

Professor Fraser was born in Pictou, N.S., and received his early education there. He graduated from McGill University with a B.Sc. degree in applied science in 1919.

The next year he was appointed an instructor at McGill and a year later entered Dominion Engineering Company Ltd., Lachine, Que.

Professor Fraser came to the University of Saskatchewan in 1921 as assistant professor of mechanical engineering and became head of that department in 1937.

He is a member of the Association of Professional Engineers of Saskatchewan and served as its president in 1939. Recently he was appointed to the Fisheries Research Board of Canada.

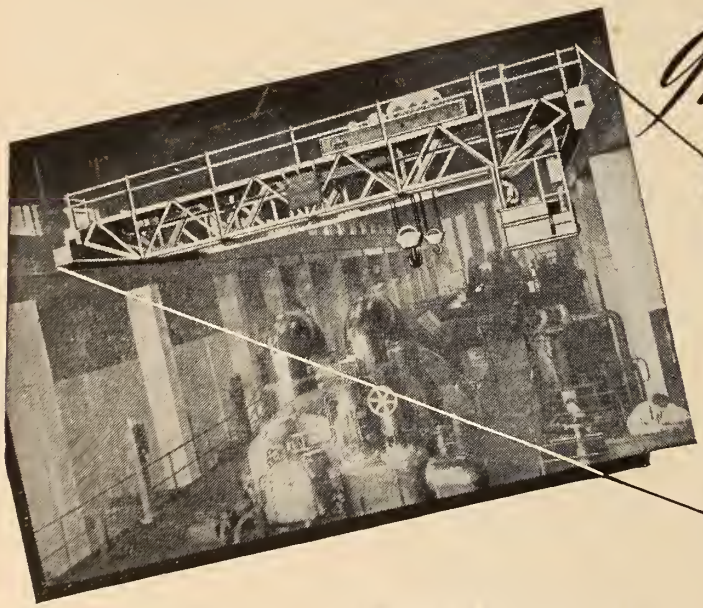
Brigadier E. R. Suttie, C.B.E., D.S.O., E.D., M.E.I.C., has joined the staff of the Steel Company of Canada Limited in Hamilton, Ont.

He was previously with Canadian Cottons Ltd., in Montreal.

Vernon Pearson, M.E.I.C., mechanical superintendent of the Department of Public Works, Edmonton, has retired from his official duties.

Mr. Pearson was born in Rye, England, and graduated from the Brassey Institute School of Science and Art in Hastings. He obtained his early practical engineering in the Corporation of Hastings and Saint Leonards, as well as Seven Oaks, in Kent.

He came to Canada in 1910 and was



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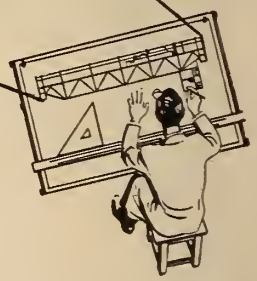

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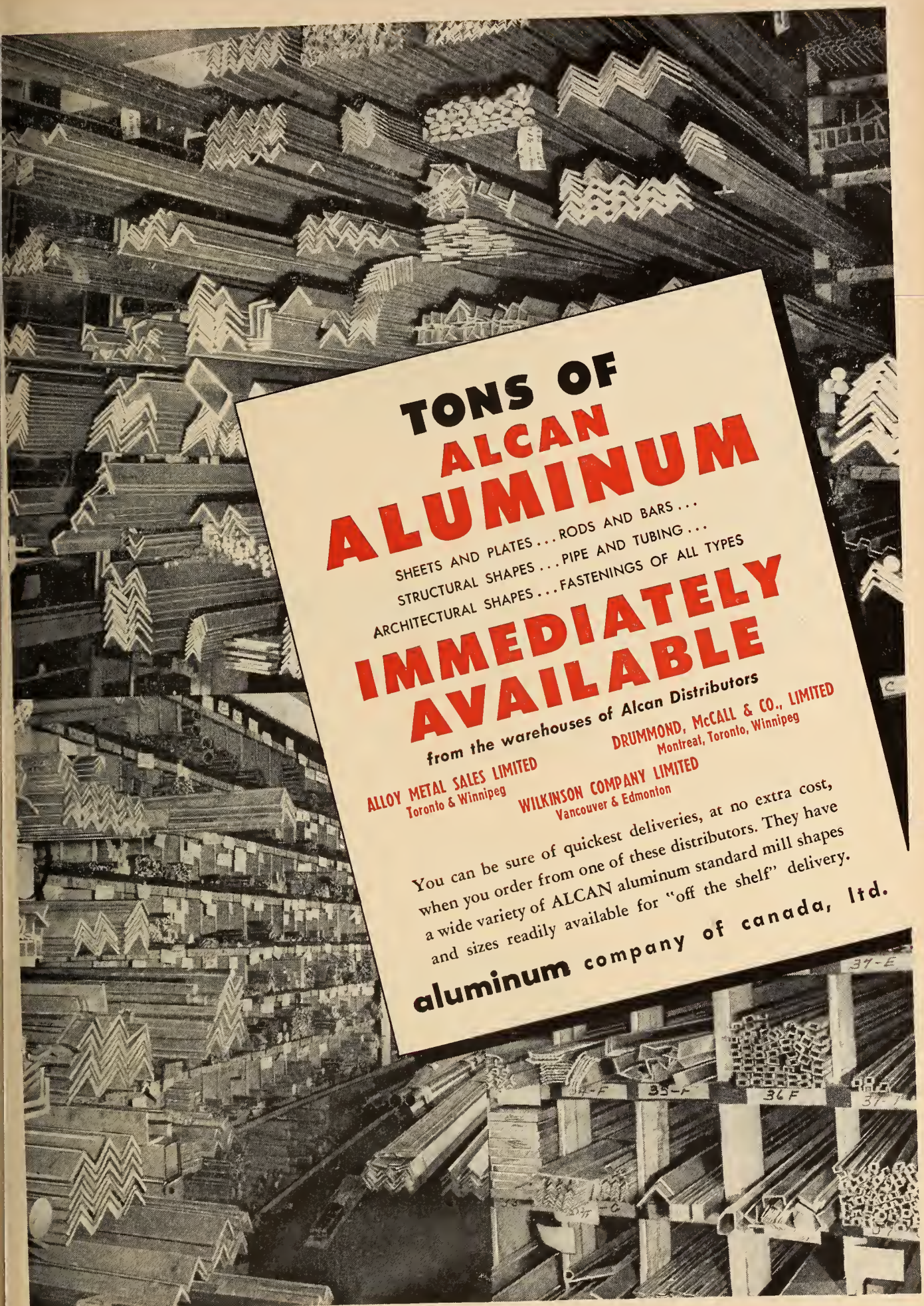
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associated with the Lethbridge Iron Works for four years, and with the Canmore Coal Company as erecting engineer and as chief engineer and master mechanic of this Company for five years.

During the next four years he served as superintendent of public utilities for the Town of Fort Macleod.

In 1923, Mr. Pearson joined the provincial service and was appointed superintendent of power plants for the Province. He continued in this position until 1928 when he entered private business in the engineering field.

He returned to the Government in 1937 as mechanical superintendent and later, in addition, took over the duties of chief inspector of boilers. He held this position until his retirement. During his tenure of office he served as technical advisor to the power commission for a period of eight years.

During the last 15 years, Mr. Pearson has served as chairman of the Edmonton Hospital Board. He is also a past-president of the Professional Engineers of Alberta. He served in the Boy Scout movement in various capacities for 22 years.

The Hon. D. B. MacMillan, former Minister of Public Works, said that Mr. Pearson's perseverance in carrying out government policies had been a credit to the Government.

William A. Duncan, M.E.I.C., has been named vice-president and director of Dominion Oxygen Company Limited, Toronto, where he has served as sales manager for the past seven years.

Mr. Duncan joined the staff of the

William A. Duncan, M.E.I.C.

Dominion Oxygen Company immediately upon graduation from the University of Toronto in civil engineering in 1928. He has held various positions including that of manager of process service prior to his appointment as sales manager in 1945. Mr. Duncan is a member of the Association of Professional Engineers of Ontario, and of the American Society for Metals.

A. S. Wall, M.E.I.C., has been appointed consulting plate and boiler engineer, eastern division, Dominion Bridge Co. Ltd.

Mr. Wall graduated from Dalhousie University. He has been associated with Dominion Bridge, in various capacities, since 1910. In 1916 he was engaged on special work relating to marine boiler design and construction, and in 1922 he was made plate and tank engineer and

C. J. Pimenoff, M.E.I.C.

commissioned to develop this type of work. He was actively engaged in the early development of welding and was one of the pioneers in this field. In 1937 Mr. Wall was appointed plate and boiler engineer, eastern division—a position he has held until recently. He is now serving the Company, in an advisory capacity, as consulting plate and boiler engineer.

A. M. Bain, M.E.I.C., has been appointed plate and boiler engineer, eastern division, Dominion Bridge Co. Ltd.

Mr. Bain graduated in civil engineering from the University of Manitoba and obtained his master's degree in structural and hydraulic engineering from McGill University. He joined Dominion Bridge in 1929 and has been with the Company continuously except for the years 1941-1946, when he was loaned to the Army Engineering Design Branch of the Department of Munitions and Supply. Towards the end of the war he became acting director of tank design at the Montreal Tank Arsenal. In 1946 Mr. Bain returned to Dominion Bridge to take charge of the boiler design department, serving the Company in this capacity until his recent appointment.

A. M. Bain, M.E.I.C.

C. J. Pimenoff, M.E.I.C., has been appointed structural engineer, eastern division, Dominion Bridge Co. Ltd.

Mr. Pimenoff graduated in civil engineering from McGill University. He joined Dominion Bridge Co., in 1935 as a structural designer—a position he held until his recent appointment. Among other important projects, Mr. Pimenoff took a leading part in the design of the Arvida Aluminum Bridge, the first aluminum structure of its type in the world.

A. S. Wall, M.E.I.C.

Douglas Stewart Ellis, D.S.O., M.E.I.C., dean of applied science at Queen's University, has been appointed to the 20-man executive council of the Association of Professional Engineers of Ontario.

Dean Ellis was appointed by the Lieutenant-Governor in Council, to fill the vacancy caused by the death of John L. Laing.

Born in Cobourg, Ont., Dean Ellis has made Kingston his home since 1893. He has been lecturing at Queen's longer than any other member of the staff, and he has had a distinguished career not only in the academic field but also in dealing with practical engineering problems.

He graduated with a B.Sc. degree in civil engineering from Queen's University in 1910 after receiving his B.A. and M.A. degrees in mathematics.

He was awarded the D.S.O. in the First World War.

He returned to the Queen's civil engineering department and after gaining his M.Sc. degree in civil engineering from Cornell University, he began to develop the hydraulics section of the department. In 1941 he was named head of the department, and two years later he was appointed dean of the faculty.

As a consulting engineer, Dean Ellis has served with the Hydro-Electric Power Commission of Ontario for a number of years, and later with the Ontario Government on a hydraulics study in connection with the Moira River project.

During World War II he was a member of the Wartime Bureau of Technical Personnel.

In 1943 Dean Ellis was appointed chairman of a board of three engineers to study the most effective means of crossing the Strait of Canso between the Nova Scotia mainland and Cape Breton Island. The board's recom-

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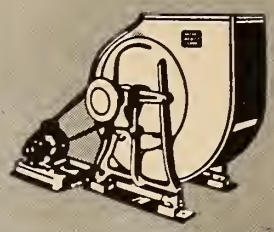
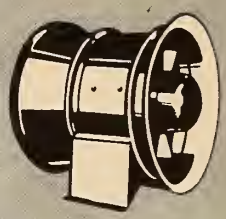


Limit-Load Ventilating Fan



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Volume Fan

Type E Blower

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mendation for a causeway has been accepted and construction of it is under way.

G. D. Lewis, M.E.I.C.

G. D. Lewis, M.E.I.C., has been appointed secretary of Dominion Engineering Works Limited. Prior to this appointment he was assistant secretary.

A graduate of Nova Scotia Technical College and Dalhousie University he joined the Company's engineering department in 1946 after service with the Royal Canadian Electrical and Mechanical Engineers.

Charles Bailey, M.E.I.C., chief engineer of the general engineering division of John Inglis Co. Limited, has left that company to take up a senior appointment with Trans Mountain Oil Pipe Line Company.

During his term of office, the Company has developed important new lines of business including paper machines, hydraulic equipment, marine turbines of advanced design, and industrial power plants.

Dugald Cameron, M.E.I.C., is president and general manager of Dugald Cameron Associates Ltd., Malton, Ont., which was incorporated last year. The firm is a fabricator of steel partitions and is agent for a wide range of British products.

Mr. Cameron came to Canada in 1923, and has been engaged in various branches of engineering, particularly the steel industry.

Charles Bailey, M.E.I.C.

FOR BULK MATERIALS HANDLING CHOOSE FROM 4 BASIC TYPES OF CONVEYING SYSTEMS

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Bauxite
Catalysts
Cement (Portland)
Cement raw materials
Chalk
Clays (dried)
Coal (pulverized)
Coke dust
Dolomite (pulverized)
Feldspar
Flue dust
Fly ash
Fuller's earth
Gypsum (calcined)
Gypsum (raw)
Lime
Limestone (pulverized)
Magnesite
Manganese dioxide
Ores (pulverized)
Phosphate rock (pulverized)
Rock dust
Soda ash
Starch

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Stationary and/or Portable Pumps for point-to-point conveying; loading and unloading hopper cars, ships and barges; mixing and blending; recovering. Remote-Control Unloaders for unloading flat-bottomed carriers and bins.

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A revolutionary type of conveyor utilizing low pressure air. Basically it is a rectangular duct divided horizontally by a porous medium. Air in the lower chamber passes through the medium and fluidizes the material in the upper section, causing it to flow.

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This pneumatic system is used extensively for unloading cars, trucks, ships, barges; also conveying to and from storage. It is a vacuum cleaner on the grand scale — with capacities ranging from a few tons up to 300 tons per hour.

FULLER-FLUXO

Long distance conveying is the special talent of this type conveyor. At Grand Coulee Dam, for instance, such an installation conveyed Portland cement from storage to a mixing plant 1¼ miles away at a rate of 1000 barrels per hour.

COMPRESSORS and VACUUM PUMPS for the above installations are of the Rotary type — thus ensuring maintained volumetric efficiency, non-pulsating flow, negligible maintenance since there are only three moving parts — rotor, blades, bearings. Ask for Bulletin C-5A.

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An active member of the Institute, Mr. Cameron is the News Editor for the Toronto Branch.

Dugald Cameron, M.E.I.C.

Robert Wilson, M.E.I.C., former manager of engineering and installation of the communications equipment division of the Northern Electric Company, was appointed assistant manager of the telephone contract division several months ago.

Mr. Wilson joined Northern Electric in 1923 as an equipment draughtsman and served in various capacities as an engineer until September, 1947, when he became installation superintendent. He was made manager of engineering and installation the following year.

J. Barcza, M.E.I.C., has joined the staff of Kolostat Heating Systems, Ltd., manufacturers and distributors of heating, air conditioning and ventilating equipment, as designer and sales engineer. Mr. Barcza is a graduate mechanical engineer and has been designing heating and air conditioning systems for many years.

J. Narsted, M.E.I.C., vice-president and manager of production of Canada Cement Company Limited, has recently been appointed a director of the Company.

Mr. Narsted has been with Canada Cement since 1945.

Gordon R. Henderson, M.E.I.C., has been appointed manager of Sun Oil Company's refinery now under construction at Sarnia, Ontario.

Before joining Sun Oil Company, Mr. Henderson was vice-president and general manager of Catalytic Construction of Canada Ltd., directing that company's Canadian activities which include the building of Sun's Sarnia refinery. He had been chief engineer of the Polymer Corporation in Sarnia prior to his association with Catalytic Construction Company.

Mr. Henderson is a member of the Association of Professional Engineers of Ontario, an associate member of the Canadian Institute of Chemistry and a director of the Sarnia Chamber of Commerce. He has also served as councillor and chairman of the Sarnia Branch of the Engineering Institute.

At the twenty-first meeting of the Canadian Management Council in Montreal in November **C. A. Peachey,** M.E.I.C., was named president of the Council, which is the Canadian affiliate of the International Committee for Scientific Management. **J. A. Coote,** M.E.I.C., was elected secretary and **J. E. Dion,** M.E.I.C., was named program committee chairman.

Among the directors of the Council are **E. B. Jubien,** M.E.I.C., **F. R. Manuel,** M.E.I.C., and **A. M. Mackenzie,** M.E.I.C.

G. L. Vickerson, M.E.I.C., president of The G. R. Locker Company of Montreal, has been appointed chairman of the Westmount School Commissioners.

John Lucyk, M.E.I.C., has been appointed chief engineer at the Canadian plant of Aerovox Canada Limited.

Mr. Lucyk has been with Aerovox Canada Limited since 1941 and prior to his new appointment was the assistant chief engineer and sales engineer.

A member of the Association of Professional Engineers of Ontario, he has also been active in the Institution of Radio Engineers, being presently the secretary-treasurer of the Hamilton Section.

F. B. Connors, M.E.I.C., district engineer at Red Deer, Alta., for the Alberta Department of Public Works, Road Branch, retired recently after 30 years of highway and railway work in the Province.

Mr. Connors was born in Chatham,

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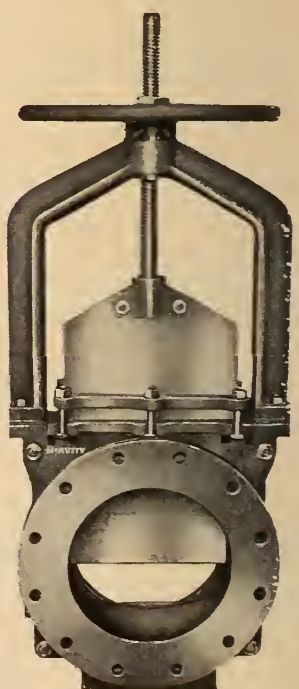

FIGURE 9940
Pulp Stock Valve

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N.B., and obtained his schooling there. In 1902 he went west to Winnipeg to complete his education. After five years in Winnipeg, he started on railway construction and worked throughout the three Prairie Provinces.

In 1915 he enlisted with the 12th Mounted Rifles, and served in England and France. He was invalided home in 1917 after being wounded at Ypres.

In 1922 he worked as railroad maintenance engineer in Edmonton on what was known later as the Northern Alberta Railway. He began work in 1924 with the Provincial Government in whose employ he has been except for two years during the Second World War.

Mr. Connors worked on main highway construction until his appointment in 1938 as district engineer. He served in this capacity at High Prairie, Medicine Hat, Grande Prairie and Red Deer.

His second war service saw him a captain with the Royal Canadian Engineers, second in command of a unit at Halifax in 1942 and 1944.

A. T. Hurter, M.E.I.C., of Montreal, was elected president of the Association of Consulting Engineers of Canada, at the Association's annual meeting in January, 1953, and succeeds **H. H. Angus,** M.E.I.C., of Toronto. **Edgar A. Cross,** M.E.I.C., of Toronto was named vice-president.

The directors are: **J. Georges Chenevert,** M.E.I.C., **E. A. Ryan,** M.E.I.C., **R. R. Duquette,** M.E.I.C., of Montreal; **H. H. Angus,** M.E.I.C., **John H. Ross,** M.E.I.C., and **Edgar A. Cross,** M.E.I.C., of Toronto.

J. Hastie Holden, M.E.I.C.

J. Hastie Holden, M.E.I.C., of Montreal, has been appointed Eastern vice-president of Westeel Products Limited. He is in charge of the Company's operations in Quebec, the Maritime Provinces and Newfoundland.

Frederick W. Bradshaw, M.E.I.C., has been appointed acting division manager of the Laurentide Division of the Consolidated Paper Corporation, Grand'-Mere, Que. Mr. Bradshaw, born in England, is an honours graduate in chemical engineering from McGill University. He has been chief engineer of the Corporation since 1943.

Mr. Bradshaw is a past-chairman of the St. Maurice Valley Branch of the Engineering Institute, and a past councillor. He is serving the Institute this year as chairman of the Nominations Committee.

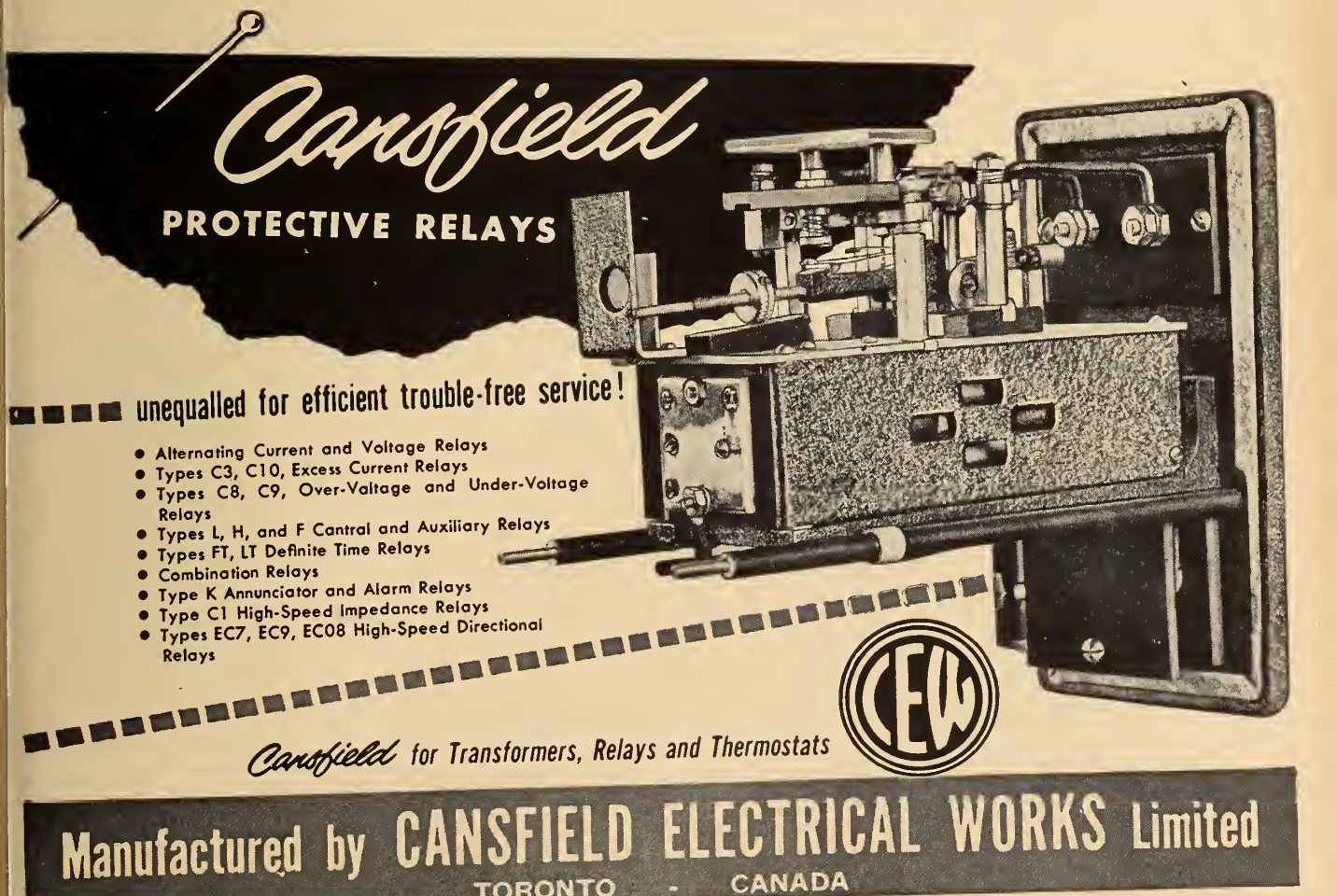
Edward T. Buchanan, M.E.I.C., has been appointed acting chief engineer of the Consolidated Paper Corporation.

Mr. Buchanan started with the Corporation in accounting work in 1935, and has been assistant chief engineer since 1946.

Mr. Buchanan, an electrical engineering graduate of McGill University, class of 1928, was granted the I. H. Weldon medal of the Technical Section of the Canadian Pulp and Paper Association in 1948. He is assistant provincial commissioner of the Boy Scouts Association. He is a past chairman of the St. Maurice Valley Branch of the Engineering Institute.

R. F. Shaw, M.E.I.C., vice-president of the Foundation Company of Canada Limited, has returned to head office in Montreal.

In May, 1951, Mr. Shaw left the Company on loan to Defence Construction (1951) Limited to assume the office of chief engineer. Two months later he was appointed vice-president of that branch of the Government. In



this capacity he acted as Canadian representative on a committee of airfield experts reporting to NATO.

R. Prefontaine, M.E.I.C., is vice-president of Dupuis Freres Limited, Montreal.

He was previously president and consulting engineer of The Solex Company, Limited, in Montreal.

George L. Schneider, M.E.I.C., has recently opened offices as general consulting engineer in Hamilton, Ont. He will do general structural design and construction consultancy, with some specialization in prestressed concrete slabs and walls.

He was previously on the staff of Frid Construction Co. Ltd., and C. C. Parker & Associates, both of Hamilton.

Mr. Schneider is a past secretary-treasurer of the Hamilton Branch of the Engineering Institute.

Boris A. Hesketh, M.E.I.C., is managing director of Hesmont Concrete Limited, Montreal.

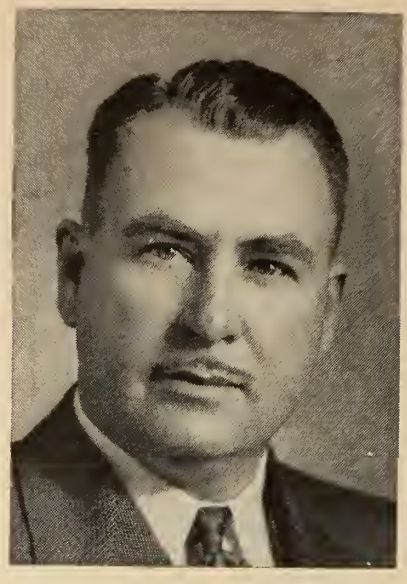
He was previously with the engineering division of the Public Works Department of the City of Montreal.

Mr. Hesketh obtained his engineering degree from Ecole des Travaux, Paris.

G. J. Dunne, M.E.I.C., has been appointed production manager of Frank W. Horner Limited in Montreal.

Previous to this appointment Mr. Dunne was assistant sales manager in the Company.

Mr. Dunne is a 1944 chemical engineering graduate of McGill University.



R. E. L. Johnson, M.E.I.C.

R. E. L. Johnson, M.E.I.C., has been named factory manager of C. A. Dunham Co. Ltd., at Toronto. He is in charge of the Davenport Road plant and the new Wendell Avenue plant in North York.

He was industrial engineer for a number of years with Stevenson & Kellogg Ltd., of Montreal. Mr. Johnson is a graduate of McGill University in electrical engineering.

D. F. Taylor, M.E.I.C., former Planning Branch director of the New Brunswick Department of Industry and Development, has been appointed assistant chief planner in the Community Planning Branch of the Ontario Department of Planning and Development in Toronto.

Mr. Taylor is a graduate of the University of New Brunswick in civil engineering, class of 1947.

F. H. Hibbard, M.E.I.C., is district engineer for the Board of Transport Commissioners of Canada with headquarters at the Union Station, Ottawa.

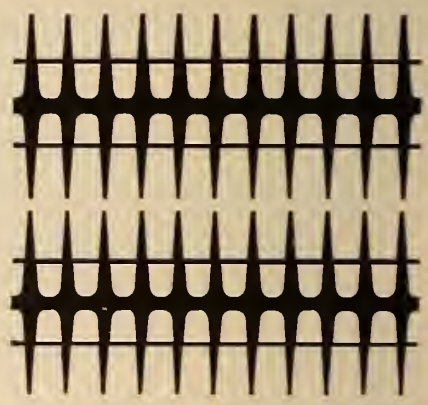
Mr. Hibbard's connection with transportation dates back to 1913 when he was engineer in charge of construction with the Quebec Central Railway Company.

G. R. Doull, M.E.I.C., was appointed several months ago assistant chief engineer of the engineering department of the Atlantic region of the Canadian National Railways, with headquarters at Moncton, N.B.

Mr. Doull entered the service of the railway engineering department in Halifax in 1914. He became a draughtsman in 1916 on the Halifax ocean terminals project, and in that same year was transferred to Moncton as assistant engineer until 1921 when he went to Toronto in the office of the engineer of standards, later transferring to Montreal. In 1943 he returned to Moncton as assistant engineer and the following year he was appointed bridge engineer for the Atlantic region.

He became principal assistant engineer in 1949, a position he held until his recent appointment.

Another Iron Curtain



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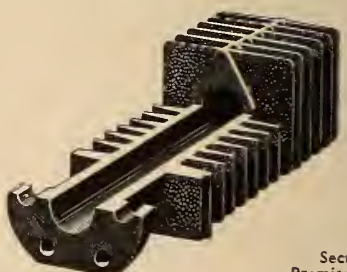

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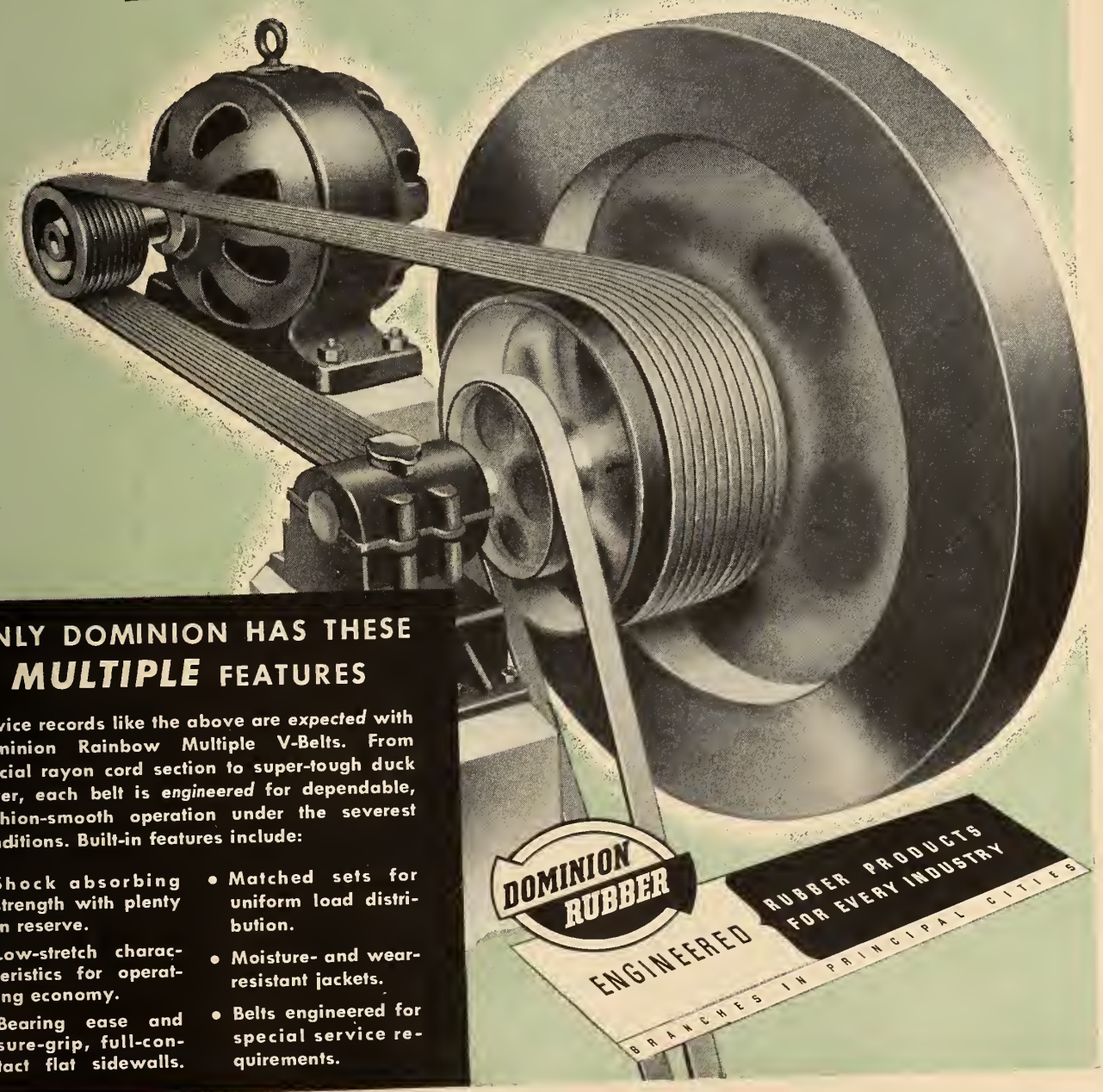

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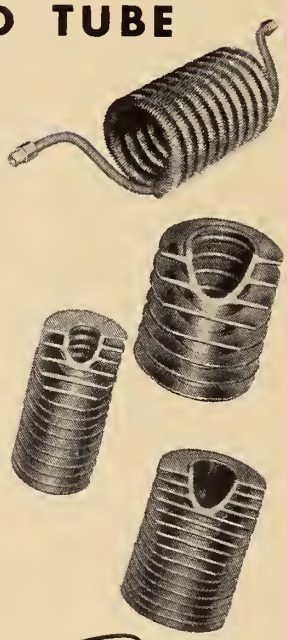

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* Patented in Canada and patents pending.

R. P. Puddester, M.E.I.C., has been appointed principal assistant engineer for the Atlantic region of the Canadian National Railways. His headquarters are at Moncton, N.B.

Mr. Puddester, a native of St. John's, Nfld., entered the employ of the Newfoundland Railway as a clerk in the engineering department in 1924. He became a draughtsman in 1931 and four years later an assistant engineer. He was appointed acting chief engineer in 1947 and the following year his appointmetn was confirmed.

With the entry of Newfoundland into Confederation in 1949 and the incorporation of the Newfoundland Railway in the Canadian National System, Mr. Puddester was made district engineer, which position he held until his present appointment.

W. M. Wood, M.E.I.C., formerly construction superintendent with Winnipeg Supply and Fuel Company Limited, is now with Universal Contractors Limited, Winnipeg, as general superintendent.

Before going to Winnipeg Mr. Wood was resident engineer for Burns & Company Limited at Kitchener, Ont.

Mr. Wood is a civil engineering graduate of the University of Manitoba, class of 1939.

P. R. Maitland, M.E.I.C., is sales engineer with the Dominion Oxygen Company, Vancouver, B.C.

He was previously chief designer of the engineering department of Barber Machinery Ltd., in Calgary, Alta.

Mr. Maitland is a graduate of the University of British Columbia in mechanical engineering, class of 1950.

Thornton E. Smith, M.E.I.C., has joined the Industrial Engineering Company in New York City. He was previously with Fraser-Brace Terminal Constructors in Saint John, N.B.

In 1948 Mr. Smith graduated in civil engineering from the Massachusetts Institute of Technology.

R. F. Hawkins, M.E.I.C., former marine engineer with Imperial Oil Co. Ltd., Toronto, has joined the staff of the National Research Council of Canada as a technical officer in the Montreal Road Laboratories.

Mr. Hawkins graduated in mechanical engineering from the College of Technology in Belfast.

Frederick Wilmot Hubbard, M.E.I.C., has joined the staff of the Quebec Iron and Titanium Corporation at Sorel, Quebec. He was formerly design engineer with Canadian Industries Limited in Montreal.

Mr. Hubbard graduated in 1943 from the University of New Brunswick in electrical engineering.

Allison F. Mosher, M.E.I.C., has been awarded one of the J. William Hersey graduate fellowships, at the School of Business Administration of the University of Western Ontario.

Mr. Mosher holds a B.A.Sc. degree in electrical engineering from the University of British Columbia.

During the Second World War he was an instructor in radio and radar theory. He has worked as a time study engineer for J. D. Woods & Gordon Ltd., and is now head of the industrial engineering department of Fibreglass Canada Ltd.

E. W. McKernan, M.E.I.C., has been transferred by the Aluminum Company of Canada Ltd., from Isle Maligne to

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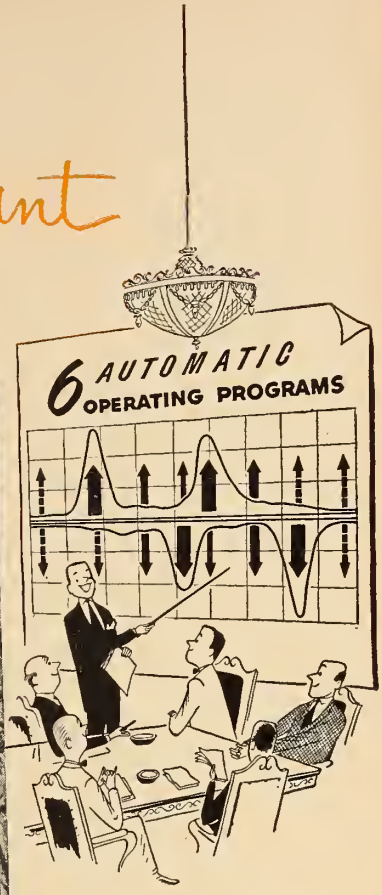

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the British Columbia project. He is an electrical engineer, and will be located in Vancouver before going into field work.

Mr. McKernan is a 1941 graduate of the University of Alberta.

M. G. Colvin, Jr.E.I.C., is structural designer with Stone and Webster in Boston, Mass. He was previously structural senior draughtsman with this same Company, which he joined in 1951 after graduating from the University of Toronto in civil engineering, class of 1951.

M. Storrier, Jr.E.I.C., is assistant to the equipment engineer with the Hudson Bay Mining & Smelting Co. Ltd., in Flin Flon, Man.

Mr. Storrier is a 1951 graduate in mining engineering from McGill University.

R. A. W. Clayton, Jr.E.I.C., is employed by Sandwell and Co. Ltd., consulting engineers in Vancouver, B.C.

Mr. Clayton is a 1951 graduate of the University of British Columbia in civil engineering.

Viggo Lewis, Jr.E.I.C., of Arvida, Que., has been awarded a scholarship offered by Industrial Acceptance Corporation at the School of Business Administration, University of Western Ontario.

Mr. Lewis is a graduate of Trinity College School and obtained his B.Sc. degree in mechanical engineering from Queen's University.

He has been employed during the summer months of his university course by Noranda Mines, Consolidated Paper Corporation, and Imperial Oil Company as a deck hand on an oil tanker.

Owen T. Linton, Jr.E.I.C., has been named Western division manager of the Interprovincial Pipeline Company. He has been with the Company since 1950.

Upon graduating in civil engineering from the University of Toronto in 1948, Mr. Linton became a student engineer with Imperial Oil Limited in Toronto, and was later engaged in work for the Interstate Oil Pipe Line Company in Oklahoma.

K. H. W. Seppala, Jr.E.I.C., has been appointed district manager of the new sales branch of Reliance Electric & Engineering (Canada) Limited with offices located in Vancouver.

K. H. W. Seppala, Jr.E.I.C.

Before joining the Company, Mr. Seppala was associated with the Canadian General Electric Company and the Canadian Comstock Company.

Mr. Seppala is a native of Vancouver and a graduate of the University of British Columbia in electrical engineering.

J. F. Perrier, Jr.E.I.C., has joined the technical staff of the Bell Telephone Laboratories Inc. in Murray Hill, N.J., and is at present engaged as research engineer in the colour television field.

He was previously lecturer in the electrical engineering department of the University of Alberta.

Mr. Perrier received his B.Sc. degree in electrical engineering from the University of Alberta in 1947, and his M.Sc. degree in 1950.

Capt. J. G. Lefebvre, R.C.A., Jr.E.I.C., has concluded his term of employment with the Defence Research Board ahead of the design section at the Canadian Armament Research and Development Establishment. He has been recently posted by the Canadian Army for two years to the Armament Design Establishment at Fort Halstead, Kent, England. The Establishment is a branch of the United Kingdom Ministry of Supply.

Capt. Lefebvre is a graduate of McGill University in mechanical engineering, class of 1948.

Fred Landis, Jr.E.I.C., is a research engineer in the thermodynamics section of Northrop Aircraft, Inc., Hawthorne, Calif.

CRADLE FOR THE GIANTS

National Auto Radiator's new Plant at Windsor, recently built by Eastern houses some of the largest stamping equipment in Canada. Huge presses with capacities up to 1200 tons produce parts for the automotive, aircraft and agricultural industries. Eastern is proud to have played a part in their expansion.

In London, Chatham and Windsor, Eastern are building new Plants for industry. We have a staff of Civil and Mechanical Engineers to manage each project.

Eastern builds: Factories. Warehouses, Office Buildings, Reservoirs, Power Houses, Bulk Elevators, Hangars, Air Strips.

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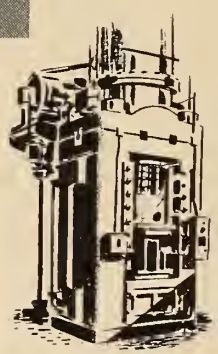

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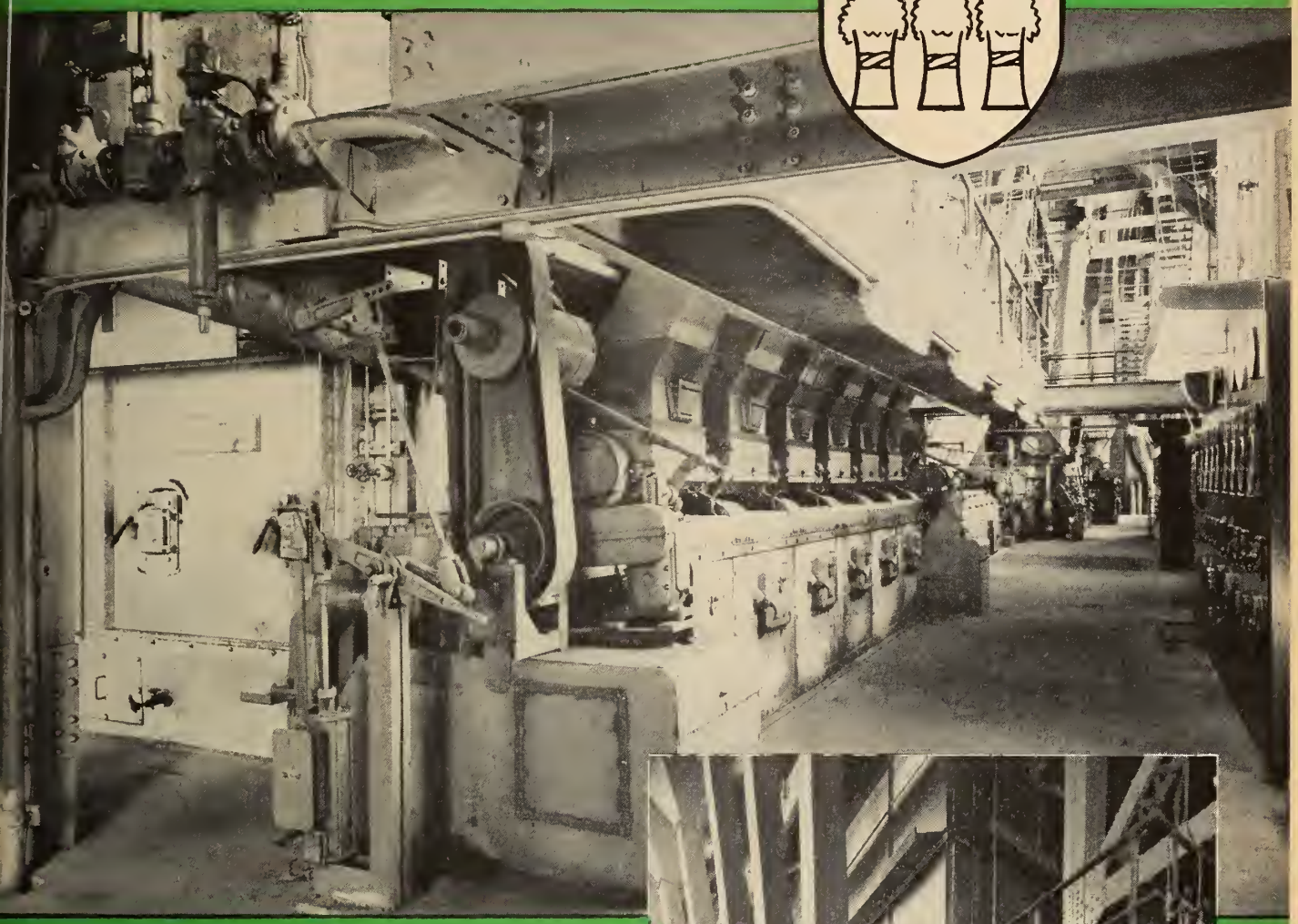
The Saskatchewan Power Corporation

SASKATOON PLANT

Depends on BABCOCK BOILERS



Four Babcock "Stirling" Boilers delivering a total steam capacity of 500,000 lbs./hr. are installed in this Saskatoon Plant.

Another "Babcock" Boiler is on order for this plant, designed for a normal steam capacity of 225,000 lbs./hr., and will also be equipped with a Babcock-Detroit Rotograte Stoker.

Babcock have supplied boilers to the Saskatchewan Power Corporation for over 20 years.

BABCOCK

STEAM FOR PROCESS • STEAM FOR POWER

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He was formerly with the department of mechanical engineering at Stanford University, California.

Mr. Landis graduated in 1945 in mechanical engineering from McGill University.

Lionel Issen, Jr.E.I.C., has joined the staff of the Pre-Compressed Concrete Engineering Company of Montreal.

He was formerly with the Canadian National Railways in Cochrane, Ontario.

Mr. Issen is a civil engineering graduate of McGill University, class of 1949.

P. M. Gillespie, Jr.E.I.C., has joined the staff of Piggott Construction Co. Ltd., Toronto. He worked previously with Sheldon Engineering Co. Ltd., Galt, Ont., and with the Dominion Textile Co. Ltd. at Montreal.

Mr. Gillespie received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1945.

Raymond Henry Whiteman, Jr.E.I.C., formerly with the National Research Council in Ottawa, has joined A. V. Roe (Canada) Limited in Malton, Ont., as design engineer.

Mr. Whiteman received his B.Sc. degree from Queen's University in 1945.

Kenneth Roland Fulton, Jr.E.I.C., is a site control engineer with Fraser-Brace Terminal Constructors in Saint John, N.B. He was previously with the County Construction Co. Ltd. in Charlottetown, P.E.I.

Mr. Fulton is a 1948 civil engineering graduate of the University of New Brunswick.

L. P. LeBlanc, Jr.E.I.C., is an assistant engineer with the Shawinigan Water and Power Company at Shawinigan Falls, Que. He entered the Company in 1951 and has just completed an 18-month training course.

Mr. LeBlanc is a graduate in electrical engineering from McGill University, class of 1951.

William M. Wilson, Jr.E.I.C., has accepted the position of plant engineer with Building Products Limited, Havelock, Ont.

He comes to his new post from British American Oil Co. Ltd., in Montreal.

Mr. Wilson graduated from McGill University in mining engineering in 1951.

O. C. Norris-Elye, Jr.E.I.C., has joined the staff of the Canadian General Electric Company in Peterborough, Ont.

He has been in the Royal Canadian Navy for the past year, serving on H.M.S. "Stadacona" in Halifax, N.S. Earlier, he was a design engineer with A. V. Roe (Canada) Limited, Malton, Ont., after graduating in electrical engineering from the University of Manitoba, class of 1950.

Charles S. Walker, Jr.E.I.C., is at present studying for a master's degree in business administration at the Graduate School of Business of Stanford University. His two-year course will be completed this year.

Mr. Walker graduated with a B.A.Sc. degree in electrical engineering from the University of British Columbia in 1951.

W. E. Dowbiggin, Jr.E.I.C., is process service representative of the Dominion Oxygen Company in Montreal. He was previously with Terrebonne Construction Inc.

Mr. Dowbiggin is a 1950 graduate of McGill University in mechanical engineering.

Wm. L. Johnson, Jr.E.I.C., is presently employed as mechanical engineer with the B.C. International Engineering Company in Vancouver, B.C.

Mr. Johnson graduated in mechanical engineering from the University of British Columbia in 1951.

A. Edgar Jones, Jr.E.I.C., is engaged as a structural design engineer with Pearson, Phillips and Barratt of Vancouver, B.C.

Mr. Jones is a 1951 civil engineering graduate from the University of British Columbia.

R. Burn, Jr.E.I.C., is assistant electrical engineer for the Central Region of Canadian National Railways.

Mr. Burn joined the Company as mechanical inspector in 1951 upon graduation from the University of Manitoba in electrical engineering.

A. E. Toole, Jr.E.I.C., is assistant resident engineer of the power plant area in the Nylon Intermediate Plant of Canadian Industries Limited in Maitland, Ont.

Mr. Toole is a graduate in mechanical engineering from Queen's University, class of 1951.

N. T. Chizik, Jr.E.I.C., is transitman with the Canadian Pacific Railway Company in Calgary, Alta.

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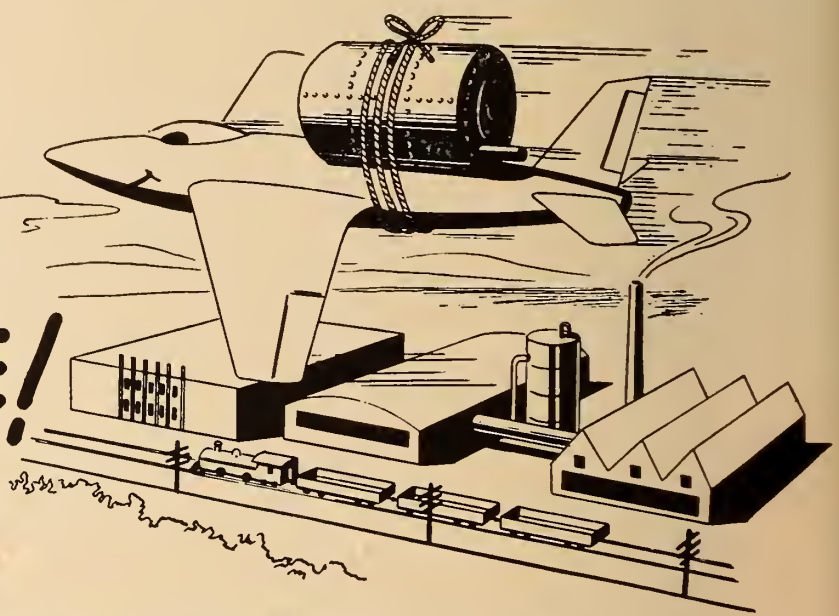

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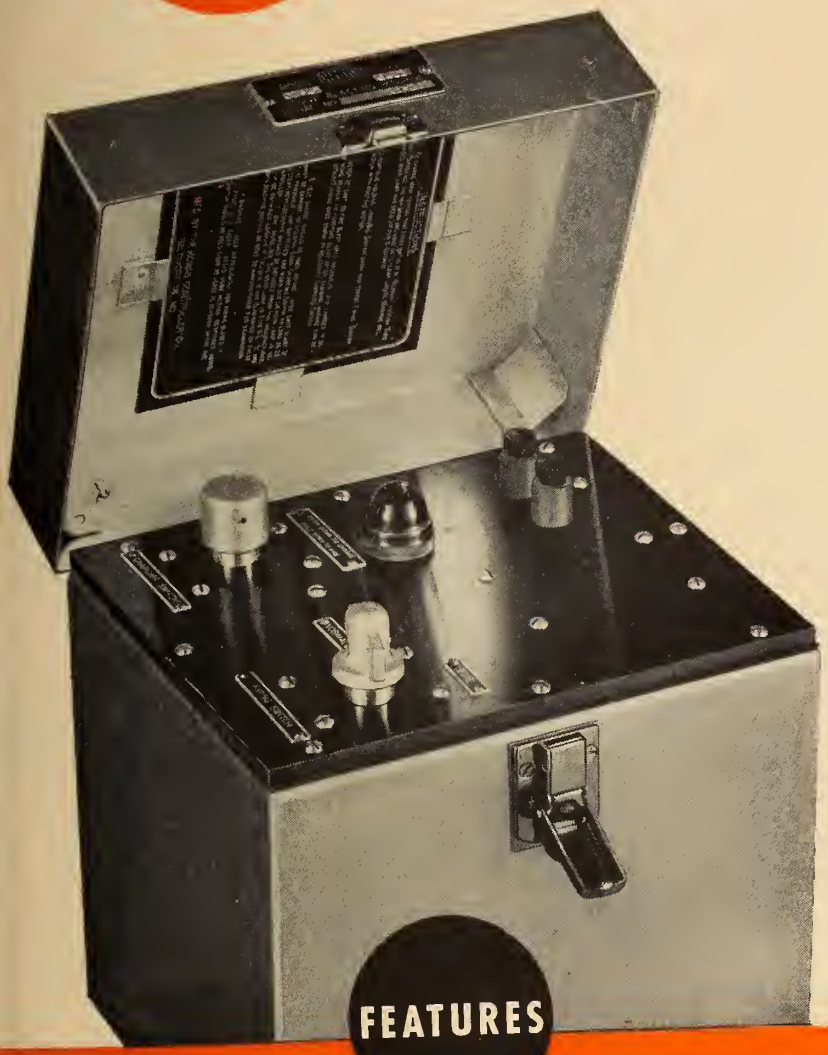
C-I-L ANNOUNCES

A New, Condenser Discharge Type

BLASTING MACHINE



Thoroughly tested and proven, the *CD-45 Blasting Machine* represents a new departure in design. It has a much higher capacity than previous machines on the market and accordingly is finding widespread application in mining and construction work where large numbers of caps are involved or where power current is not readily available for firing.

FEATURES

√ HIGH CAPACITY . . . 450 volts from a 1200 m.f.d. condenser, using long-lasting 90-volt dry cell batteries. Capable of firing up to 1000 E.B. Caps when connected in 25 series of 40 caps each.

√ EASY TO OPERATE . . . Current is generated with no moving parts and the output is not dependent on the physical effort of the operator. Charging switch is depressed until pilot light indicates the condensers are fully charged, then held down while a simple "flick" of the firing switch releases the charge to the blasting circuit.

√ SAFE . . . Designed to prevent current from reaching output terminals, except through *two-handed* operation of charging and firing switches, in proper sequence.

√ COMPACT . . . Complete unit measures 11 inches long, 9½ inches wide and 12 inches high.

√ PORTABLE . . . Enclosed in rugged, water-resistant, metal case; weighs 31 pounds.

Complete information about the *CD-45 Blasting Machine* may be obtained from your nearest C-I-L Explosives Division branch office or Canadian Industries Limited, Explosives Division, P.O. Box 10, Montreal.

"Everything for Blasting"

C-I-L EXPLOSIVES

SERVING CANADIANS THROUGH CHEMISTRY

CANADIAN INDUSTRIES LIMITED

He is a 1951 graduate in civil engineering from the University of British Columbia.

Wm. J. Roy, JR.E.I.C., is employed in the engineering department of the City of Lethbridge, Alta.

Mr. Roy graduated in civil engineering from the University of British Columbia in 1951.

Olar Dodson, JR.E.I.C., is a field engineer with Foundation Company Limited in Toronto.

He is a 1951 civil engineering graduate of the University of Toronto.

H. A. Baragar, JR.E.I.C., is a partner with his father in the firm of E. A. Baragar & Son, road construction contractors in Elm Creek, Man.

Mr. Baragar is a graduate of the University of Manitoba in civil engineering, class of 1950.

Capt. H. E. R. Colyer, R.C.E., JR.E.I.C., is second in command and training officer of Military Training Squadron at the Royal Canadian School of Military Engineering at Chilliwack, B.C.

Capt. Colyer is a 1951 graduate in civil engineering from the Nova Scotia Technical College.

K. A. Mellish, JR.E.I.C., is now located in Truro, N.S., as assistant engineer for the Nova Scotia-Prince Edward Island District of the Public Health Engineering Division of the Department of National Health and Welfare.

Mr. Mellish is a graduate in civil engineering from the University of New Brunswick, class of 1950.

Norman J. Olsen, JR.E.I.C., is employed by the Canadian National Railways as mechanical engineer in the mechanical department in Montreal.

Mr. Olsen is a graduate in mechanical engineering from McGill University, class of 1951.

J. Gieysztor, JR.E.I.C., formerly with the engineering department of Montreal Locomotive Works Ltd., has joined Canadian Fairbanks-Morse Co. Ltd., Montreal, as mechanical engineer in the diesel engine, pump and electrical equipment division.

Thos. B. Macaulay, JR.E.I.C., is on the staff of the McGill University Gas Dynamic Laboratory at Macdonald College, Que. He was previously associated with A. V. Roe (Canada) Limited, at Nobel, Ont.

Mr. Macaulay is a 1951 graduate in mechanical engineering from McGill University.

William Albert Vallance, JR.E.I.C., has joined the staff of Ford Motor Company of Canada Limited in Windsor, Ont.

Previous to this appointment Mr. Vallance was engineering assistant to the mechanical maintenance supervisor of Canadian Industries Limited in Brownsburg, Que.

Mr. Vallance graduated in mechanical engineering in 1949 from Queen's University.

Wm. George Gerry, JR.E.I.C., has completed the academic requirements for his M.Sc. degree from the civil department of Colorado A. & M. College, majoring in hydraulics and irrigation.

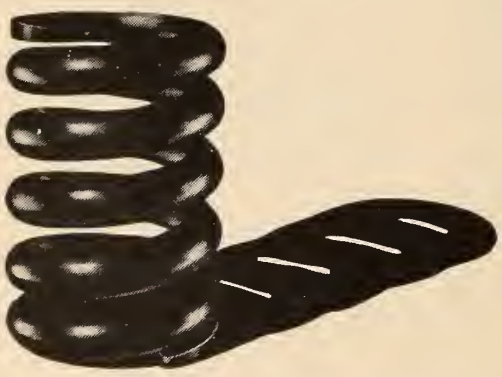
He is at present on the engineering staff of Burns & McDonnell, consulting engineers, and is employed in the hydraulic and sanitary department.

Mr. Gerry is a 1951 graduate of the University of Toronto in mechanical engineering.

Earle G. Bennett, JR.E.I.C., has been appointed to the staff of the sales department of English Electric Company of Canada Limited, Ottawa. He will be working with Mr. Watt in the Ottawa office.

Mr. Bennett graduated in electrical engineering from the University of Brit-

E. G. Bennett, JR.E.I.C.



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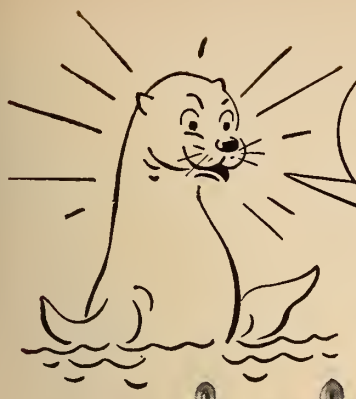

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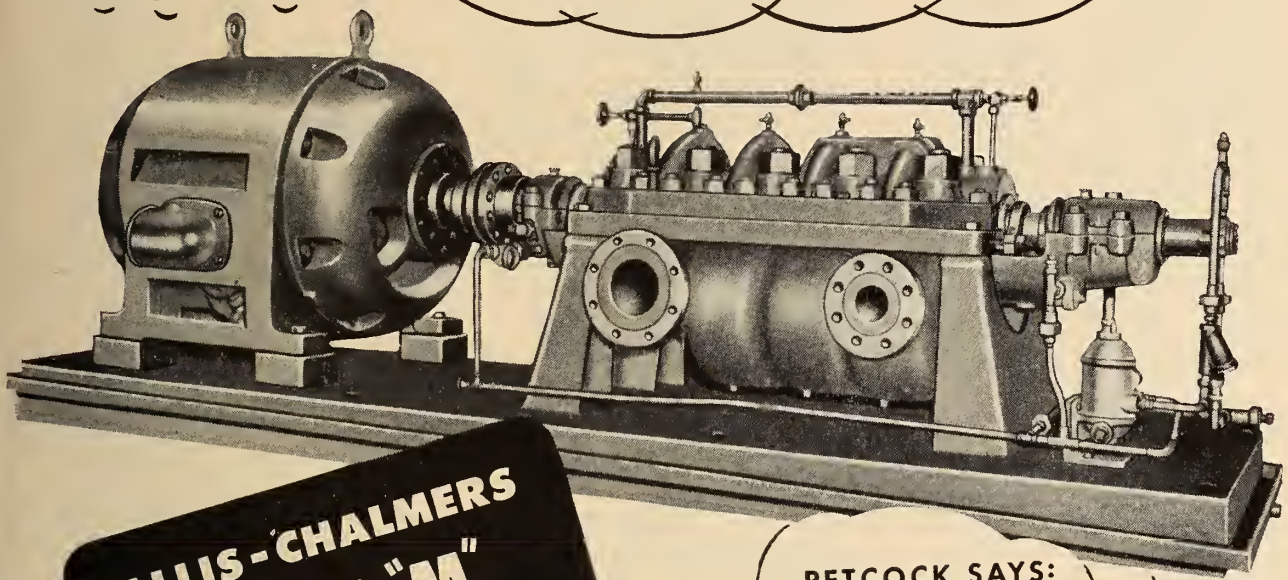

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Multi-Stage Pumps

PETCOCK SAYS:
"They're designed to meet your specific needs."

DESIGNED FOR CONTINUOUS SERVICE—that's what so many users are discovering about Type M pumps. Today, more and more industries are relying on Allis-Chalmers Multi-stage Pumps for high pressure mine service, boiler feed service, bulk storage transfer, or oil refinery service. Type M pumps give you maximum dependability, maximum economy and minimum outage with sustained high pressure pumping. Check these "extra" features which reduce costly down-time:

- **End thrust eliminated by double suction impellers—special thrust balancing devices unnecessary.**
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- **Equalized low stuffing box pressure reduces packing maintenance.**

For high temperature service—water cooled stuffing boxes are supplied. In addition, ring oiled ball bearings with water jacketed housing, mechanical seals, smothering glands, forced oil lubrication with cooler, ball, sleeve or Kingsbury bearings are provided when required.
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CANADIAN ALLIS-CHALMERS

ish Columbia in 1950. After completing the graduate training course in England, he returned to work with the Company in Canada.

R. W. Lockie, Jr.E.I.C., has been appointed to head office sales on rotating equipment and control, for English Electric Company of Canada Limited, St. Catharines, Ont.

R. W. Lockie, Jr.E.I.C.

Graduating in mechanical engineering from the University of British Columbia in 1950, Mr. Lockie completed the two-year graduate apprenticeship course in England.

Gerald G. Lantz, Jr.E.I.C., has been appointed to the staff of the sales department of English Electric Company of Canada Limited.

After graduating in electrical engineering from the Nova Scotia Technical College in 1946, Mr. Lantz completed the Canadian General Electric Company training course.

G. G. Lantz, Jr.E.I.C.

He was employed by the Hydro-Electric Power Commission and later joined Canadian Brazilian Services, recently completing a three-year term in Brazil.

After a training period in St. Catharines, Mr. Lantz will be located in the Toronto office.

W. D. McEwen, Jr.E.I.C., has been appointed to the sales department of

W. D. McEwen, Jr.E.I.C.

English Electric Company of Canada Limited.

Mr. McEwen graduated in mechanical engineering from the University of British Columbia in 1950 and has completed the English training course.

He will assist the manager of central station sales in the handling of propositions on hydro-electric equipment.

Guy Lacroix, Jr.E.I.C., has been appointed to the sales staff of English Electric Company of Canada Limited.

Guy Lacroix, Jr.E.I.C.

After graduating in electrical engineering from Laval University in 1950, Mr. Lacroix completed the St. Catharines training course and is now in general sales work in the Montreal office.

Malcolm E. MacDonald, Jr.E.I.C., has been on the staff of Doran, Turnbull and Price Ltd., consulting engineers in Saint John, N.B., since May, 1952.

Since graduation in civil engineering from the Nova Scotia Technical College in 1951, Mr. MacDonald has been associated with McNamara Construction Co. Ltd., Toronto, and with Halifax architect A. Edwin Priest, F.R.A.I.C.

During this latter period he completed the requirements for a diploma of architecture from the Nova Scotia Technical College.

B. Beaudoin, Jr.E.I.C., has been appointed Quebec City and district resident field engineer of Square D Company Canada Limited.

A graduate in electrical engineering from the University of Montreal in 1946, Mr. Beaudoin has been with the Square D Company for four years.

G. W. Flewelling, Jr.E.I.C., is employed as aeronautical engineering officer at Goose Bay, Labrador. He was previously engaged as the officer in charge of servicing at Dorval, Que.

Mr. Flewelling is a mechanical engineering graduate of McGill University, class of 1950.

E. E. MacEacheron, S.E.I.C., has joined the staff of The Bell Telephone Company of Canada as a plant engineer.

Mr. MacEacheron is a graduate of civil engineering from the Nova Scotia Technical College, class of 1952.

N. O'Brien, S.E.I.C., has joined the staff of Asbestos Corporation at Thetford Mines, Que.

Mr. O'Brien was previously with International Nickel Company Ltd., at Copper Cliff, Ont.

R. G. Hatton, S.E.I.C., has joined the sales department of Pilkington Glass Limited at Toronto.

Mr. Hatton is a 1952 graduate in mechanical engineering from the University of Manitoba.

John H. Taylor, S.E.I.C., is assistant utilities engineer at the Montreal East refinery of the Shell Oil Company.

Robert J. Cream, S.E.I.C., is board mill control chemist with the Donnacona Paper Company, Donnacona, Que.

Mr. Cream is a 1952 graduate of McGill University in chemical engineering.

Clark H. Smith, S.E.I.C., is now associated with International Petroleum Co. Ltd., in Talara, Peru.

Mr. Smith is a graduate in engineering physics from the University of Toronto, class of 1952.

Frank Berto, S.E.I.C., is now associated with the Lago Oil and Transport Company, Aruba, N.W.I., as a junior engineer. He was previously employed by the Vancouver Engineering Works Limited.

Mr. Berto graduated in mechanical engineering from the University of British Columbia in 1952.

Visitors to Headquarters

R. G. Huggett, Montreal, Quebec, January 20, 1953.

E. C. Orford, Jr.E.I.C., Vauxhall, Alberta, January 20, 1953.

W. C. Angevine, Jr.E.I.C., Halifax, Nova Scotia, January 26, 1953.

Kyung Mo Ahn, South Korea, January 29, 1953.

G. D. Sauer, M.E.I.C., Vancouver, British Columbia, January 29, 1953.

W. C. R. Jones, Prince Rupert, British Columbia, February 3, 1953.

D. S. Laidlaw, M.E.I.C., Ottawa, Ontario, February 3, 1953.

A. L. Swanson, M.E.I.C., Vancouver, British Columbia, February 9, 1953.

Neil Metcalf, M.E.I.C., Dundas, Ontario, February 12, 1953.

E. M. Rensaa, M.E.I.C., Edmonton, Alberta, February 23, 1953.

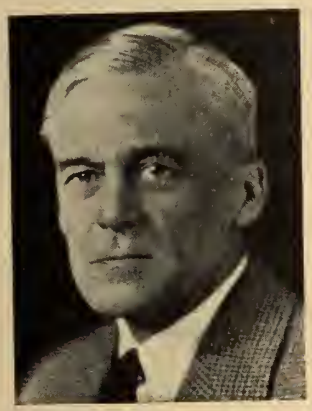
William J. Gall, Jr.E.I.C., Montreal, Quebec, February 25, 1953.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Grote Stirling, Hon.M.E.I.C.

Grote Stirling, former Minister of National Defence in the Conservative Cabinet, died in hospital at Kelowna, B.C., on January 18, 1953.



Grote Stirling, Hon.M.E.I.C.

He was born at Trunbridge Wells, England, in 1875. He received his early education at University College School, London, and graduated as a civil engineer from the Crystal Palace School of Engineering in 1895.

After graduation he was occupied for several years in railway work as assistant resident engineer and resident engineer with the Midland and Great Northern Joint Railways.

In 1907 he was engaged in private practice in Norfolk, England. He came to Canada four years later and settled in the Belgo district where he took up land and started an orchard. At that time he became resident engineer on the construction of the Black Mountain Water Company's main irrigation system at Kelowna, B.C., until 1913. He was engaged as consulting civil engineer in that part of the country for many years.

During his years in Kelowna, Mr. Stirling took an active part in community affairs, including a term as president of the Kelowna Board of Trade.

In 1924 he was chosen Conservative candidate to contest the federal constituency of Yale. He continued to represent this riding for 23 years. After the Conservative party swept the country in the 1930 general election, the leader of the party, the late Viscount Bennett, recognized Mr. Stirling's qualifications as a leader, and he was appointed Minister of National Defence and acting Minister of Fisheries. Although the Conservatives were swept out of office in the 1935 election, Mr. Stirling was personally returned to office by a large majority and he continued to hold the Yale seat until 1947 when he retired from active politics due to ill health.

During his term of office, his business, engineering and agricultural experience were put to use. He gave valuable counsel in the framing of legislation of prime importance to the country.

In 1901 he was elected an associate member of the Institution of Civil Engineers of Great Britain. Mr. Stirling was one of the earliest members of the Association of Professional Engineers of British Columbia, and in 1948 the association conferred on him an honorary life membership.

Mr. Stirling joined the Engineering Institute of Canada as a Member in 1927. Honorary membership was conferred on him in 1937.

Stewart Fleming Rutherford, M.E.I.C., of Montreal, who was prominent in engineering circles and public affairs, passed away suddenly on January 29, 1953.

Mr. Rutherford was born in Montreal in 1875 and received his education at the High School of Montreal and at McGill University where he gained his B.Sc. degree in 1896. After graduation he was engaged on the engineering staff of Canadian Pacific Railways as assistant engineer during the construction of the Crow's Nest Pass section. He later held positions with William Rutherford and Sons, and the Dominion Box and Packing Company.

Mr. Rutherford was vice-president and managing director of the Grier Timber Company until his retirement in 1946.

He served as an alderman in Westmount for 20 years and was a trustee of the Westmount Library.

He was honorary secretary of the Quebec Society of Professional Engineers, a commissioner of the Superior Court, and a commissioner of the Quebec Streams Commission, and a former member of the council of the Montreal Board of Trade.

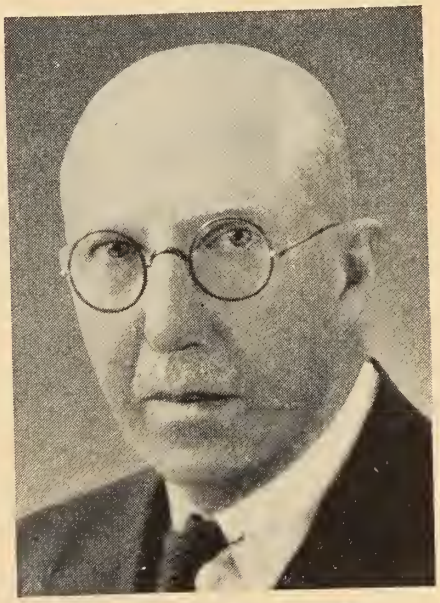
Mr. Rutherford joined the Engineering Institute as an Associate Member in 1899, transferring to Member in 1940.

Charles Harvey Wright, M.E.I.C., former Maritime district manager of Canadian General Electric Limited, and a prominent figure in professional and commercial life of Halifax, died in hospital after a brief illness on January 28, 1953.

He was born in Renfrew, Ont., in 1875. He graduated with a B.A.Sc. degree in electrical engineering from McGill University in 1896. His early post-graduate years were spent in the employ of the Renfrew Electric Company and the Royal Electric and Terminals Railways in Montreal.

He joined the engineering service department of the Canadian General Electric Company in 1900 and was engaged first in general installation work.

In 1906 he was transferred to the agency department, now the Apparatus Division, as sales engineer, a position he held until his appointment as district manager at Ottawa in 1907.



Charles Harvey Wright, M.E.I.C.

Mr. Wright went to Halifax in 1909 as district manager and retained that position until his retirement in 1945.

He was a past-president of the Association of Professional Engineers of

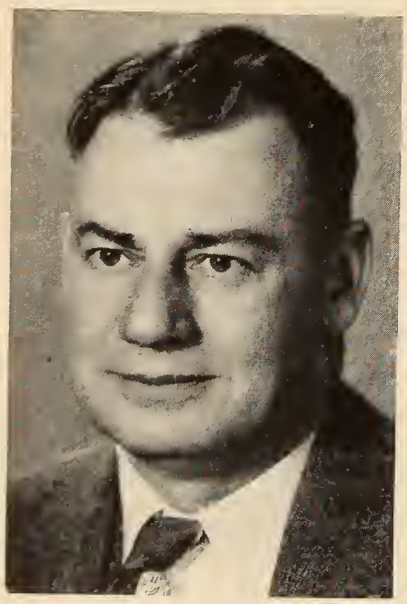
Nova Scotia. He was elected president of the Halifax Board of Trade in 1929 after serving for two years as vice-president. He was for a time councillor of the Canadian Chamber of Commerce.

Mr. Wright served as president of the Halifax Rotary Club, president of the McGill Graduate Society of Halifax, as vice-president of the Halifax Y.M.C.A., and also as vice-president of the Halifax Branch of the Canadian Institute of Public Affairs.

He joined the Engineering Institute of Canada as a Member in 1918. In 1949 he was granted life membership. Keenly interested in Institute affairs, Mr. Wright represented the Halifax Branch on the Council in 1926 and was also a chairman of that Branch.

Joseph Taylor Thwaites, M.E.I.C., manager of electronics research and development for Canadian Westinghouse Company Limited, died January 16, 1953, while en route from Montreal to Hamilton.

Mr. Thwaites was recognized as one of Canada's foremost electronic engi-



Joseph T. Thwaites, M.E.I.C.

neers. Noted for his work in radar, radio communications and industrial electronics, he was widely known on this continent and in Europe.

He was born in Bolton, Lancashire, England, in 1901 and came to Canada in 1905. He received his early education at Hamilton Collegiate Institute and entered Queen's University in 1921 where he gained his B.Sc. degree in engineering physics in 1925. He then undertook a two-year post-graduate course in electronics, and had the distinction of being the first to take such a course in Canada.

Before entering Queen's University, he was employed by Canadian Westinghouse Company Limited. In 1929 he resumed his association with this Company, entering the radio engineering department as assistant engineer. The following year he joined the switchgear division and served as a special products engineer until his appointment as division engineer in charge of electronics in 1939.

Between 1940 and 1943 he was instrumental in increasing the Canadian production of aluminum beyond all expectations during World War II by the use of ignitrons on a wholesale scale. He also carried out pioneer work on X-ray penetration of steel, part of the general program which led to X-ray inspection of welds and castings.

On loan to the U.S. War Department, and serving in the United Kingdom, Mr. Thwaites led in the development of high-frequency transmitting stations placed along the British coast to interfere with the V-2 rockets. These stations were responsible for sending many of the bombs off course, and toward the end for keeping many of them from reaching England.

When the device was tried and proved to be effective, Prime Minister Winston Churchill sent Mr. Thwaites a prearranged code telegram to inform him of the success of his work. The telegram's single word was "cigars".

His war-time service was recognized by the United States Government when he was presented with three certificates of appreciation. The first from the U.S. Office of Scientific Research and Development in 1945, and the second, in 1946, from the U.S. War Department. In 1948 he received the U.S. War Department and Navy Department certificate, becoming the first civilian so honoured by the U.S. Government.

While the full story behind these awards has not yet been fully told, it was known that Mr. Thwaites' work was one of the greatest significance and that the success of his efforts, and those of his co-workers was responsible for the Allied success against enemy radar and German V-2 rockets.

Mr. Thwaites was a member, and took an active part in many professional societies including the American Institute of Electrical Engineers, International Conference on Large Electric Systems, International Special Committee on Radio Interference, Canadian Standards Association, Canadian Radio Technical Planning Board, Canadian Radio-Television Manufacturers' Association, the Association of Professional Engineers of Ontario, Canadian Association of Physicists, and American Association for the Advancement of Science.

Mr. Thwaites joined the Engineering Institute as a Student in 1924 and transferred to Junior in 1928. He became an Associate Member in 1939 and transferred to Member in 1940.

Edward McKinney Nason, M.E.I.C., district engineer in the public health engineering division of the Department of National Health and Welfare at Moncton, N.B., died on January 6, 1953.

Mr. Nason was born at Welsford, N.B. in 1912. He entered the Saint John Vocational School in 1928 and graduated in two courses in 1932. He received his B.Sc. degree in civil engineering from the University of New Brunswick in 1936 and his M.Sc. degree from the same university in 1950.

He served as instrument man and assistant engineer in charge of highway

Edward M. Nason, M.E.I.C.

construction for the Department of Public Works of New Brunswick for three years. In 1940 he was employed with the R.C.A.F. Eastern Air Command on construction at Moncton, and at Boundary Bay, B.C. He later worked with the Department of Transport, Air Services in the Moncton Branch; and with the Canadian Pacific Railway at Fredericton, N.B.

In 1945 Mr. Nason was appointed assistant city engineer of St. Catharines, Ont., and two years later joined the staff of the City of Saint John where he was appointed director of works. He later became town engineer for Bridgewater, N.S. In 1949 he joined the public health engineering division of the Department of National Health and Welfare in Moncton, N.B., where he served as district engineer for New Brunswick, Newfoundland, and the Gaspe Coast of Quebec below Rimouski.

Mr. Nason was an active member of the New Brunswick Rifle Association and was the winner of several trophies with the New Brunswick team at the Dominion Rifle Meet held annually at Ottawa.

He was an enthusiastic member of the Engineering Institute and was appointed chairman of the Moncton Branch in 1951. He joined the Institute as a Student in 1936, transferring to Junior in 1940, and to Member in 1942.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

TWO CANADIAN GRADUATES in Chemical Engineering required by organization in Ontario. Primarily interested in 1952 graduates with interest in process and supervisory work. Salary depends on qualifications. File No. 4501-V.

GRADUATE ENGINEER required in Quebec city to be employed in air-conditioning and refrigeration department. Applicant must be bilingual and conversant with the application, selection, sales, administration and service of such equipment and to act as manager of the department. Salary is open depending on the experience and capabilities of the applicant. Age range between 27 to 40 years of age. File No. 4509-V.

CIVIL

CIVIL ENGINEER required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

STRUCTURAL DESIGN ENGINEERS, an assistant chief engineer and a design engineer are required for a recently organized bridge design section of a Government department which is to be responsible for the complete design and construction of a number of special bridge projects. Applicants must be graduates in engineering from a university of recognized standing with a number of years of experience in the design and construction of engineering structures, particularly bridges of all types in both reinforced concrete and steel. Please state experience, references and salary expected. Application forms which may be obtained from Post Offices in major cities, district offices of the Civil Service Commission, University Placement Bureaus and offices of the National Employment Service, should be filed with the Civil Service Commission, Ottawa, not later than March 20, 1953. File No. 4506-V.

ELECTRICAL

ELECTRICAL ENGINEERS required by large organization with head offices in Montreal. Applicants should be electrical engineers, who are preferably air force veterans about 30 years of age. Duties include the supervision of the installation and maintenance of specialized equipment in RCAF aircraft, and also the instruction of air crews. Candidates must be free to travel. Salary will be negotiated on the basis of experience and qualifications. File No. 4491-V.

A LARGE PUBLIC organization requires a design engineer with an electrical engineering degree, or its equivalent plus at least three years or more practical experience in electrical construction work, and preferably training with a contractor. Duties would be design and layout of electrical power and lighting circuits, equipment, substations, etc. Salary dependent on experience. Location Toronto. Applicants are requested to apply in their own handwriting. File No. 4507-V.

MECHANICAL ENGINEER required for the position of service supervisor. Applicant must have at least 5 years experience on or associated with steam power house equipment particularly boilers, have a good personality and be capable of meeting people and possess the ability to organize and operate a service department. The work will be chiefly in the Head Office in Ontario, but will entail travelling. Salary open. File No. 4497-V.

MECHANICAL ENGINEER for plant engineering department in Montreal. Candidates should be recent graduates with approximately two years experience in mechanical maintenance field. Initiative and mature judgment are, of course, requisites. Duties would involve design, planning and estimating. File No. 4499-V.

MISCELLANEOUS

ESTIMATOR FOR SPECIAL machine tools, fixtures, dies, etc. Position requires a knowledge of design and modern production methods. Location Western Ontario. File No. 4490-V.

THE RESEARCH COUNCIL of Alberta requires an industrial engineer, preferably with mechanical or metallurgical experience, to assist in making industrial surveys, to prepare reports on processes and developments and to provide liaison between science and industry. Position available immediately. The salary will depend on academic attainments and experience. File No. 4492-V.

ELECTRICAL ENGINEERS or physicists with an interest or experience in radar or electronics required by leading electronic organization located in Southern California. After successful training periods applicants would become Canadian representatives with Canadian companies where equipment is being installed. Applicants should be under thirty-five years of age, a Canadian citizen. Write giving full resume of experience, etc. File No. 4493-V.

RUBBER CHEMIST required by progressive manufacturer of rubber footwear has an opening for a rubber chemist experienced in compounding development and process control. Must have complete knowledge of formulating compounds, factory processing and laboratory control. Should be able to express himself in French. Salary commensurate with experience. File No. 4494-V.

JUNIOR ENGINEER required in Montreal by manufacturer of plumbing and heating materials to work in the estimating department. File No. 4495-V.

ENGINEER REQUIRED for intermediate position in Ontario by organization with head offices in Montreal. Applicant should have some experience in time study and have good engineering background. File No. 4495-V.

AIR CONDITIONING AND refrigeration engineer required by Canadian representative for outstanding line of American equipment, to carry out engineering sales work in Ontario and Quebec. Applicant must have several years experience in this or related field and have successful sales record. File No. 4496-V.

ENGINEER REQUIRED by manufacturer located in Ontario for estimating and scheduling department. Applicant must have experience in the field of mechanical assembly and/or architectural drawing, practical shop and some general contracting experience, estimating experience is very desirable. Age 30 to 40. The starting salary would be commensurate with the man's experience. File No. 4498-V.

SUPERVISOR REQUIRED for a large Western Canadian Warehouse containing varied types of merchandise as well as workshop and assembly areas. Quali-

CHIEF ENGINEER

A well-established Western Canadian organization, engaged in both the repair of R.C.A.F. aircraft and industrial manufacturing, wishes to enlarge its operation in the sheet metal, plate work and mechanical fields, particularly with regard to fabrication equipment for the petroleum and petro-chemical industry. A chief engineer with proven record of extensive experience in one of the following fields is required to head the Industrial Engineering Department: structural steel, sheet metal, plate work, pressure vessels, boilers, heat exchangers or mechanical equipment.

Responsibilities will include the supervision of the development, design and costing of articles manufactured by the Industrial Division.

Good salary offered to right man.

File No. 4503-V.

fications: age preferably 30 to 40, education, University degree with emphasis on engineering. Must have had at least five years of supervisory experience and must know how to deal with people. Prefer someone with experience in bulk handling methods. Salary will be in accordance with qualifications. File No. 4500-V.

SURVEYOR WANTED FOR Labrador-Ungava area with experience in transmission line surveying and knowledge of spans and structural location spotting. Applicants should give full details including age, education, experience, marital status and salary requirement. File No. 4502-V.

CHIEF ENGINEER required by a well established Western Canadian organization, engaged in both the repair of R.C.A.F. aircraft and industrial manufacturing wishes to enlarge its operation in the sheet metal, plate work, and mechanical fields, particularly with regard to fabricating equipment for the petroleum and petro-chemical industry. A chief engineer with proven record of extensive experience in one of the following fields is required to head the industrial engineering department: structural steel, sheet metal, plate work, pressure vessels, boilers, heat exchangers or mechanical equipment. File No. 4503-V.

INSTRUMENT ENGINEER required with university degree in engineering. Experience in instrument work a requirement. Preference given to engineers with refinery experience. This is an excellent opportunity with a progressive and expanding oil company located in Western Ontario. Reply giving details of education, experience and background. File No. 4505-V.

CHEMICAL SALES ENGINEER required to work in Central Ontario. Employment would be employed in marine department this season and would work from Toronto to Port Colborne and would be eventually taken into industrial department. File No. 4508-V.

CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS with industrial plant design experience for employment on the following: structural design, architectural details and layouts. Electrical design on power distribution, lighting and production equipment controls, mechanical design on production and foundry equipment, piping, heating and ventilation. Location Ontario. File No. 4510-V.

INSTRUMENT ENGINEER REQUIRED by large firm of consulting engineers in Montreal. Must have several years experience on interpretation of flow sheets, flaw calculations, industrial measuring and control instruments. File No. 4511-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

SALES ENGINEER required to establish an Edmonton Branch Office for a well-known Canadian industrial company handling boiler water treatment, combustion controls and industrial instruments. Applicant should have sound knowledge of chemistry, so as to be capable of being trained in its application to boiler water conditioning and should preferably be acquainted with boiler instruments and controls. Territory to be covered is Alberta, Saskatchewan, and N.W.T. This position will be permanent, and on a salary basis. State sales experience and qualifications. File No. 4442-V.

CHEMIST OR CHEMICAL ENGINEER experienced in compounding and laboratory testing of rubber goods, particularly along mechanical lines. Location Province of Quebec. File No. 4470-V.

CHEMICAL ENGINEER required in province of Quebec for designing process services, plant layout and supervising equipment installations. Accommodation available. File No. 4471-V.

CIVIL

YOUNG GRADUATE CIVIL ENGINEER for position of transitman on a railway division in P.Q. Commencement salary $306.00. Increases according to service and experience. File No. 4366-V.

GRADUATE CIVIL ENGINEERS required with a minimum of five years experience in the heavy construction industry, some with field experience. Work consists of the following, project liaison, progress scheduling, quantity take-off or requisitioning. Salary ranges from $400.00 to $600.00 per month. File No. 4443-V.

CIVIL ENGINEERS required, field engineers of all types, construction superintendents, assistant superintendents and engineering administrative personnel on all levels. File No. 4443-V.

CONSTRUCTION ENGINEER required as department manager for expanding construction firm in Alberta. Must have field experience in concrete work. Unlimited opportunity. Give all qualifications and remuneration expected. File No. 4467-V.

ENGINEER REQUIRED by city located in Western Canada to perform traffic studies and to design highway parking systems. Qualifications: degree in Civil engineering with considerable experience. Preferably experience in highway and traffic problems or the equivalent. Salary $357.00 to $428.00 per month. File No. 4468-V.

CIVIL ENGINEER required by organization in P.Q. Experience in reinforced concrete, building and structural steel design, age about 30, housing available. File No. 4471-V.

CIVIL SERVICE (FEDERAL) requires civil engineer (construction) and an electrical engineer (power and lighting) at salaries depending upon qualifications of applicants, for the Department of National Defence at Ottawa. Many years experience in related fields required. File No. 4477-V.

ELECTRICAL

ELECTRICAL ENGINEERING graduate for established manufacturer of electrical signalling equipment located in Ontario. Sickness and accident insurance plan, pension plan, five day week, pleasant surroundings. This man should be capable of engineering work involving design and manufacturing problems, engineering correspondence, and preparation of instruction manuals. File No. 4444-V.

ELECTRICAL ENGINEERS with experience in communications and television system engineering required by a large organization in Montreal. Salary commensurate with ability and experience. File No. 4447-V.

A LEADING ELECTRONICS manufacturing firm, located in Montreal has an exceptional opportunity for an electrical engineer (or equivalent training) who has had several years of practical experience in the design and manufacture of small transformers and other radio receiver components. This position has unusual immediate and long-term prospects. Only fully-qualified engineers will be considered. File No. 4460-V.

ELECTRICAL SALES ENGINEER required by manufacturer located in Hamilton, Ontario. of electric motors to cover Province of Quebec. Applicant must be bilingual. File No. 4472-V.

ASSOCIATE PROFESSOR electrical engineering, duties: to instruct undergraduate students and develop post-graduate work. Time and facilities for research. Qualifications: university graduate, preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Location Halifax, N.S. File No. 4475-V.

ELECTRICAL ENGINEER required by firm of architects in Edmonton. Applicant should be qualified to handle all electrical design. Good salary offered. File No. 4481-V.

JUNIOR ELECTRICAL ENGINEERS required in the signalling department of Canadian railway. Work is related to the entire field of railway signalling including design, installation, maintenance, repair and inspection. File No. 4485-V.

MECHANICAL

GRADUATE MECHANICAL ENGINEER required by well established Canadian manufacturer. An excellent opportunity for young graduate engineer to train as sales engineer. Apply stating age, name of university and scholastic attainment to File No. 4392-V.

MECHANICAL ENGINEER required for plant engineering department of medium size manufacturer. Duties include design and installation of new equipment, improvement and modification of existing equipment, constructional engineering and project cost estimates. Southern Ontario town. File No. 4440-V.

MECHANICAL ENGINEER required by large organization in Montreal. Duties include supervision of construction and building facilities with general mechanical problems involved. Age range 30 years. File No. 4449-V.

REFRIGERATION ENGINEER required by large manufacturer of home appliances in Montreal to do design and development work on refrigerator units. Applicant should have at least three years experience in domestic refrigerator unit engineering, and be able to carry out the work with a minimum of supervision. Graduate in mechanical

WAREHOUSE SUPERVISOR

WE REQUIRE A SUPERVISOR for a large Western Canadian Warehouse containing varied types of merchandise as well as workshop and assembly areas:

QUALIFICATIONS:

Age: preferably 30 to 40.

Education: University degree with emphasis on Engineering. This is not essential if made up for by equivalent experience.

Business Experience: Must have had at least five years of supervisory experience and must know how to deal with people. We prefer someone with experience in bulk handling methods.

Salary: Will be in accordance with qualifications.

Please apply to File No. 4500, giving details of experience and history. All replies will be treated as confidential.

engineering preferred, age 25 to 40 years, salary according to qualifications. File No. 4454-V.

MECHANICAL ENGINEER required by organization manufacturing small automotive pistons and aircraft components located near Montreal. Duties include production on design. File No. 4465-V.

JUNIOR TOOL AND DIE designer required by pulp and paper industry in Province of Quebec. Applicant must also be able to do construction drawings, also maintenance of plant engineering records and various detailed reports. Job also covered by group insurance and pension plan. File No. 4469-V.

MECHANICAL ENGINEER required by firm of architects in Edmonton. Applicant must be able to handle all heating and plumbing design. Good salary offered to applicant with experience. File No. 4481-V.

STEAM PLANT ENGINEER required for large Newfoundland paper mill. Essential requirements: 1st class British Board of Trade Marine engineers certificate, sound mechanical training, preferably with experience in paper or pulp mill, experience with high pressure boilers and turbines. Age limit 45 years. Attractive salary and good working conditions. Other detailed information available on application. File No. 4483-V.

SALES ENGINEER preferably mechanical to work in Montreal district for manufacturer of compressed gases, equipment and supplies for welding operations. Bilingual preferred but not essential. Age 25 to 40 years. File No. 4487-V.

MISCELLANEOUS

DESIGN AND FIELD ENGINEERS required by a firm of engineers and builders specializing in prestressed and precast concrete throughout Canada. Several years experience in reinforced concrete is required. Position offers salary, participation in company hospitalization and pension plans and eventual bonus. Applicants should give full details including age, education, experience, marital status, salary requirements. Personnel interview will be arranged with selected applicants. File No. 4436-V.

ENGINEERING SALES POSITION available in promotion of original and maintenance equipment used in mines, paper mills and heavy industry. Company operating in Northern and North Western Ontario and north western Quebec. Progressive training for suitable applicant. Mechanical maintenance or mill experience desirable. Submit record of education, experience with reference and photograph. File No. 4437-V.

SALES ENGINEER required to sell rust preventatives, cuttings oils and drawing compounds for Canadian manufacturer to large industrial accounts. Chemical or mechanical engineer preferred with some industrial experience, but this is not essential. Guaranteed salary and expenses with profit sharing arrangement. Our employees have been advised of this ad. File No. 4439-V.

IRON MINE MANAGER required. Open pit iron mine in production requires competent manager capable of increasing production, improving mill operations and shipments. Reply stating qualifications, record of employment and starting salary. Outstanding opportunity. File No. 4441-V.

DESIGN ENGINEER or senior mechanical draughtsman required by manufacturer in Ontario of pipe and bolt threading machinery. File No. 4445-V.

APPLICATIONS ARE INVITED for the position of Town Engineer for a rapidly expanding town in Ontario. Present population approximately 3,500. Applicants must have practical experience in the supervision of construction and maintenance of waterworks, sewers, roads and sidewalks. Age, experience, references and salary expected must be included in applications. File No. 4446-V.

SENIOR ESTIMATOR required to join a growing concern that offers excellent opportunity. Applicant should be able to take off quantities accurately and have pricing and general contractor's office routine experience. Salary commensurate with experience and ability. File No. 4448-V.

MECHANICAL OR MINING ENGINEER, recent graduate required as plant engineer in Ontario, for organization with head offices in Montreal. Age 25 to 30 years. Salary range $350.00. File No. 4450-V.

TWO METALLURGISTS, recent graduates, to undergo training in production methods of large organization. Location, short distance from Montreal. File No. 4451-V.

TECHNICAL REPRESENTATIVE required. Applicant must be Canadian by birth or of British origin and familiar with Canada as the result of 5 or 6 years residence with University degree in engineering. Good general engineering experience, experience of diesel engines and/or heavy earth moving desirable but not essential. Age 30 to 35 years. Personality is of great importance. Future prospects in view of the stability of the company are excellent. File No. 4453-V.

INDUSTRIAL ENGINEER required by large container manufacturing firm in Montreal. Applicant should have experience in development, overhead and operating labour standards, time study, job evaluation, cost reduction, etc. Personality and ability to deal with people important. This company is expanding in Canada and the opening holds definite future opportunity. Man under 30 preferred. File No. 4455-V.

PETROLEUM ENGINEER for the Saskatchewan petroleum industry. Salary $273.00 to $348.00 per month. A variable cost of living bonus is paid in addition to the above stated basic salary. Current cost of living bonus is $9.60 per month. To perform research work, involving field activities on gas and oil reserves. Require university graduate in related field such as geologist, petroleum chemical or mechanical engineer. Position will be filled as soon as a suitable applicant is obtained. File No. 4456-V.

TWO SALES ENGINEERS, civil or mechanical, to sell road machinery in Northern and Eastern Ontario. Preferably married. Age 30 to 35 years. Apply by letter with full particulars as to education, military service, sales experience, etc. File No. 4457-V.

INDUSTRIAL ENGINEER, preferably bilingual, with good knowledge of accounting. File No. 4458-V.

LARGE MULTIPLANT company has an important administrative position open

for a graduate engineer. The scope of the position embraces the design, upkeep and improvement of manufacturing units engaged in the casting and machining of brass, iron and steel components with mass production foundry equipment and machine tools. The responsibilities of the position includes the direction and efficient operation of the engineering forces at the various plants located across Canada. Salary open. File No. 4459-V.

ESTIMATOR REQUIRED for all types of construction in the commercial institutional and industrial field. Location, Hamilton area, medium size construction company. Applicant must have had experience in these fields. File No. 4461-V.

GRADUATE ENGINEER member of association of provincial engineers of P.Q., required to act as field engineer. Applicant should be bilingual 25 to 35 years of age, of direct sales contact type with good personality and personal background and owner of serviceable car. Experience of one year minimum selling technical products to industry. To be sole contact for technical sales of premium quality industrial power transmission V belting and drives, full range of specialized industrial hose and other mechanical rubber goods. Territory Montreal and other main trading areas of the Province of Quebec. File No. 4462-V.

MECHANICAL OR CIVIL ENGINEER required by large automotive industry in Ontario to act as process engineer. Duties include the preparation of packaging specifications, including materials for rust and damage protection for unit and immediate packs of vehicle components to be shipped to overseas territories to investigate complaints from overseas territories, recommend corrective action, institute experimental packs, request out-turn reports. File No. 4464-V.

MECHANICAL AND CIVIL ENGINEERS wanted for a large pulp and paper organization located in Quebec City. Applicants should have one to three years experience in pulp and paper mills or allied industry. File No. 4466-V.

ENGINEER REQUIRED by large departmental store in Montreal to act as maintenance engineer. Applicant should be graduate mechanical or electrical engineer with about 5 years experience. He should also be capable of designing and supervising any alterations necessary. File No. 4473-V.

MINING OR METALLURGICAL ENGINEER required by Montreal sales office. Applicant should be 25 to 30 years with preferably milling experience to act as assistant manager of the department. File No. 4474-V.

SUPERINTENDENT REQUIRED FOR natural gas department by Western Canadian Power Corporaiton to assist in setting up a provincial gas utility. Experience in actual operation of collection, transmission and distribution systems, with particular reference to rates and customer acquisition and relations important. Excellent superannuation plan, sick leave with pay and other fringe benefits. Salary $5,000 to $8,000 per year commensurate with experience and responsibility. File No. 4484-V.

Situations Wanted

CIVIL AND SANITARY ENGINEER, Jr.E.I.C., P.Eng., B.Sc., Queen's 1948, M.A.Sc., Toronto 1949. Age 28, single. Presently employed as municipal engineer with 5 years experience on design and construction of waterworks systems, sewer systems, reinforced concrete structures, road construction and pavements. Have extensive experience in planning and estimating and also on administration. Seeking a more progressive position as design engineer or on construction where opportunity exists to apply past advanced technical training and experience to the job. Prefer to locate in Vancouver, Montreal or Toronto but not governing if suitable position is offered elsewhere. Available on reasonable notice to present employer. File No. 250-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1947 graduate with additional university training in psychology, guidance and counselling; also short factory courses in foremanship, methods and human relations. Age 26, married. Over two years in chemical industry on process development and plant engineering. One summer as temporary assistant engineer on oil refinery expansion. Presently employed as a technical instructor. Available in July. Location preference Western Canada or Ontario. File No. 1014-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., B.A., B.Sc., age 37, married, two children, veteran, R.C.E. bilingual. Experience in concrete and steel design, supervision of construction. Sales ability. Looking for an opening on fee plus percentage basis in the sale of structural steel, reinforcing steel, structural steel products or products related to cement. Location central or eastern preferred. File No. 2140-W.

PROFESSIONAL ENGINEER and land surveyor, M.E.I.C., available. Experience includes steel plant layout and construction, power houses, large office buildings, mine surveying, land surveying with considerable office experience in draughting and estimating. File No. 2153-W.

PROFESSIONAL ENGINEER, qualifications grade VI. Experience heavy machine shop manufacturing, field erection of machinery and general industrial construction. Available immediately, on full time, part-time or job basis. File No. 2526-W.

ENGINEERING REPRESENTATIVE for Canadian territory available. Interested in sales, installation and maintenance in the fields of instrumentation and electronic control equipment. Graduate in electrical engineering from large Canadian university, diversified experience, multilingual. Considerable travel experience. Member of Engineering Institute of Canada, Institute of Radio engineer, age 39, married. Willing to undergo short company training program. File No. 2635-W.

MECHANICAL ENGINEER, Sask. '46, Jr. E.I.C., P.Eng. (Que.), with some experience in design of steel and reinforced concrete structures desires a position with consulting engineers. Experience since graduation includes 18 months drafting in plant expansion programme, 3½ years on project work for plant expansion and modernization and 18 months on plant maintenance and new equipment installation. The last two positions are with the same firm. File No. 2909-W.

MECHANICAL ENGINEER, P.Eng., 9 years industrial experience in staff and supervisory positions in production, maintenance, and plant engineering. Wage incentives, contract estimating and control for manufacture of heavy equipment, methods study, production eng., purchasing, for volume production. Sound business background. Desire plant or production management or technical sales. Presently employed. File No. 2920-W.

CIVIL ENGINEER, Jr.E.I.C., married, presently employed, with 5 years experience in all types of structural design, field work and sales, desire first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to future partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

CIVIL ENGINEER, M.E.I.C., professional engineer, age 48. 10 years experience railway and highway construction, 10 years as sales and service manager large eastern electric, gas and transportation utility. 5 years experience ship construction. Presently employed but available on two weeks notice. Seeking permanent position where technical skill, knowledge of handling men and public relations experience would be of value. File No. 3057-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., (McGill 1949) B.Sc. 1947, age 25, married. 3 years experience as a structural designer, mostly on bridges. Experienced in reinforced concrete, steel, and timber design. Desires position with future anywhere in Canada where design experience will be an asset. Presently employed in the Maritimes. Available on approximately one month's notice. Box No. 3097-W.

PRODUCTION EXECUTIVE, P.Eng., M.E.I.C., B.A.Sc., age 43, family. Extensive production and manufacturing experience in Canada and United Kingdom in variety of industries in senior management positions. Proven administrator and organizer with outstanding drive and energy. Interested in establishing connection with medium to large sized concern in which ability to organize and produce can be utilized Montreal area preferred but will locate anywhere depending upon proposition. File No. 3138-W.

CIVIL ENGINEER, M.E.I.C., P.Eng. N.S. graduate of U.N.B. 49, age 36, married, 53 car. Experienced in construction work, estimating, field engineer, concrete inspection, and etc., on wharf and building construction. Interested in a change to sales engineering. Willing to travel one month's notice or less. File No. 3182-W.

MECHANICAL ENGINEER, McGill 1949, desires position as plant engineer or assistant plant engineer in any field of manufacturing. Experience consists of two years with pulp and paper industry on design, installation and maintenance, and one and one half years as project engineer on oil refinery construction. Age 26, married. File No. 3219-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., age 29, married, without children, desires position with advancement possibilities in Montreal area. Would also consider offer leading to future partnership. One year with large paper company on design and construction of electrical installations. Also some experience on instrumentation and control. At present with leading electrical manufacturer as junior project engineer. Available on reasonable notice. File No. 3310-W.

CIVIL ENGINEER, Jr.E.I.C., age 28, married, 1 child, with 5 years varied structural experience with architects, contractors, and concrete and steel fabricators, in design, estimating, detail, field supervision and liaison desires position with responsibility leading to future partnership in progressive concern. Or would consider sales development and/or administrative position with a firm that can offer the right incentive and advancement to an ambitious engineer. File No. 3340-W.

WORKS MANAGER, 19 years diversified experience in heavy industry including, maintenance, inspection, design, production administration and over five years as works manager of large mechanical plant. Graduate mechanical engineer presently employed, but interested in more responsible position offering scope to introduce improvements, including cost reduction and the promotion of sound employer-employee relations. Location preferably Quebec Province, but would go elsewhere in

The United Townships of Neelon and Garson

Applicatians will be received by the undersigned far the position af Tawnship Engineer and Road Superintendent far the United Tawnships af Neelan and Garson in the District af Sudbury. Populatian now 7,500.

Applicants must be qualified civil engineers and shauld be prepared ta handle all problems in connectian with raads, water works, etc., in a grawing municipality. We emplay a work supervisor.

Applicants shauld state age, qualificatians, past experience, references, and salary expected.

HAROLD BONDETT,
Clerk-Treasurer,
United Townships af Neelan and Garsan,
Garsan, Ontario

Canada dependent on nature of position offered. File No. 3355-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc., 1949, twenty-four years old, married, two years service with the Canadian Hydrographic Service and 1½ years construction work in Labrador. Position in construction work preferred, but will consider others. File No. 3429-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field, or in instrumentation and control. File No. 3460-W.

CIVIL ENGINEER, M.Eng., Jr.E.I.C., P.Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement. Montreal area preferred. File No. 3466-W.

COMBUSTION ENGINEER and fuel technologist, M.E.I.C., M.Inst. Fuel, (Eng.), twenty years experience construction, operation and maintenance coke ovens, manufactured and synthetic gas plants, industrial refractory settings, kilns, furnaces, boiler settings, waste heat recovery units, etc., can assume complete charge for all phases of works from foundations to performance tests and reports. Married, free to travel, locate anywhere. File No. 3505-W.

1949 GRADUATE, Jr.E.I.C., P.Eng., desires part-time work in Montreal and vicinity doing design work, drafting, checking, etc. File No. 3699-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I. Mech.E., (G.B.) M.E.I.C., P.Eng. 20 years experience in development various types high speed I.C. engines, (carburettor, diesel, petrol-injection, supercharged, etc., from 20-1,000 H.P.). At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. File No. 3863-W.

ENGINEER CIVIL/STRUCTURAL, 15 years experience design and construction of buildings, industrial and chemical plant structures and foundations. Trained in England, field and office. Sound theoretical background. Four years senior design engineer with large Canadian company engaged on hydro-electric development work. Member E.I.C., A.S.C.E., etc. Interested in senior positions only. File No. 3702-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 24, single. Presently employed in propane gas, have had six months experience in building construction. Desire permanent position with good opportunities for the right man, no preference to job location available at reasonably short notice. File No. 3903-W.

LANDSURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of a land-surveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. File No. 3908-W.

CIVIL ENGINEER, age 28, 1st class honours, B.E. degree, National University of Ireland (1950), D.I.C. for post graduate course in the theory and design of structures at the Imperial College, London, England. P.Eng. (Ontario). Some experience in surveying. Presently employed (since July, 1951) at the design of buildings and other structures required for mining plants. Desires position which would give some experience in reinforced concrete or steel design or construction. Location preferably Southern Ontario or Montreal, but will also consider others. File No. 3927-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

Here is what one of these positions offers you

to the

E. E. or PHYSICIST

with an interest or experience in

RADAR or ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operations.

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to Canadian government agencies and Canadian companies purchasing Hughes equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories in Southern California for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this helpful in your new work.

WHERE YOU WORK

After your period of training—at full pay—you may (1) become the Hughes representative at a Canadian company where our equipment is being installed, or (2) be the Hughes representative at a Canadian military base. Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply

If you are under thirty-five years of age, a Canadian citizen, and if you have an E.E. or Physics degree, write to the Laboratories giving résumé of your experience.

HUGHES

Research and Development Laboratories
Scientific and Engineering Staff
Culver City, Los Angeles County, California, U.S.A.

EXECUTIVE AVAILABLE, P.Eng., M.E. I.C., B.A.Sc., age 38, family. Offers direct administrative experience at a high level of responsibility in a large chain-retail merchandising operation, combined with teaching experience, university administration, and background of electrical engineering followed up by technical experience in the electronic instrument field. Present location southern Ontario but willing to move. Interested in management of a medium-sized industry with growth possibilities dependent on capable administration and promotion; or employee relations and personnel administration, production-sales liaison, or cost control in a large organization which also provides opportunity for advancement. File No. 4075-W.

CIVIL ENGINEER, S.E.I.C. (McGill 1952) seeks employment in design of reinforced concrete and steel structures for consultant firm. Location: Montreal preferred but not governing. Sound knowledge of field practices and methods. Presently employed. Available on reasonable notice to present employer. File No. 4089-W.

ENGLISH ENGINEER (33), member of Inst. Mech. Eng., engineering diploma, 14 years experience chemical, civil and mechanical engineering. Emigrating early 1953, seeks appointment as industrial or mechanical engineer; preferably B.C., Ontario or Quebec. Fluent knowledge technical and commercial French and Italian. File No. 4091-W.

CIVIL ENGINEER, B.Sc., Jr.E.I.C., P.Eng., Grad. I.C.E., Queens, Northern Ireland, 1948, married, age 28. Experience in general contracting in Northern Ireland, tunneling and water works engineering in the Far East, and heavy building construction in Canada. Desires work, preferably in connection with hydraulic engineering, anywhere outside Canada. File No. 4097-W.

CHEMICAL ENGINEER, B.Sc., Laval, 1953, age 24, married, available at the end of April, 1953. File No. 4098-W.

1951 U.B.C. graduate electrical engineer S.E.I.C., requires employment in Western Canada preferably. Two years manufacturing experience in carrier telephone, 2 years maintenance and installation of radio communication equipment. 6 months telephone installation, 6 months commercial wiring. Age 30, married. File No. 4100-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., B.E. 1949, M.Sc. 1951, University of Saskatchewan, married, age 25. Experience includes two years conducting research on heat and moisture transfer through building materials, and two years design work on heating, piping, air conditioning, steam plant and paper mill equipment. Desire responsible position in plant engineering, design or development work where initiative is required. Would prefer to be located in small city or town. File No. 4107-W.

CIVIL ENGINEER 1951, university graduate with post graduate work, married, age 28, offers experience in construction, machine shop, plant layout, machinery installation, structural draughting and design, estimating, specifications, municipal planning, writing and public relations. Desires an active position with responsibility. File No. 4136-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., Sask. 1949, age 25, single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting, design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

ELECTRICAL ENGINEER, P.Eng. (Ont.), 1950 Saskatchewan and Westinghouse training course graduate, age 28, married, requires work in Edmonton or Calgary. Will relocate before May first. Presently employed in a switchgear section. Formerly instrumentman with P.F.R.A. three years with Army Signal Corps, special wireless. File No. 4138-W.

FULLY QUALIFIED ELECTRICAL, mechanical and patent engineer and lecturer, 22 years experience in power stations, transmission and distribution, installation of electrical and mechanical plant. Energetic, reliable and can undertake variety of responsible positions. File No. 4139-W.

JUNIOR E.I.C., 1947 graduate, offers 5 years of quality control and production supervision experience in non-metallic processing industry. Desires supervisory or administrative position in industrial minerals, pulp and paper or chemical industry, preferably located in Western Canada. Age 27, married, 1 child. Available on reasonable notice to present employer. File No. 4142-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.E. (Sask.) 1949, D.L.S., age 29, married. 4 years experience electronic surveying. Army veteran with radar technical training. Desires position in field of engineering or surveying. File No. 4146-W.

METALLURGICAL ENGINEER, 1951 McGill graduate, S.E.I.C., age 29, married, bilingual. R.C.A.F. commissioned service. Desires employment leading to the production and supervision fields. Summer experience in copper and nickel production. 2 years experience in steel plant operations. Wish location in southern Ontario, but preferably in Quebec (Montreal area). File No. 4148-W.

ENGLISHMAN DESIRES POST in Canada. B.Sc. (Eng. Lond.), M.I.E.E., A.M. Inst. C.E. At present employed in hydro-electric projecting dept. of world-renowned European Continental electrical firm. Specialist in traction from tramcars to diesel and gas turbine locomotives, long operational experience. Practically bilingual (French mother). 52 but healthy and active. File No. 4149-W.

JR.E.I.C., P.Eng., B.Sc. in civil engineering U.N.B. '48, desires responsible position with construction firm. Age 29, veteran, married, two children, five years experience in construction in estimating, purchasing materials and job supervision on building projects. Desires position in Ontario or Western Canada with progressive company having good opportunity for advancement. Available on two weeks notice. File No. 4150-W.

ELECTRICAL ENGINEER, B.A.Sc., U.B.C. 1950, age 28, married, 2 children. Completed Westinghouse's 2 year graduate training course. Desires position in plant engineering, manufacturing engineering, or electrical design. File No. 4153-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., university graduate, over 20 years diversified plant engineering experience in process industries and steam power plants seeks responsible position in pulp and paper industry or allied fields. Experience includes de-

The Defence Research Board

REQUIRES

ENGINEERS AND PHYSICISTS

The Defence Research Board of Canada requires Graduate Engineers who are either Canadian citizens or British subjects, for full time employment in Quebec, P.Q., in the following specialized fields:—

Microwave & Electronics Engineer or Physicist—with six to ten years' experience to carry out research and development on guided missiles. The applicant must have experience in planning ond directing the work of junior scientists.

Servo-Mechanisms Engineer—to carry out reseorch and development on guided missiles. Experience with electrical and electro-hydraulic servo system and with navigation equipment desirable.

Electrical Engineer or Engineering Physicist—with experience in electronic computation to carry out development work on aircraft fire control computers—basic knowledge of microwave and servo-mechanisms desirable.

Electrical Engineer or Engineering Physicist—to direct electronic designs and electronic systems production engineering for guided missile development. The applicant must have experience in electronic component testing and subminiaturization techniques, and must be capable of directing the work of junior scientists.

Electronic Instrumentation Engineer—to carry out instrumentation work on guided missiles—telemetering and range instrumentation experience desiroble. The applicant must be capable of planning and directing the work of junior scientists.

Mechanical Engineers—with six to ten years' experience to carry out design and development on armament systems. The applicants must have experience in planning and directing the work of junior scientists.

Salary: Salaries will be commensurate with experience and qualifications, but will not exceed about $9,000 per annum.

Employee Benefits: Modern well-equipped laboratories provide excellent facilities and working conditions for the individual scientist, and every opportunity is presented for advancement, a five day week, and superannuation and hospital-medical insurance plans are in effect. Liberal provision is made for vacation and sick leave.

Applicants may obtain application forms by writing to:

Post Office Box 1427,
Quebec City,
Quebec, Canada.

sign, construction, maintenance, planning and administration. File No. 4155-W.

GRADUATE METALLURGICAL ENGINEER, age 41, seeks a progressive and responsible post. Intimate knowledge of the steel industry fits him for an operating or research post. Married with children, homeowner and financially solvent. Presently employed. Willing to consider anywhere in Canada. File No. 4156-W.

CIVIL ENGINEER, A.M.I.C.E. (qualified 1949), age 31, married (2 children); at present Deputy Engineer of a town (population 11,000) in England; seeks any appointment in Canada offering scope for his capabilities. Particularly experienced: roads and sewers, house design, housing layouts and planning. Used to writing specifications, taking-off quantities, preparing estimates, drawing up of contracts and supervising construction. 4½ years war service RAF. File No. 4157-W.

GRADUATE MECHANICAL ENGINEER, age 39, (15 years diversified experience in heavy industry, including maintenance, plant layout, erection, production and administration. Special knowledge of steel plant machinery, operation and production of rolling mills, electric welded plants, pipe galvanizing and steam power plants. Knowledge of technical correspondence in English, French, German and Portuguese. Presently employed and interested in more responsible position with a company that can offer incentive and advancement to an ambitious engineer. Willing to locate anywhere if position suitable. Available on reasonable notice File No. 4158-W.

DESIGN ENGINEER, M.E.I.C., fully experienced in reinforced concrete design and water works engineering available for part time work in Montreal. Designing drafting or detailing. File No. 4159-W.

ENGINEERING PHYSICIST, B.Sc. 1948, M.Sc. 1950, P.Eng. Two years university teaching in physics, two years research in X-ray diffraction and electron microscopy in government laboratory. Age 31, married. Seeks position in industry offering opportunity for advancement. Willing to take training course. File No. 4160-W.

POST-GRADUATE CIVIL engineering, McGill student, who is also honours graduate in mathematics, seeks part-time work. Available for full-time work from June 1st. File No. 4108-W.

MECHANICAL ENGINEER, Jr.E.I.C., married, age 28. Nearly three years experience in pulp and paper industry. Desires position with control or production department of paper company which will eventually lead to a position of responsibility. File No. 4109-W.

METALLURGICAL PHYSICIST AND physico-chemist, graduate, 16 years experience, married desires position with initiative and responsibility. Experience consists mainly in the development for technique of procedures, especially in thermo-chemistry and measuring technique. File No. 4110-W.

CIVIL AND STRUCTURAL ENGINEER arriving in Canada April, seeks responsible position. Age 26, B.Sc. (Eng.), A.M.I. Struct.E., graduate I.C.E. Experience includes field survey; site investigation; design of general and reinforced concrete structures, sewerage and sewage disposal schemes and water supply; supervision of construction. Presently employed as resident engineer on the construction of new sewerage schemes. Will consider any location in Canada. File No. 4111-V.

CIVIL ENGINEER, Jr. E.I.C., P.Eng. (Ont.), B.A.Sc., Tor. 1951, M.Sc., Illinois, 1952, age 24, married, one child. Presently employed, one year's experience in soil mechanics. Desires work in structural engineering or with consulting engineer engaged in such or in construction. Available on one month's notice to work anywhere in Canada. File No. 4112-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age 28, married, graduated 1949. Experience includes design, specifications, and field work in ground services, some reinforced concrete design; past 2½ years as resident engineer on multimillion dollar townsite project. Desire responsible position with real opportunity for advancement. Available upon month's notice to present employer. File No. 4119-W.

FIELD ENGINEER, S.E.I.C., 28, married, family. Presently employed as administrative engineer on general building. Studying civil engineering and road design under C.I.S.T. Wishes position with responsibility under contractor or consultant. Future promotion on ability. Administrative abilities proven. 1 year on N.H.A. housing; 2½ years on highway location surveys, draughtsman, instrument, etc.; 2½ years on subway underpinning, instrumentman yard layouts, assistant project engineer. Familiar with office procedure and field take-offs for quantities. References. Prefer Ontario to start. Working Brockville area now. Available on reasonable notice to present employer. Open for interviews. File No. 4121-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.), 1949 graduate, age 31, married, one child. 4 years varied experience in electronics, inspection of steams and hydro power plant machinery, hydro power plant layout and design. 3 years wartime aviation electronics experience. Desire change of location, preferably Ontario or Western Canada. File No. 4124-W.

ELECTRICAL ENGINEER. S.E.I.C., power option, grad. McGill 1952, age 31, married, R.C.A.F. veteran with overseas service, presently employed in Montreal, desirous of improving present position with greater scope of responsibility. Would accept position in industry or sales engineering in Quebec City or Chicoutimi district. File No. 4125-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.A.Sc. (Toronto 1950), master's degree in Business Administration, age 24, single, 2 years' experience in electrical manufacturing company. Desires position in production supervision with medium-sized company anywhere in Canada where recognition is given for ability and initiative. File No. 4126-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A.Sc. (Chemical, Toronto 1946), Dr. Sc.nat. (Swiss Federal Institute of Technology, Zurich (1950). Canadian, married, age 28, abroad last six years residing in Switzerland, France, Indonesia. Just completed three years with a United Nations Specialized agency in scientific liaison work. Travelled extensively. Desirous of organization and management work—policy formulation, planning and administration, leading to increased responsibility and independent action; definite possibilities for advancement dependent on competence in a situation where initiative, imagination and resourcefulness are assets. An organization with foreign interests would be of most interest. File No. 4129-W.

CIVIL ENGINEER, S.E.I.C., Nova Scotia, Technical College, 1953. Age 29, married. Overseas with R.C.A.F. Summer experience includes assistant resident engineer department of highways. Seeking employment in structural engineering and steel erection. File No. 4130-W.

1951 GRADUATE IN CIVIL ENGINEERING, National University of Ireland, with one year's experience as designer with consultant and at present engaged on construction with railway company, desires employment with consulting engineers in Montreal or Toronto. File No. 4131-W.

ELECTRICAL ENGINEER, M.E.I.C., age 43, married, no children, desires responsible position, 17 years experience in design and construction of electrical lighting and power installation, and electric hydro and thermo electric power stations. At present with leading consulting engineering firm. Available on reasonable notice to present employer. File No. 4132-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 31, bilingual with some teaching experience at leading University and production experience in a nationally known sewing machine company, etc., seeks position in a well established peace time mass production industry (automotive, chemical, oil, etc.), interested in working on development of new processes or machines or preferably an extensive period of training leading eventually to an executive opening. Services available May 15, or possibly before if employer offers an attractive long term future. File No. 4161-W.

National Research Council

REQUIRES

Communications Engineer

To study and report on new and existing communications systems and on developments in ancillary equipment; to act as liaison officer on radio propagation matters. Honours degree in engineering physics or electrical engineering and knowledge of Multiplex and Telegraphic equipment required. Post-graduate training or experience desirable.

Electronics Engineer

To carry out research on electronic telecommunications equipment; to design and develop specialized electronic equipment as required; to carry out technical liaison duties. Honours degree in physics, engineering physics or electrical engineering with specialized training in electronics required. Must have interest and ability in circuit design; must have interest in or experience with electronic computers. Research experience in circuit work would be useful.

Initial salary up to $5,200 per annum depending on experience and qualifications. Preference will be given to Canadian applicants. Apply by mail, giving full details of qualifications and experience to Chief, Personnel Branch, National Research Council, Ottawa, Ontario.

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NEWS of the BRANCHES

Activities of the Forty-one Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. LUSK, JR.E.I.C.,
Secretary-Treasurer

February Meeting

The Belleville Branch held its regular monthly meeting at the Masonic Temple on February 9, with 39 members and guests present.

G. A. Bradford, chairman of the Branch, presided and brought to the attention of the Branch a booklet prepared by the Canadian Management Council.

An announcement was made regarding the prizes provided by the Institute for technical papers presented by Junior and Student members.

The members were advised that a general invitation had been issued by the Committee in charge of the Junior Engineers' Training Course to attend its meeting on February 23 when the subject of "Personal Investment Policies" would be presented by Arthur Bell.

It was announced that the executive was considering establishing a bursary for high school students interested in the engineering profession.

A standard charge of 35 cents per member had been established by the executive to cover the cost of the refreshments provided at each meeting.

The guests of the Branch were then introduced by J. Lawn, after which the speaker of the evening was introduced by A. D. Janitsch.

D. C. King of the Canadian Standards Association Approvals Laboratory traced the history of this Laboratory from its beginning as part of the H.E.P.C. laboratories. He described the various functions of the Laboratory, particularly with regard to electrical equipment.

Appreciation of the Branch was expressed to Mr. King by W. C. Benger.

Central British Columbia

H. L. TOPHAM, JR.E.I.C.,
Secretary-Treasurer

Joint Executive Meeting

A joint executive meeting of the Central British Columbia Branch of the Institute and the Society of Professional Engineers of British Columbia was held in the Water Rights Office in Kelowna, B.C., on January 23.

Representing the Institute was Chairman R. L. Bigg, Vice-Chairman M. L. Zirul, Branch Councillor M. L. Wade, Secretary-Treasurer H. L. Topham, and Committeemen A. F. Joplin and W. A. Ker. Representing the Society were Chairman S. D. H. Pope and Committeeman R. G. Harris. H. R. Hatfield, past chairman of both organizations, was also present.

The minutes of the previous meeting held on December 12, 1952, were adopted as read.

Dates and locations were then set for the general meetings to be held during the remainder of 1953. For the meeting on May 15 in Kamloops it was proposed that a special invitation be extended to all members north of Kamloops, and if sufficient interest were shown by the northern members of both organizations, that the next meeting be held at some point in the Cariboo.

The location of the meeting on July 10 was left open. On August 14 the meeting will take the form of a Ladies' Night in Kelowna. A special invitation will be forwarded to the Canadian Institute of Mining and Metallurgy members at Hedley and Princeton to attend the September 18 meeting at Penticton. The annual meeting of the Society will be held in Kelowna on October 30, while that of the Institute Branch will take place in Kamloops on November 27.

The secretary-treasurer was advised to answer the enquiry of the Vancouver Branch of the Institute to the effect that full co-operation already existed between the Society of Professional Engineers and the Central British Columbia Branch of the Institute and that the Branch would be pleased to have its councillor meet with the others to discuss the problems of the B.C. branches.

Joint Dinner Meeting

A joint dinner meeting with the British Columbia Engineering Society was held in the Legion Hall in Kelowna, B.C., on January 23. There were 36 in attendance.

Following the dinner, R. L. Bigg, chairman of C.B.C. Branch of the Institute, expressed his appreciation to the members for his election to the office. He stressed that 1953 would be a good year for the Branch only if the members were active in the affairs of the Institute. It was his feeling that membership should be increased as records indicate only 50 per cent of the engineers in Canada are members of the Institute. He emphasized that from a mailing list of more than 100 names, attendance at Branch dinner meetings was only between 30 and 35. He felt that the members should have more interest in their professional society, and endeavour to attend the meetings which occur every two months only.

The chairman outlined to the meeting the proposed changes to the by-laws regarding the increase in fees, resident and non-resident boundaries, and the increase in *Journal* subscription rates. He requested all members to be sure to cast their ballots when they were received from headquarters.

The minutes of the annual meeting, held in Kamloops on November 24, 1952, were adopted as read.

The general business meeting of the Central B.C. Branch of the Professional Society followed with S. D. H. Pope presiding.

The speaker of the evening, W. A. Ker, district engineer of the Water Rights Branch in Kelowna, was introduced by H. H. Hatfield. Mr. Ker outlined the activities of the Water Rights Branch, and followed this with a series of interesting slides. A vote of thanks was proposed by M. L. Zirul on behalf of both groups.

After a short recess, M. L. Wade, Branch councillor, gave a short account of the business discussed at the Zone "A" council meeting held in Edmonton on December 6, 1952, and an interesting summary of his holiday trip to Eastern Canada.

Cornwall

L. SNELGROVE, JR.E.I.C.,
Secretary-Treasurer

JOHN E. PESCOD, JR.E.I.C.,
Branch News Editor

Joint Meeting With C.I.C.

On January 20, 1953, a joint meeting of the Cornwall Branches of the Engineering Institute and the Chemical Institute of Canada was held in the Assembly Room of Courtaulds (Canada) Limited.

Monel goes hand in hand with chemistry

When an engineer considers new equipment for one of the various operations of the chemical industry, probably he thinks first of corrosion. But physical and mechanical properties—strength, wear resistance, ease of fabrication and so forth—are important, too. There are also economic considerations. Because Monel ranks high in *all* the above factors, it has long been classified as the *general purpose alloy* for chemical equipment.

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Professor F. K. Hare, chairman of the Department of Geography of McGill University, speaking on "Canada's Natural Resources—Some Queries", said that in respect of development of her natural resources Canada is in the same position as the United States was 75 years ago. Considering hydro-electric power resources alone, Canada is second only to Norway in installed capacity per capita, yet only 22 per cent of her readily accessible potential has been developed.

One of the main problems of exploration in Canada is the vastness of the areas involved. However, recently developed techniques which employ aircraft for assessing the mineral, timber and hydro-electric resources have overcome this difficulty to a great extent.

The speaker expressed concern that Canadian capital was relatively unavailable for exploration and development of our natural resources, particularly for those projects which cannot ensure an immediate return on the investment. Thus it is impossible even if it would be advisable to exclude foreign capital, and in particular American, from such ventures.

Donald Ross-Ross, E.I.C., councillor, presented B. T. Yates with a gold plated membership pin in recognition of his splendid service as the immediate past-chairman of the Cornwall Branch.

Professor Hare was introduced by G. B. Stidwell, E.I.C., and thanked by M. Alguire of the Chemical Institute. John Hawkes, E.I.C. Branch chairman, presided at the meeting.

Montrealers Are Guests

The February general meeting of the Cornwall Branch of the Engineering Institute of Canada was held at the Cornwall Golf and Country Club. Honoured guests were I. R. Tait, vice-president of the Montreal Area of the Engineering Institute and H. G. Thompson, assistant general secretary of the Engineering Institute of Canada, who gave informal talks on Institute affairs. Following a discussion period, refreshments were served.

Previous to the meeting, Mr. Tait and Col. Thompson were guests of the executive of the local branch at dinner served at the Golf Club. Mr. J. Hawkes was chairman for the evening.

Edmonton

J. L. PULFORD, M.E.I.C.,
Secretary-Treasurer

R. D. ROSSER, M.E.I.C.,
Branch News Editor

Joint Dinner — January 29

The annual joint dinner of the Association of Professional Engineers of Alberta, the Edmonton Branch of the Engineering Institute of Canada, and the Canadian Institute of Mining and Metallurgy was held in the new banquet room of the MacDonald Hotel on January 29, 1953. Approximately 200 members attended this worthwhile event. H. H. Moore, president of the A.P.E.A., was chairman for the evening.

Dr. R. M. Hardy, dean of engineering, University of Alberta, introduced the guest speaker, Dr. Andrew Stewart, president of the University. Dr. Stewart discussed "The Social Implications of Expanding Technology."

The Province of Alberta, according to Dr. Stewart, is entering a period of growth, which is based on the use of her natural resources. This growth is dependent on our expanding knowledge and expanding technology, and to a lesser extent on the wants of the people and on the use of the resources to meet these wants. The course of expanding knowledge is undirected and unpredictable, and you can never be sure that these new developments will add to material welfare.

New knowledge creates the necessity of changes and constant adjusting, and is actually a disturbing feature in our lives. Advances in knowledge bring about obsolescence, and skills have to be adjusted to cope with new developments.

Dr. Stewart pointed out that the application of new knowledge also requires new investment, which means savings. This, then, has the effect of reducing present consumption, and therefore we must balance the importance of the present and the future.

Despite all the difficulties and problems which we encounter because of expanding knowledge, we are all for it. Why? asked Dr. Stewart. There appears to be no answer to this.

Some cultures have never experienced the effects of new ideas and knowledge. Our own Western culture was static for a long time, but is certainly not so today. Our system of education has set up a social environment which leads to expanding knowledge. To maintain a growth of knowledge requires an expanding educational system because more and more people must be educated.

There is a definite relationship between educational facilities and industrial expansion, and the rate of industrial expansion will decrease if we do not expand our educational facilities. The rate of industrial expansion also depends on an environment which stimulates discoveries, and creates an open, critical, and inquiring mind. This the universities can do, and should do. They should not become absorbed in teaching facts alone. Ideas occur with individuals, not societies, and therefore the rate of expansion depends on the attitudes of individuals.

The research worker is a specialized worker of today—he is a specialist in looking for new knowledge, and he requires a high degree of training.

Research is now becoming a function of governments and large industrial concerns, as well as universities. However, research controlled by governments and industry is usually directed along particular lines for immediate needs. Dr. Stewart suggested that there is a place for the research worker who searches for the unknown, undirected. The university is the place for this type of research.

However, any knowledge whether for immediate needs or not, is good knowledge, and contributes to the growth of the province.

Dr. Stewart was thanked by Mr. J. Ross, president of the C.I.M.M.

Young Engineers' Stag — February 20

The annual young engineers' stag was held February 20, and a crowd of 150 turned out to a very enjoyable evening. The program was emceed by Dave Panar, who carried it along in a light

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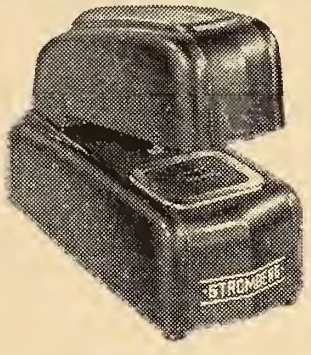

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ad humorous manner. Lunch, cards ad skits were the features of the program.

rofessionol Development Progrom

The Edmonton Branch has commenced a program of professional development this year. The program consists of a series of six lectures, and is patterned along the lines of the programs being used by the Toronto and Hamilton branches. If this initial series proves successful, it is intended to prepare a more extensive program for next winter.

First Annual Convention — APEA — Morch 28

The first annual convention of the Association of Professional Engineers of Alberta will be held in Lethbridge on March 28. It is planned to make this a gala affair, and a convention train is being made up in Edmonton to accommodate all Edmonton members who are going.

Fredericton

R. E. Tweeddale, M.E.I.C.,
Secretary

The executive and members of the Fredericton Branch have given much serious consideration of late to the status of professional engineers in their city and province and as a result, have placed on record three resolutions directed to the Premier of New Brunswick, the Mayor and Council of Fredericton, and the executive of their Provincial Association, as follows:

To the Premier and Government of the Province of New Brunswick:

"Whereas it has come to the attention of the Fredericton Branch of the Engineering Institute of Canada, through the press, that the resignation of the Deputy Minister of Public Works has been announced, and

"Whereas the Deputy Ministers of Public Works or their counterparts in the majority of Provinces of Canada and the States of the Union are Professional Engineers, and

"Whereas the duties of the Deputy Minister of Public Works are principally connected with engineering matters,

"Therefore, be it resolved,

"That the Fredericton Branch of the Engineering Institute of Canada, strongly urges that the Lieutenant-Governor in Council appoint, a qualified Registered Professional Engineer to fill the important office of Deputy Minister of Public Works of the Province of New Brunswick."

To the Mayor and Council of the City of Fredericton:

"Whereas the Members of the Fredericton Branch of the Engineering Institute understand from pronouncements made during the recent mayorality contest that a city manager form of government is being considered for the City of Fredericton, and

"Whereas the City of Fredericton, due to the establishment of the new army training camp in the area, is without doubt on the verge of a large expansion program, and

"Whereas a city manager would find that a large percentage of the problems to be solved would be purely engineering problems and many of the remaining problems would be directly connected with engineering,

"Therefore be it resolved:

"That the Fredericton Branch of the Engineering Institute of Canada do respectfully suggest that in the interests of the ratepayers of the City of Fredericton, the appointment of a City Manager should be made to a qualified Registered Professional Engineer."

To the President and Council of the Association of Professional Engineers of the Province of New Brunswick:

"Whereas a feeling has been expressed that organizations for the benefit of engineers and furtherance of engineering ethics are not doing all that could be desired, and

"Whereas there is a movement in the Fredericton Branch of the E.I.C towards a decrease in the number of younger members because of the apathetic attitude of engineers as a group, and

"Whereas the Fredericton Branch of the Engineering Institute of Canada having many joint members, feels the Association of Professional Engineers of the Province of New Brunswick to be the medium properly set up to administer the practice of engineering and to represent the engineers in collective matters,

"Therefore be it resolved that the Fredericton Branch of the Engineering Institute of Canada strongly urge the Association of Professional Engineers of the Province of New Brunswick to immediately take under *active* consideration all matters which will strengthen and tighten our Association having particular reference to; immediate revision of the Act; preparation, establishment and approval by the Lieutenant Governor in Council of a schedule of basic fees and salaries for professional services; fostering publicity to make the public conscious of the role of the professional engineer; implementing a series of lectures or papers on the responsibility of the engineer in public life for both student and practising engineers; giving assistance and advice to the Civil Service Commission of the Government of the Province of New Brunswick in the matter of duties and remuneration for professional engineers in the Civil Service; and other matters pertinent to the advancement of engineering aims."

Ponel Discussion, Jonuory 12

An exceptionally successful meeting of the Branch took place on January 12, 1953, at the Area Headquarters Officers Mess on Woodstock Road. A record turnout of members and student members from the University of New Brunswick was present.

The meeting took the form of a panel discussion, with two teams debating on the topic "Should Engineers Join Unions?" Dr. E. O. Turner, dean of engineering at the University of New Brunswick, acted as chairman of the discussion and skilfully conducted the course of the discussion. Prof. R. H. B. McLaughlin, assistant professor of civil engineering at U.N.B.; M. B. Morgan, location engineer with the Provincial Department of Public Works, and R. S. Myles, assistant design engineer, took the affirmative stand and maintained that engineers should have a vertical union with more strength and vitality than the present organization. J. L. Feeney, chief engineer of the New Brunswick Electric Power Commission; Stan Cassidy, a local electrical engineer, contractor and businessman, and William Barrett, second assistant city engineer, took the negative stand. They felt that engineers should have strength and more active organizations but felt that they should keep away from unions. The discussion was brisk and, at times, came very close to being heated. Dr. Turner, as chairman, called for written questions from the audience and was flooded with questions which showed that a keen interest had been created; in fact, Dr. Turner had to curtail the discussion due to the lateness of the hour.

After the panel had been adjourned, coffee was served which was enjoyed by all present. It was felt by all that the meeting was a huge success and more meetings will be held along this line in the future. Prof. Herb Loane, chairman of the papers committee, organized the discussion, and deserves a great deal of credit for its success.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

W. J. Roy, Jr.E.I.C.,
Branch News Editor

Dinner Meeting, January 17

A dinner meeting was held by the Lethbridge Branch of the Institute on Saturday evening, January 17. Sixty-four members attended the meeting, which was conducted by Chairman James C. Neufeld.

Following the dinner and the customary musical entertainment, the guest speaker, F. D. Aaring, was introduced by J. A. Leask. Mr. Aaring is the assistant chief engineer of the Canadian Gulf Oil Company. He titled his talk "A Reservoir Study of the Pincher Creek Field."

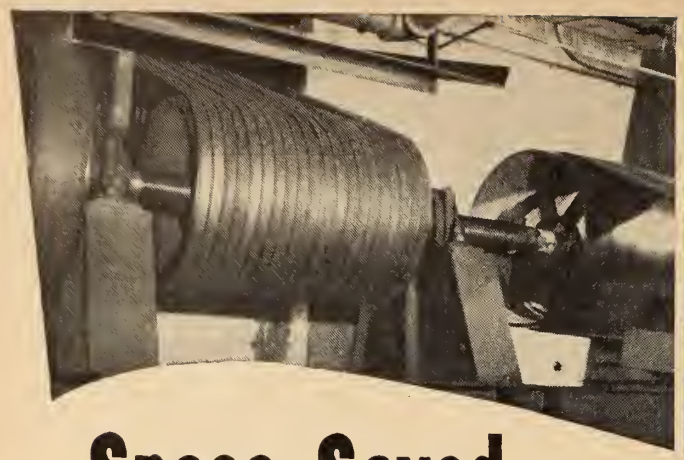
Some 80 per cent of the 2.4 trillion feet of reservoir gas in the Pincher Creek Natural Gas field will be saleable as dry gas. From the remaining 20 per cent the following bi-products could be obtained: 8,400,000 barrels of condensate oil; 9,800,000 barrels of natural gasoline; 12,700,000 barrels of propane; 10,400,000 barrels of butane; and 7,400,000 long tons of sulphur.

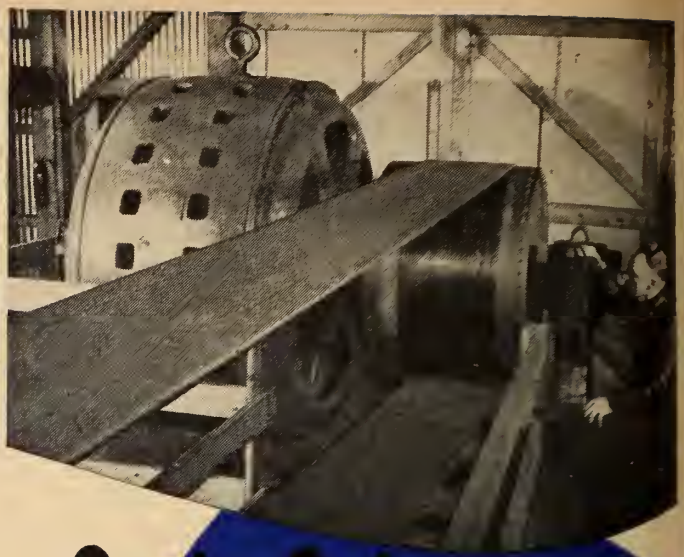
Mr. Aaring went on to describe the depletion process of the field. For optimum recovery of the natural gas and its bi-products, the field should produce 200,000,000 cubic feet of fluid per day for the first 20 years. After this period of time it would be necessary to reduce the flow in order to keep up the amount of condensate recovered.

Condensate oil is a light crude oil which is usually mixed with heavy crude to make the heavier material easier to refine. If refined by itself the condensate would yield 98 per cent gasoline.

The desired rate of production (200,000,000 cu. ft. per day) could be obtained from ten wells. However, since wells are often erratic, it would be necessary to drill ten to 15 extra wells to ensure the desired steady rate of flow.

A detailed study of the porosity of the 500 feet of Madison limestone in which the gas is held showed that the void space, for the wells drilled, averaged 29.85 feet. In other words, if all the porous material were consolidated





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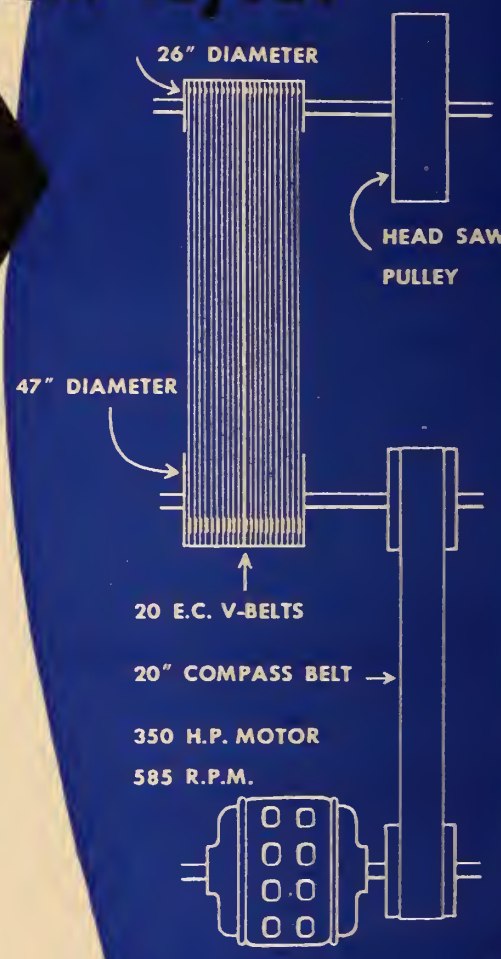

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ıe space would be 29.85 feet deep. The)eaker noted that so far the results of :illing have substantiated the informa- on gained from seismographic tests. [e estimated the size of the field at 17,- 50 acres with reserves contained in 16,500 acre-feet of void space.

J. A. Leask, another Gulf Oil Com- any official, gave a short description f the difficulties encountered in drilling ı the Pincher Creek field. Terrific re- :action in the underground strata made he drill holes crooked, he said, and it ;as often difficult to end up within the equired area two miles underground. The first test hole drilled by the Com-)any cost in the vicinity of $1,000,000,)ut since that time the cost per hole ıas been reduced to $650,000.

The speakers were given a hearty vote)f thanks by R. D. Livingstone.

London

R. S. Cuthbertson, M.E.I.C.,
Secretary-Treasurer
I. D. Patterson, M.E.I.C.,
Branch News Editor

Annual Meeting, January 22

The annual meeting of the London Branch was held at the Cobblestone Inn on Thursday, January 22.

The guest speaker of the evening was Dr. A. E. Berry, director of sanitation of the Ontario Department of Health. Dr. Berry was suffering from an attack of 'flu at the time and should have been home in bed instead of coming 120 miles to meet a public gathering.

Dr. Berry gave an excellent address on that most timely subject "Water Resources". He said that Canada had tremendous resources in electricity, oil, coal and water; that Canada had demonstrated to the world that she has the engineers to utilize these resources: that New York was short of water due to increase in population and industrial demand and that some Canadian cities might soon find themselves in the same situation. Dr. Berry said that the water supply industry was a tremendous business and represented an investment of $7 billions; that there were 1,500 waterworks in Canada charging an average of 5 cents per ton of water delivered. Dr. Berry suggested that some of the inland cities in Western Ontario might be forced to go to the Great Lakes for water supply.

Dr. Berry was introduced by Ken Clawson and thanked by John Gilchrist.

The new executive, consisting of Chairman Ian Patterson, Vice-Chairman Don Cooke, Secretary-Treasurer Bob Cuthbertson, Don Jenkins, Don Mathews, Don Bird, Russel Allison and Ken Clawson, was introduced by Councillor Verne McKillop.

At the close of the meeting Chairman Don McGeachy officially handed over the meeting to Ian Patterson.

The meeting was attended by approximately 50 members.

Newfoundland

R. W. Pike, M.E.I.C.,
Secretary-Treasurer
R. P. Hunt, Jr.E.I.C.,
Branch News Editor

December Meeting—Panel Discussion

The regular monthly meeting of the Newfoundland Branch was held at the Memorial University on Monday, December 8. Branch Chairman S. J. Carew presided over the short business session, after which he passed the chair over to Dr. Cooper for the second part of the meeting.

This was a panel discussion on the effect of dams and other obstructions on the movement of salmon in rivers. Before the discussion three movies were shown by Dr. Cooper. The first two were general interest films of Nova Scotia, the third, leading up to the subject to be discussed, showed the methods used on the La Have River, Nova Scotia, to increase its salmon population.

The first speaker of the panel was Mr. Forbes-Roberts. He pointed out that the salmon population of all rivers of the Atlantic seaboard had declined during the last fifty years. His company had not, so far, encountered the problem of the protection of salmon populations in any of their operations on the Avalon Peninsula. The second speaker was H. Walters, chief game warden for the Province of Newfoundland. He pointed out the fields of responsibility of both the federal and provincial governments in inland fisheries. He described the work of his department and some of the causes of the depletion of salmon populations. The next speaker, E. Dickenson of United Towns Electric Co., Ltd., was followed by Dr. W. Templeman of the Newfoundland Fisheries Research Station. He told of the research on salmon carried on by members of his staff and gave a short life history of the salmon in Newfoundland rivers. The final speaker, Mr. Desbarats, suggested that certain rivers be set aside as salmon rivers while others should be used solely for hydro electric development.

The meeting adjourned at 11.00 p.m. after which the members were served supper provided by the Engineers Wives' Association.

Colonel R. F. Schirmer, U.S.A.F., Guest Speaker

The January meeting of the Newfoundland Branch was held at Memorial University on January 12, 1953.

S. J. Carew, the Branch chairman, presided over the business portion of the meeting.

Following the reading of the minutes of the last meeting, B. A. Monkman gave a brief account of the meetings of the Council of the Institute that he had attended in Edmonton in December.

G. Knight reported for the social committee on the plans for the annual dance to be held at the Old Colony Club on February 5.

The chairman then called upon J. M. Hopkins to introduce the special speaker of the evening, Colonel R. F. Schirmer, U.S.A.F., who took as his topic, "Master Planning of Air Bases".

The speaker began by defining master planning which is, in effect, the proper selection of a site and the layout of an air base, keeping in mind its present use and probable future expansion.

Colonel Schirmer went on to explain the sequence of steps necessary for the proper planning of an air base, beginning with the factors that determine selection of the site, such as topography, prevailing winds, etc., and continuing with the various stages in the planning of a base. The speaker illustrated his talk by a series of charts depicting the development of a selected site into a modern air base.

A vote of thanks was extended to Colonel Schirmer by B. Monkman.

The meeting adjourned at 10 p.m. after which the members were served a supper provided by the members of the Engineers' Wives Club.

Second Annual Dance, February 5

The second annual dance of the Newfoundland Branch was held at the Old Colony Club, St. John's, on February 5. The Club was suitably decorated for the occasion with posters depicting the various branches of the engineering profession. The music for the evening was provided by the Rhythmaires Orchestra. About one hundred couples were present.

S. J. Carew, the Branch chairman, welcomed the members and their guests, and thanked the social committee, G. Knight, A. Butt and G. Cummings, for the excellent arrangements they had made for the dance. He then called upon G. Knight, the chairman of the social committee, to act as master of ceremonies for the evening.

In addition to several novelty dances, for which prizes were awarded, there was a door prize and a drawing of two lucky numbers. The balloon dance was won by Dr. and Mrs. Baird and the elimination dance by Mr. and Mrs. Rupert Bartlett.

Nipissing and Upper Ottawa

D. K. Campbell, Jr.E.I.C.,
Secretary-Treasurer
W. Bramah, Jr.E.I.C.,
Branch News Editor

Dinner Meeting, North Bay

The Nipissing and Upper Ottawa Branch held a dinner meeting on the evening of February 11 at the Marine Room in North Bay. The guest speaker of the evening was Colonel L. F. Grant, field secretary of the Engineering Institute of Canada, who spoke on "The St. Lawrence Waterway and Power Project" to the 50 members and guests in attendance.

Colonel Grant traced the history of the waterway, beginning with the first crude construction in 1700, when the first Lachine Canal was built by enlarging a tributary to a depth of 1½ feet; and including the construction of the canals at the Cascades in 1785; at Sault Ste. Marie in 1797; on the Hudson River (the Erie Canal) in 1825; and at Welland in 1833.

Colonel Grant also traced the history of the improvements to the waterway. The construction of the first large-size Lachine Canal was finished in 1825, and the enlargement of the Welland and St. Lawrence Canals was made in 1850. The construction of a United States Canal at Sault Ste. Marie was completed in 1855 and the enlargements to it were made in 1881, and the Canadian Government built a canal and lock at Sault Ste. Marie in 1888-1895. Final enlargement of the St. Lawrence canals to their present size was finished in 1903. Deepening of the Thousand Island Channel section was accomplished in 1935, and the construction of last lock at Sault Ste. Marie on the United States side, brought the total to five locks on the United States side and one lock on the Canadian side, in 1945.

Colonel Grant touched briefly on the political aspects of the various treaties and agreements between Canada and the United States during the history of

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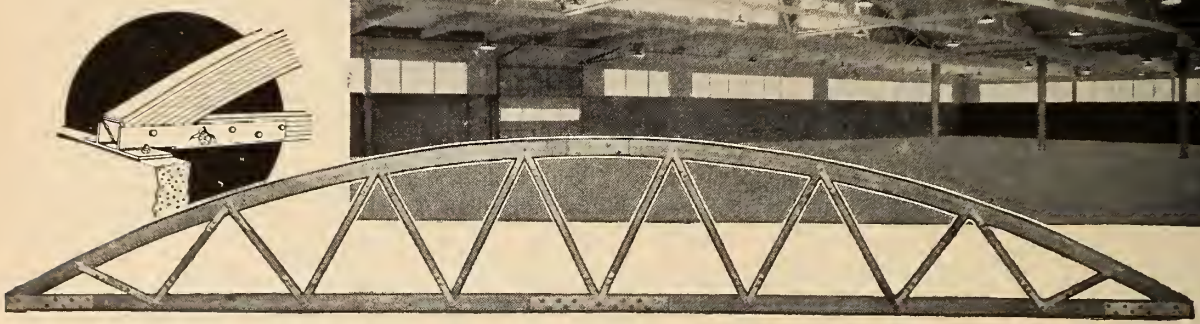

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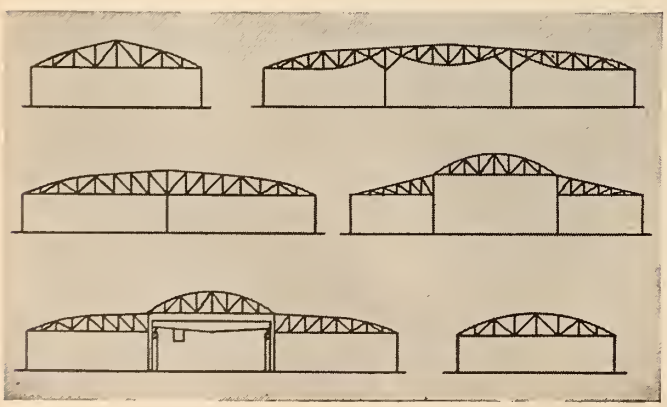

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the waterway and he was very strong in his praise of the International Waterways Commission which was set up in 1903.

He pointed out that the present-day advantages of the waterway are threefold: About 2,200,000 hp. will be developed in the international rapids section of which one half is allotted to each country. There will also be a great increase of power for the development of the Cedar and Cascades Rapids; there will be a substantial decrease in the freight costs from the Lakehead Ports to Liverpool; there will be a direct route for iron ore boats from the Labrador iron ore deposits to the steel mills.

So great was the interest in Colonel Grant's speech that engineers gathered from such outside points as Sturgeon Falls, and Temiskaming.

At the next meeting of the Branch to be held in Temiskaming, it was announced that R. H. Foy would speak on "Electronic Trends" and H. Watson would discuss the subject of "Safety in Industry".

Saint John

J. A. B. Brenan, Jr.E.I.C.,
Secretary-Treasurer

H. McCleave, M.E.I.C.,
Branch News Editor

A.P.E.N.B.-E.I.C. Dinner

Over 100 engineers from various centres of New Brunswick gathered at the Admiral Beatty Hotel, Saint John, on Jan. 29, to attend the joint dinner meeting of the Saint John Branch of the E.I.C. and the Association of Professional Engineers of the Province of N.B.

A. G. Watt, chairman of the local branch of the E.I.C. who presided at the dinner, welcomed the large group and introduced city councillor Belyea and Stan Emmerson, who extended greetings on behalf of the City of Saint John and the Architectural Institute respectively.

Paul Levesque, of the N.B.E.P.C., Fredericton, proposed the toast to the Association which was responded to by M. Lamb, newly elected vice-president of the Association, in the absence of the president J. D. McKay. The toast to the E.I.C. was proposed by R. Yuill, port manager who mentioned the duty that we all owe to the Institute. H. Townsend responded.

Certificates were awarded to 15 newly registered professional engineers and D. O. Turnbull presented the annual Association Scholarship to R. I. MacDonald, a fourth year engineering student at the University of New Brunswick.

Mr. Watt next introduced Major A. A. Turnbull who awarded the Royal Canadian Engineers Memorial Scholarship to E. L. Bryerton, a final year engineering student at the University of New Brunswick. This scholarship is awarded through the Military Engineers Association of Canada to students in 12 universities across Canada. It was formed from funds contributed by all ranks of the Royal Canadian Engineers after the end of World War II and is in memory of the engineers who gave their lives in this conflict. "The student's scholastic ability, leadership and his participation in the C.O.T.C. are deciding factors in the awarding of this scholarship and Mr. Bryerton has well fulfilled these requirements," said Major Turnbull when congratulating Mr. Bryerton.

Mr. Watt then introduced the principal speaker of the evening, R. M. Richardson, chief engineer of the N.B. Telephone Co. Ltd., and president of the Dominion Council of Professional Engineers, who spoke on the necessity of a strong Dominion Council.

St. Maurice Valley

C. Yoshida, Jr.E.I.C.,
Secretary-Treasurer

D. G. Demianiw, Jr.E.I.C.,
Branch News Editor

Golf Tournament

The opening event of the 1952-53 session was a golf tournament which was held on September 20, 1952 at the Shawinigan Falls Golf Club. Attendance was poor due to the occasional rain showers. Following the tournament, supper was served in the club house where the members were later entertained by Robert Perry, local magician.

December Meeting

On December 10, 1952, at the Hotel Chateau de Blois, Three Rivers, Barry Graham of the Aluminum Company of Canada spoke on the "Alcan Expansion in British Columbia". Mr. Graham's talk included a colour movie entitled "The Nechako Survey" which showed the preliminary work on the Kitimat Project. Coloured slides showed the progress to date.

January Meeting

C. K. Lockwood, newly appointed vice-president of Shawinigan Chemicals Ltd., Montreal, and general manager of its Stainless Steel Division, addressed the members on the subject "Stainless Steels" at a meeting held on January 7, 1953, at the Cascade Inn, Shawinigan Falls.

Mr. Lockwood traced very briefly the development of stainless steel alloys and described the physical and chemical properties produced by varying the components in these alloys. The nomenclatures assigned by the different manufacturers of the alloys have led to considerable confusion, but efforts to standardize are being made. Examples were given of cases where stainless steels were almost indispensable, e.g. sulphite pulp digesters, jet engines. One weakness of stainless steel was its failure to resist muriatic acid. With the aid of slides, the many applications of stainless steel were illustrated.

The speaker was introduced by L. A. Robillard of Shawinigan Falls and thanked by C. M. Williams of Grand'Mere. More than 50 members were in attendance.

Three Rivers Junior Section

New executive officers of this Section for the 1952-53 session are, chairman, A. P. Earle; vice-chairman, K. Eaton; secretary-treasurer, J. L. Desautels; committeeman, S. Thibeau.

On October 2, 1952, Dr. L. Austin Wright addressed the Section on the subject "The Shortage of Engineers in Canada". In his address which took the form of an open discussion, Dr. Wright reviewed the evidence indicating the shortage of engineers in Canada. Many engineers are engaged in other than strictly engineering occupations, such as sales and administration, because their training makes them more qualified in these fields. Also salaries are usually

Montreal Branch Annual Meeting

Right: At the head table, Mrs. R. L. Dunsmore, Dr. J. B. Stirling, and G. N. Martin, chairman of the Branch.

Below left: Dr. T. A. Monti receives from Dr. Stirling the T. C. Keefer Medal awarded in 1952.

Below right: Neil Morrison receives from the President the certificate of the E.I.C. prize to McGill University students.

Below: The head table at the annual meeting. Left to right, Mrs. L. A. Wright, Dean R. E. Jamieson, Mrs. I. R. Tait, L. L. O'Sullivan, Mrs. R. L. Dunsmore, J. B. Stirling, G. N. Martin, Mrs. Stirling, R. L. Dunsmore, Mrs. O'Sullivan, I. R. Tait, Mrs. Jamieson and Dr. L. Austin Wright.

higher in these occupations. The speaker stated that the number of European engineers which could be absorbed by Canadian industry is very small compared with the present need, and therefore their importation is not likely to threaten the position of Canadian engineers, but would help to alleviate the shortage mainly in the specialized fields involving such projects as pre-stressed concrete and soil mechanics.

A more permanent cure for the shortage would be more efficient utilization of engineering skills and training of engineers within the industries.

It was also noted that the Engineering Institute was doing much to relieve future shortages of engineers by the

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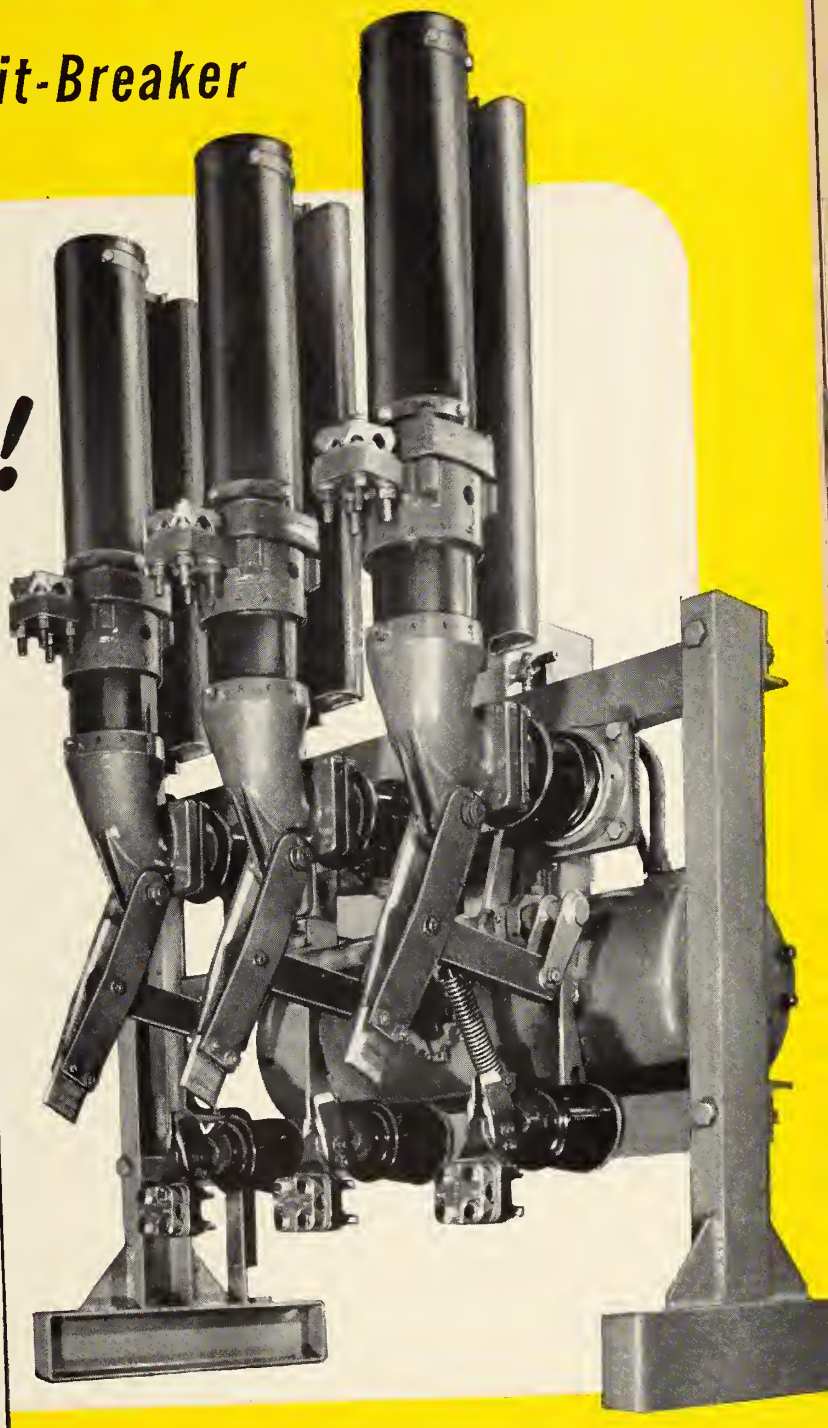

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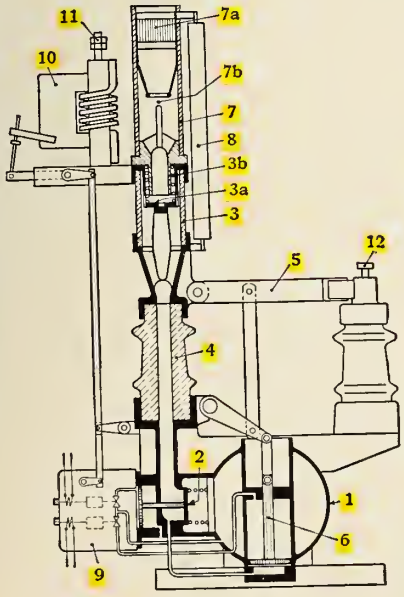
7. Exhaust cooler
   - 7a. Damping baffles
   - 7b. Spark for switching resistor 8
8. Damping resistor
9. Control unit
10. Built-on relay
11. Line terminal
12. Load terminal



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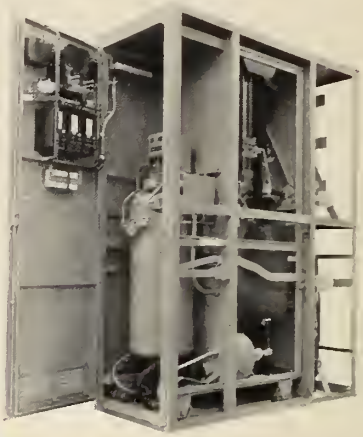

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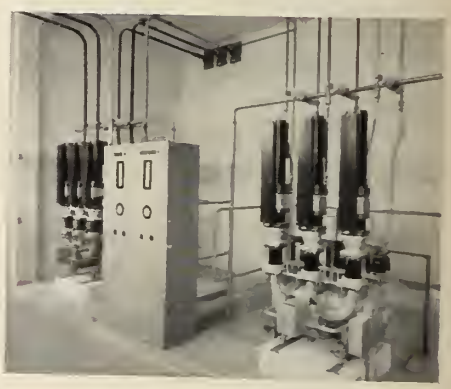

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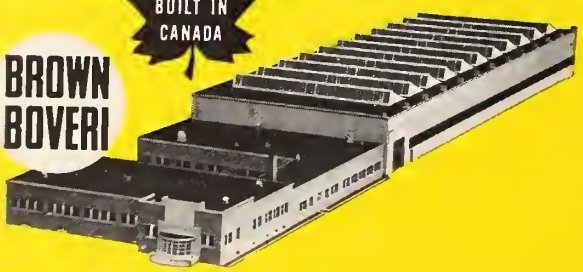

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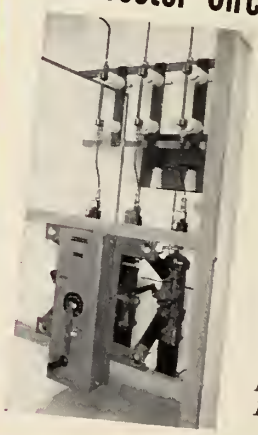

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ounselling of high school graduates oncerning the opportunities in the ngineering field. The speaker was introduced by W. G. Seline and thanked by G. H. Cook.

Shawinigan Falls Junior Branch

On October 15, the 1952-53 session of the Shawinigan Falls Junior section was officially opened. C. Holm of Shawinigan Chemicals Ltd. spoke at this meeting on "South Africa". Mr. Holm, who had just returned from a six-month visit to the Union of South Africa, discussed the history, topography, sociology, and the politics of South Africa. He demonstrated the effect of each factor upon the industrial worth of the country and its relationship with the rest of the world at the present time. The speaker was introduced by D. Demianiw and thanked by K. Moynahan.

The second meeting of the section featured an address by J. M. Lambert, local manager of the Royal Bank of Canada, who spoke on "Banking". Mr. Lambert discussed the history of banking, and the functions of banking in the economic and cultural structure of today's society. A lively discussion period followed. Mr. Lambert was introduced by B. MacTavish and thanked by J. Whitehead.

N. R. Fasken, research director of the Shawinigan Water & Power Research Laboratories, spoke on "Industrial Research" at the third meeting. Mr. Fasken's humorous and informative talk dealt with the work carried out by industrial research groups and by his own laboratory in particular. Slides and specimens were shown to illustrate the talk. The speaker was introduced by D. Cowan and thanked by V. Martinusen.

The final event of the first half of the session was a dance held on December 5, 1952, at the Shawinigan Falls Legion Hall. In spite of the inclement weather, the event was well supported by an attendance of 80 couples.

Montreal

R. J. Harvey, M.E.I.C.,
Secretary-Treasurer

Student Guidance Forum

A forum for English-speaking high school boys was held on January 28 at the Engineering Institute Headquarters.

Notice cards and a letter of invitation had been previously sent to 19 schools, and newspaper notices were secured.

After the roll-call, 14 schools were found to be represented, with about 125 boys in attendance. Prof. R. K. G. Morrison, Canadian Institute of Mining and Metallurgy, and B. G. Spracklin, Chemical Institute of Canada, were guests. Messrs. Bournival, Goodwin, Moxon, Nourse, Rousseau, Tinkler and Wong were the student guidance committee members present.

An address "Professional Engineering as a Career", was given by Irving R. Tait, consulting engineer of Canadian Industries Limited. Mr. Tait interpolated suitable personal experiences, and featured in his excellent talk the duties of a project engineer. It was received by the boys with great interest. He was introduced and thanked by the chairman.

This address was followed by an hour's question and answer period. Some 68 cards were sent up by the boys, with a wide variety of questions. Replies to selected questions were given by the engineers present. All cards collected were later mailed to 12 schools concerned.

Sudbury

G. W. Fleming, jr.e.i.c.,
Secretary-Treasurer

H. M. Whittles, jr.e.i.c.,
Branch News Editor

Members Night Dinner Meeting

The Sudbury Branch held a "members night" dinner meeting at the Sudbury Granite Club on Thursday, February 12, 1953. The speakers were two Sudbury Branch members, J. F. McCallum and N. J. Weedmark, both of whom have had considerable experience in their respective fields.

After the dinner and general business meeting George Green introduced J. F. McCallum who graduated from Queen's University in mechanical engineering in 1942, and has been with The Kalamazoo Vegetable Parchment Company at Espanola for the past few years. His address was entitled "The Engineer's Place in The Pulp and Paper Industry".

Mr. McCallum outlined two types of paper mills, the "mechanical mills", producing newsprint of which Canada supplies 85 per cent of the United States' demand, and the "chemical mills", producing the higher quality papers. The latter type has two distinct processes, the "sulphite" or "acid" process from which comes the softer papers, and the "sulphate" or "alkaline" process, producing the stronger types of paper. The chemical mills such as the one at Espanola are meeting severe competition from the Scandinavian countries whose economy depends upon selling their pulpwood at whatever price the market will yield.

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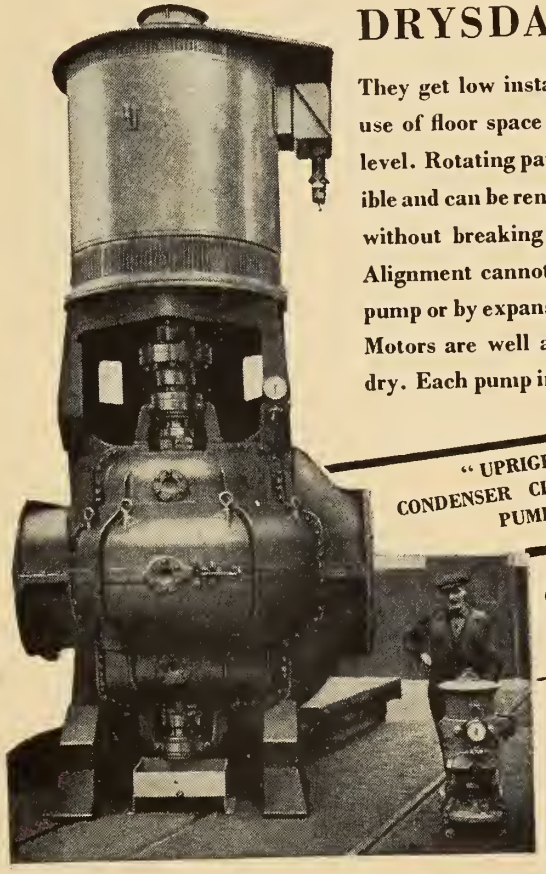

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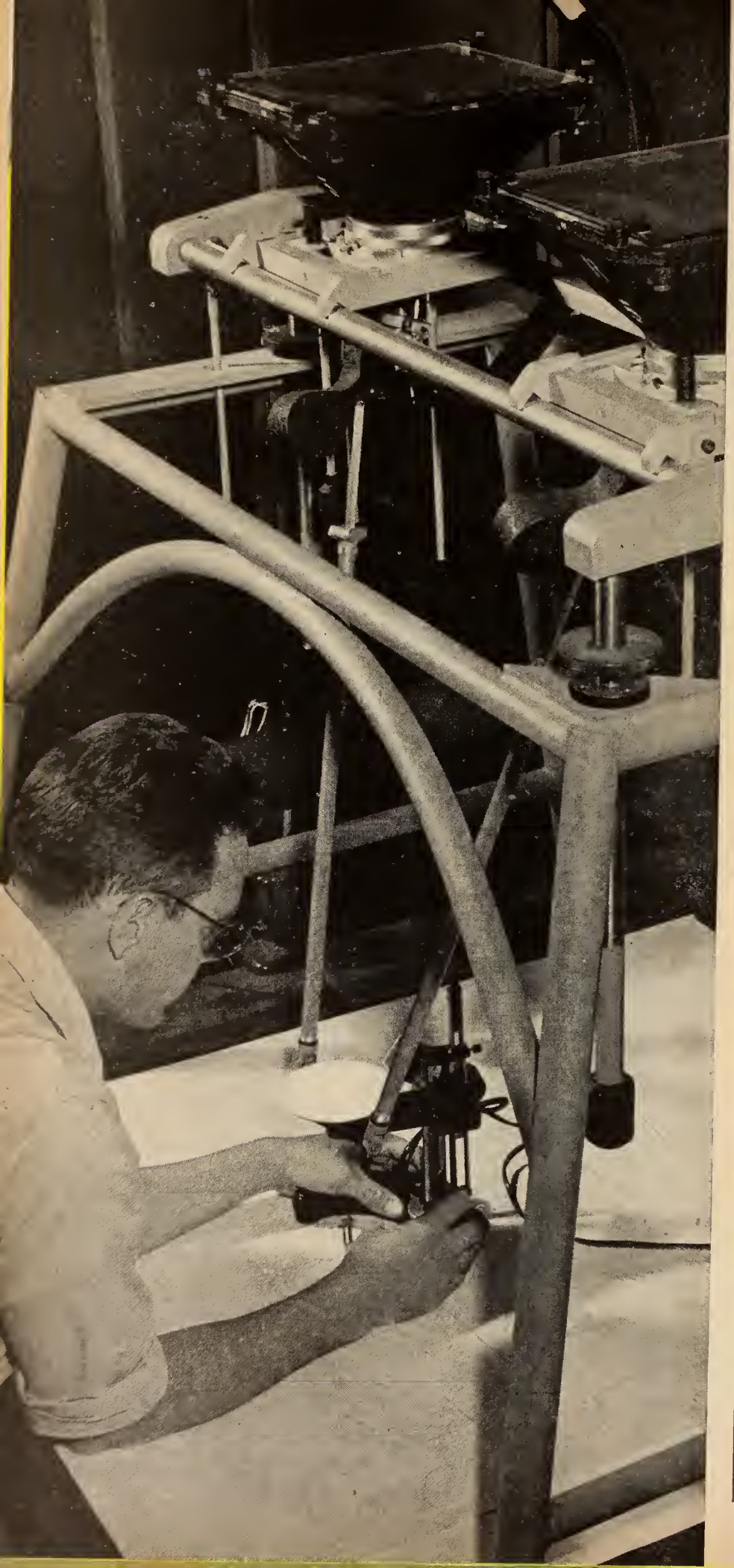

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Maps are different today, and so are map-makers. Now air photos swiftly record the map data. Surveying and leveling are used chiefly to provide a network of ground control for the air survey. Today precise stereoplotting instruments like this one are at work at CANADIAN AERO, producing air maps for engineering requirements all over Canada.

But Mercator's demand for accuracy still holds, and these modern maps are fully detailed and dependable within quite exact limits—so much so that estimates for cut and fill are based on AERO maps. Other AERO maps are used for city planning, mining developments, power and pipe line location, logpile and ore dump inventories, and for a host of other projects.

Moreover, the cost of AERO methods is a fraction of ground survey costs—*often half or less!* And air mapping is many times faster than ground surveys, so the whole project is greatly speeded.

Working as a team, our flight staff, field surveyors and office personnel join their special skills to compile maps you can depend upon. CANADIAN AERO's broad experience can aid your project. Call on us.

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Mr. McCallum stated that the industry now employs more men with an engineering background than were required prior to the war. This is due to the vast improvement in machinery and the production rate speed-up which require mechanical, chemical, civil, and electrical engineers, each for a specific task within the plant. He also stressed the fact that although the pre-war rate of production has been increased by over 200 per cent, the greatest saving in cost still has to be realized from improving the methods of cutting and removing the pulp to the mills. Regeneration and reforestation are contributing factors in making it possible for the industry to operate on a continuous basis.

The mill at Espanola is producing approximately 100 grades of paper, all of which have to pass through converting mills to be waxed, coated, painted or sized before going to market. About 30 per cent of these grades are for ordinary household purposes.

The next speaker, N. J. Weedmark, a graduate in electrical engineering from the University of Toronto, was introduced by Grant Benjafield. Mr. Weedmark who is employed by the International Nickel Company in the electrical engineering department at Copper Cliff, spoke on "Control of Interlocking Electrical Systems".

He used several electrical diagrams and graphs to illustrate what takes place when two or more large electrical power plants are interlocked with a common tie-line, and how the electrical balance which has been temporarily upset, is quickly restored to its original normality. This control is made possible now by the use of governors and new electronic devices which quickly sense that the balance has been upset and set about almost immediately to restore it. This control, which formerly had to be done by manual methods, if at all, which at best, were very slow and unreliable, is now very rapid and accurate.

Mr. Weedmark stated that the trend in the future would be to interlock many large power plants over the entire country or continent and thus bring about a considerable reduction in the cost of power and the maintenance of equipment. By this means one unit could be cut out of the circuit quite easily without increasing the load on the remainder of the system too greatly. The limiting factor with such a system, however, would be the distance that power can be carried without too large a line loss. At any rate, engineers could look forward to a great many benefits in the future.

Both speakers conducted a brief question period immediately following their respective addresses, and were thanked by D. J. Ripley for two very interesting and informative talks.

Lennox Lane, chairman of the education committee, announced a series of "members address" meetings that will be held once every two weeks for approximately a dozen meetings. The attending members will be called upon to give short addresses on a subject chosen at random. This plan will give the local members experience in speaking before an audience. A sidelight of this plan is that a junior member of the Branch will be appointed to act as chairman for the regular member meetings and gain experience in handling the proceedings.

W. J. Miller, chairman of the local Branch, announced that a nominating committee, consisting of Jim Smith and Bill Dale had been appointed. Mr. Miller also called for a discussion on the idea of a working agreement between the Professional Engineers of Ontario and the Engineering Institute. Such an agreement had already been reached in all other provinces except Ontario and British Columbia which were lagging behind in a movement that would affect a considerable savings in costs and overlapping services.

John Quance announced that the next meeting would be held in about four weeks with Rolly Graham of North Bay speaking on "The Hydro Electric Development at Niagara Falls", and supplementing his address with some slides.

Toronto

H. M. Kolesar, Jr.E.I.C.,
Secretary-Treasurer

Dugald Cameron, M.E.I.C.,
Branch News Editor

J. Ross Addresses February Meeting

The February meeting of the Toronto Branch was held on Thursday,

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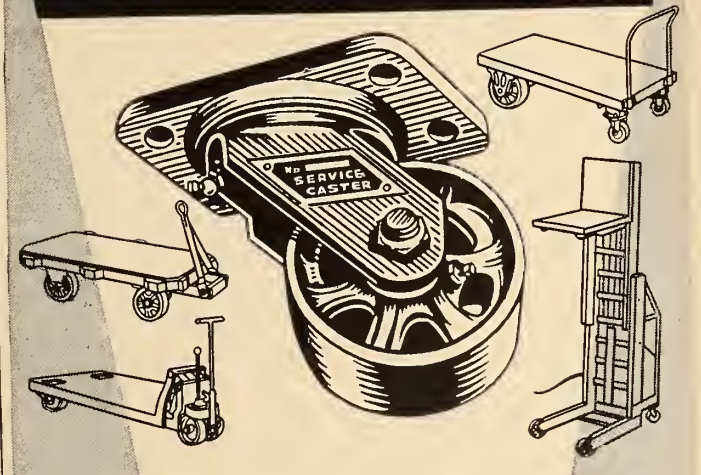

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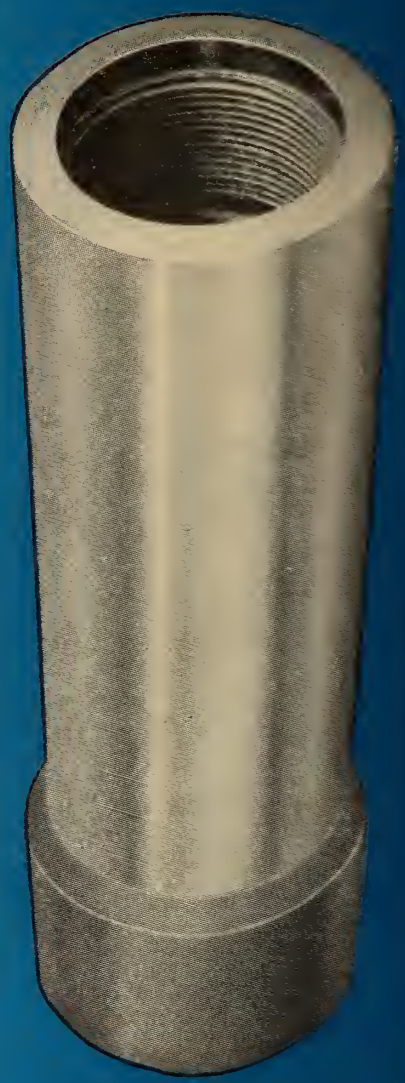

DELORO SMELTING & REFINING COMPANY, LTD. DELORO, ONTARIO

February 5, 1953, in the Mechanical Building of the University of Toronto.

The meeting was well attended both by members of the Branch and an interesting number of visitors including members of the American Institute of Heating Engineers.

John Hall, Branch president, opened the meeting and called on Harvey Self to introduce the new Canadians attending the meeting. There was quite a number from various parts, including one from Turkey. The meeting gave them a very hearty welcome and Mr. Self invited them to place their names on the mailing list for notice of future meetings and to attend if they so desire.

J. Ross introduced the speaker who was Walter Bartel, public relations director for the Ric-Wil Company of Cleveland, Ohio. His subject was District Heating sometimes called Central Heating and explained by Mr. Bartel, Block Heating.

Mr. Bartel traced the development of district heating from its origins in Northern Minnesota down to the present day, now an industry of major importance and increasing interest, serving large sections of down-town property in many American cities. In areas served by electric power generated largely from steam, district heating systems have developed as a by-product of the power systems, utilizing exhaust steam. In areas served by hydro-electric power, district heating systems have developed independently of any other industry, and in the Northern States of the Central region, there are a number of examples of systems serving residential areas, some of them whole communities.

Growing emphasis on a number of common problems has focussed increased interest and stimulated the growth of district heating in recent years. Some of these considerations are smoke abatement; conservation of fuel, including problems of distribution to domestic consumers; rising labour costs; greater safety and fire protection through eliminating the greatest single source of house fires; community planning trends; opportunities for improvement of heat balance and economy of operation in industrial and power plants.

Economic factors on which the advisability of developing a district system may be determined vary widely, but in general it is considered that a seasonal heating requirement of at least 6,000 degree-days is essential in the case of systems where no by-product power is involved.

With reference to district heating in Canada, it was noted that examples are to be found in Toronto: Toronto Terminals Railway Company, serving the Union Station, Coachyards, Royal York Hotel, now being extended to supply the new Unemployment Insurance building on Fleet Street; the systems serving the University of Toronto and Queens Park, and the Toronto General Hospital group; and the housing development at Ajax. Also mentioned were the district heating systems in Winnipeg, one serving downtown office buildings, and a second serving residential areas with a total of more than 4,000 homes.

System pressures vary widely, depending on the requirements of industrial and commercial users whose equipment cannot utilize steam at less than 15 p.s.i.g.; existing networks at low pressure are usually supplied by high-pressure feeders through pressure reducing stations when the capacity of the system becomes limited by that of the low-pressure mains alone.

Mr. Bartel's discussion was accompanied by slides and two excellent films showing heating systems under construction, illustrating the tools and installation techniques applied to the type of underground piping and insulation developed by his Company.

This paper was well received by the meeting and a number of questions were asked.

Ontario Division

W. L. Saunders, M.E.I.C.,
Chairman

January Meeting

The meeting of the Ontario Division was held at the Royal York Hotel on January 24, 1953. Members present included Chairman W. L. Saunders, of Owen Sound; N. Metcalf, Hamilton; W. A. T. Gilmour, Hamilton; J. W. Graeb, Sarnia; F. Dyer, Sarnia; J. J. Rowan, Sarnia; S. V. Antenbring, Sarnia; F. R. Pope, Peterborough; G. S. Wade, Peterborough; W. B. Pennock, Ottawa; E. R. Eaton, Sudbury; E. V. Buchanan, London; M. McMurray, Toronto; J. McLaren, Toronto; E. Cross, Toronto; R. Graydon, Toronto; and C. D. Carruthers, Toronto.

C. D. Carruthers was appointed secretary of the meeting by the chairman.

Mr. Saunders expressed his satisfaction at the excellent turnout and the interest shown. He informed the meeting that since he was retiring from the Department of Highways at Owen Sound he would have to resign as chairman of the Ontario Division.

Mr. Graydon read from the constitution of the Division the clauses dealing with election of officers which called for the chairman and secretary to appoint a nominating committee.

Mr. Saunders then appointed the following to make up the nominating committee: E. Cross, Toronto; C. Carruthers, Toronto; and W. B. Pennock, Ottawa.

This committee was to prepare a slate of officers to be sent to all members of the executive of the division.

A letter from G. T. L. Andrews, councillor of the Kingston Branch, was read giving his opinion upon seeking some agreement with the Professional Engineers of Ontario.

There was considerable discussion on the question of an agreement with the Professional Engineers of Ontario regarding scope, timing and the method of approach.

Finally it was moved by N. Metcalf and seconded by E. Cross, that the three Toronto councillors should be given authority to explore the situation with respect to furthering co-operation with the Professional Engineers of Ontario and to appointing a committee to seek a meeting with a similar committee from the Professional Engineers of Ontario. The motion was carried unanimously.

The opinion was expressed that no paid officers of either organization should be on these committees.

It was moved by R. Graydon and seconded by W. Pennock that the meeting be adjourned.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

K. R. Shipley Guest Speaker in December

A meeting of the Winnipeg Branch was held on December 18 and the topic under discussion was "Planning a Modern Petroleum Refinery for Manitoba".

Some of the more important problems in connection with the overall design of Imperial Oil Limited Winnipeg refinery were outlined by K. R. Shipley, superintendent of the recently completed East St. Paul plant, who was guest speaker. Slides were shown to illustrate the important processes used in the refinery.

It was first pointed out that the Interprovincial Pipe Line made it economically possible to build a refinery in Winnipeg as it brought to Manitoba crude oil at a competitive price for the first time.

Some of the factors effecting the location of the refinery in Manitoba were brought out. It was pointed out that Manitoba with its reliable supply of electrical power with a minimum of interruptions and at reasonable cost had a decided effect on the design of the utilities for the refinery. This meant that most of the drivers for the process pumps and the 1,000 hp. driver for the centrifugal air blower on the catalytic cracking unit could be electric motors rather than steam turbines.

At the time the design of the refinery was made, the lube oil requirements for the province were comparatively small and therefore good lube oil refining facilities could not be constructed at a sufficiently low enough cost to make lubes at a price competitive with those imported into the province. It was only possible, therefore, to design a fuel products refinery to meet the company's marketing requirements with some added capacity to take care of the immediate future.

The effect of quality, especially that of motor gasolines, on the design of the cracking and treating equipment, was stressed.

Some of the design changes, compared with older petroleum refineries, were mentioned to show the effect on the construction costs and operation. The more important departures were: non-centralized field pumping and shipping facilities without shelters; location of boilers outside without the conventional large building to completely house them; and centralization of control facilities combined with integration of the processing operations.

Centralization of the control facilities permitted operation of the processing equipment with less manpower. This was important in a refinery of this capacity as it is necessary to man the process units for 24 hours daily.

Comparative costs of the processing equipment, utilities, tankage and other facilities were given.

The following slides were shown: a crude unit flow diagram; a fluid catalytic cracking unit flow diagram; a central treating facilities flow diagram; a utility plant; a water separator; and a view of the completed crude unit and catalytic cracking unit.

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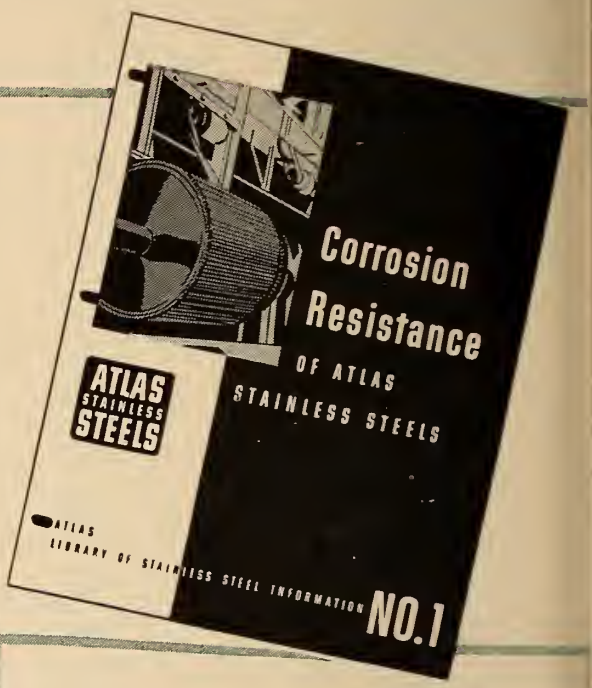
this book helps you...



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It's a "must" for executives, engineers, metallurgists, designers, superintendents, and foremen who fabricate and deal with stainless steel products. AND—it's yours for the asking!

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If you would like a copy of this invaluable handbook, address your request to the Advertising Department, Atlas Steels Limited, Welland, Ontario. As Canada's pioneer producers of stainless steels, Atlas is naturally anxious to familiarize fabricators with correct methods of selection, use and handling. In addition to technical literature, we are pleased to provide expert metallurgical counsel and service on request.

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SS1-53

T. E. Storey speaks to the members of the Electrical Section prior to the tour. Mr. C. D. Osterland, Electrical Section chairman, is in the foreground, and directly behind Mr. Storey is H. L. Briggs, general manager of the Winnipeg Hydro Electric System.

Winnipeg Electrical Section

G. Flavell, jr.e.i.c.,
News Editor

Tour Through Winnipeg Hydro Steam Plant

One hundred and fifty members and guests of the Electrical Section participated in an interesting and enjoyable evening on Thursday, February 5, as guests of the Winnipeg Hydro's engineers at their steam plant on Amy Street.

Arrangements for a tour of the plant were more than complete, as each member was provided with a printed booklet, describing in detail the steam and electrical facilities of the plant. The thoughtful host had even provided paper towels for the trip to take care of soiled hands.

Prior to the trip, H. L. Briggs, general manager of the Winnipeg Hydro Electric System, briefly outlined the history of the plant and it's original purpose. After a heavy storm in 1922 which interrupted power for several days, it was decided to erect a steam stand-by plant, and to offset the high fixed charges, they included a central steam heating system to serve downtown Winnipeg. Since that time the plant load has steadily increased and boilers and turbo generators have been added to keep up with the demand. At the present time, there are the three original turbo generators, one 1,000-kw., and two 5,000-kw. units, and in addition a 15,000-kw. unit has just been completed, and a 25,000-kw. unit is presently being prepared for.

Originally, there were three electric boilers to make use of off-peak power, and four 70,000-lb.-per-hr. pulverized coal fired boilers. Since then, there has been added a 125,000-lb.-per-hr. stoker coal boiler and a 165,000-lb.-per-hr. pulverized coal fired boiler, with a 280,000-lb.-per-hr. boiler to be installed for the new turbo generator.

Mr. Briggs pointed out that for the present, the turbo generators would be used only for peak-load power or when the waters at the hydro electric plant were low. The capital cost for the completed steam plant will be approximately $90.00 per horsepower.

Mr. T. E. Storey, assistant general manager of the Winnipeg Hydro Electric System, then outlined briefly what the guests were to see during the tour of the plant, and then the assembly was divided into groups, each group provided with a "steam plant" guide and then a "electrical" guide to answer any questions that arose.

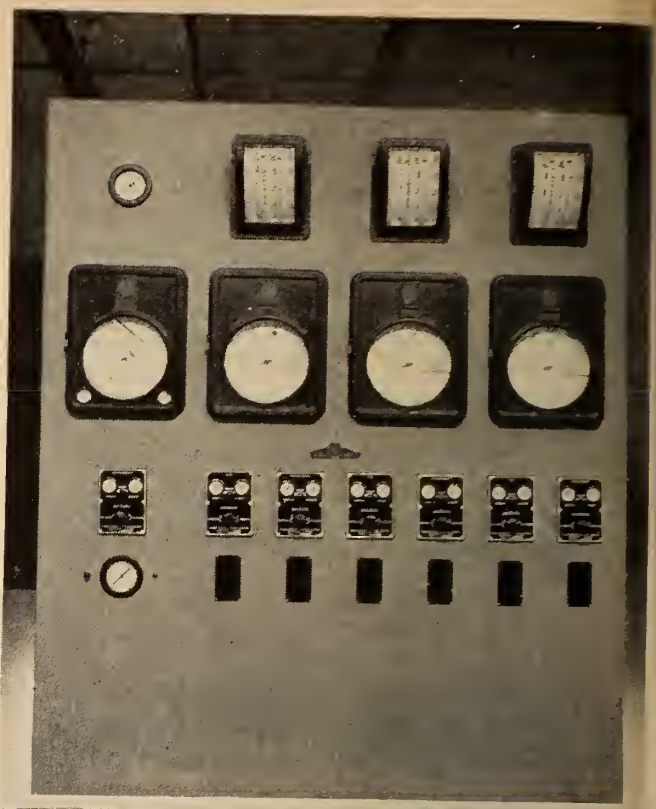
The group inspected the turbo generators, electric boilers, coal fired boilers, coal pulverizer systems, ash handling systems and the feed water pumps. Following this the "electrical" guide took over and guests visited the outdoor switchyard, the indoor distributing system, transformers, regulators, relay panels and finally, the control room.

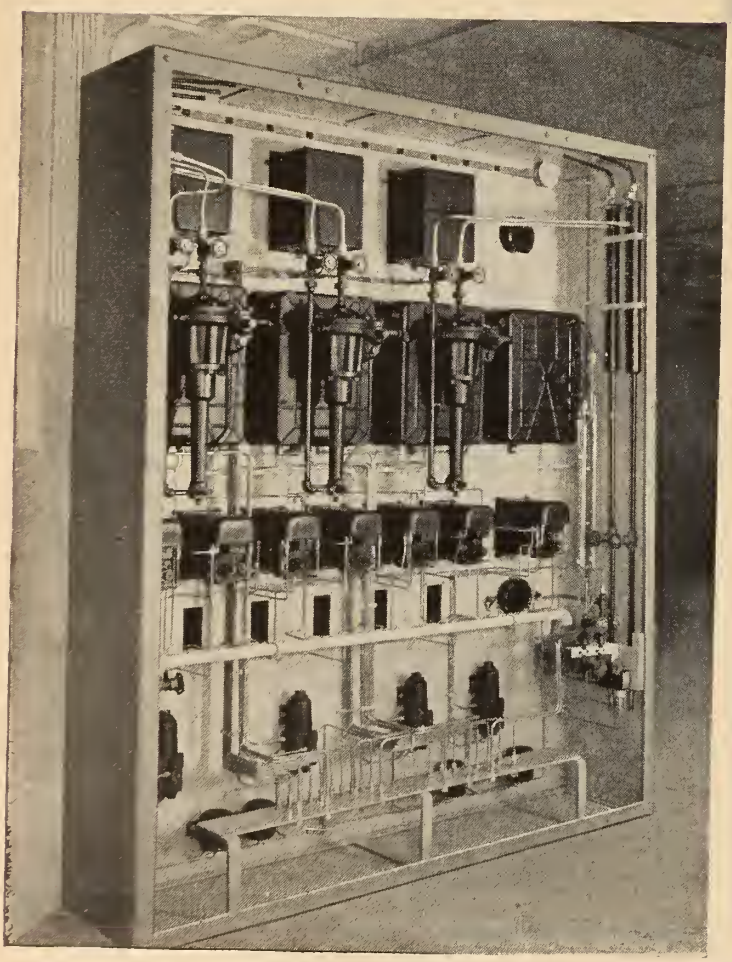
On completion of the tour, the guests were treated to a very ample supply of coffee, sandwiches and cake. As hosts to the Electrical Section, the Hydro engineers had provided a most enjoyable evening for those in attendance.

From left to right: C. D. Osterland, chairman, Electrical Section; T. E. Storey, R. A. Stewart, L. A. Bateman, and D. C. Bryden.

One group of the members on tour are shown beside the coal pulverizer for the new 15,000-kw. turbo-generator boiler.

Bailey panel boards





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case history

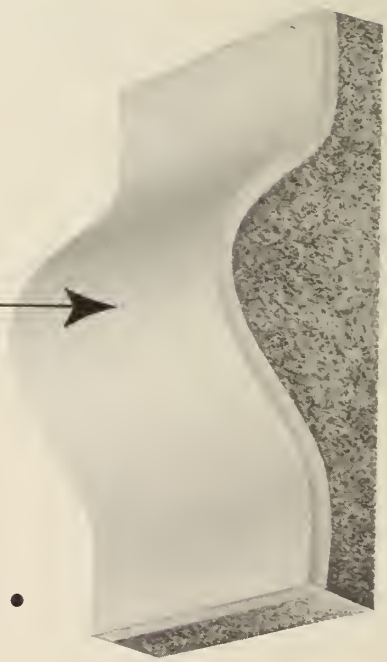
DOMINION ENGINEERING WORKS LTD., LACHINE, P.Q.

THE MONTREAL PLANT of the Dominion Engineering Works Limited at Lachine, Quebec, consists of a group of buildings each housing a different phase of the company's operation. The construction of all newer buildings follows a basic pattern. The result is a harmonious architectural relationship, but more important is the fact that with such a basic plan, the erection of additional structures is simplified.

The relative lightness of the steel in the walls is due to the low weight of the siding which is asbestos-cement sheeting. Where insulation is required sprayed asbestos fibre is applied, resulting in a tight insulation with minimum weight. The old concept that the thickness of the walls determines the effectiveness of the insulation no longer applies. With the above mentioned type of sidewall construction, in addition to the use of lighter steel wall members, there is a further economy factor in the application, as large sheets of this type can be quickly erected. With building costs as they are it is found that compensation can be attained, in some measure, by selecting materials on which maintenance cost is low or nil. This point of view is long range but merits consideration.

For pictorial and other data please turn page

There are 2 sides to this story...



It is the story of a building of Dominion Engineering, Lachine, Que. The outside walls are of Turnall Trafford Tile and the inside of the walls are insulated with Sprayed "Limpet" Asbestos. This is a happy combination of kindred materials that combine to provide a building which is ideally suited for our rigorous and variable climate.

TURNALL TRAFFORD TILE

Briefly, it is economical because it need never be painted . . . becomes even tougher with age . . . requires little or no maintenance . . . large areas can be quickly covered. Its appearance is eye-pleasing and it lends itself to most any architectural form.

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Where a tight insulation is required Sprayed "Limpet" Asbestos is the answer, for it seals every joint and crevice. It is specially treated asbestos fibre projected simultaneously with a fine water spray. The thickness of the "Limpet" is determined by the conditions and the results required.

See next page for data on both products.

ASBESTOS-CEMENT Turnall TRAFFORD TILE

SPECIFICATIONS

Purlin Spacings up to 4′ 6″.

Side or Gable Girts spacing up to 6′ 0″.

Standard lengths from 4′ to 10′, rising by 6″ increments.

Standard width, 3′ 8″.

Net covering width when laid, 3′ 4″.

Cover efficiency, 86 per cent.

Thickness, 9/32″.

Number of corrugations per tile , 4.

Pitch of corrugations, 1′—1 -1/3″.

Depth of corrugations, 2″.

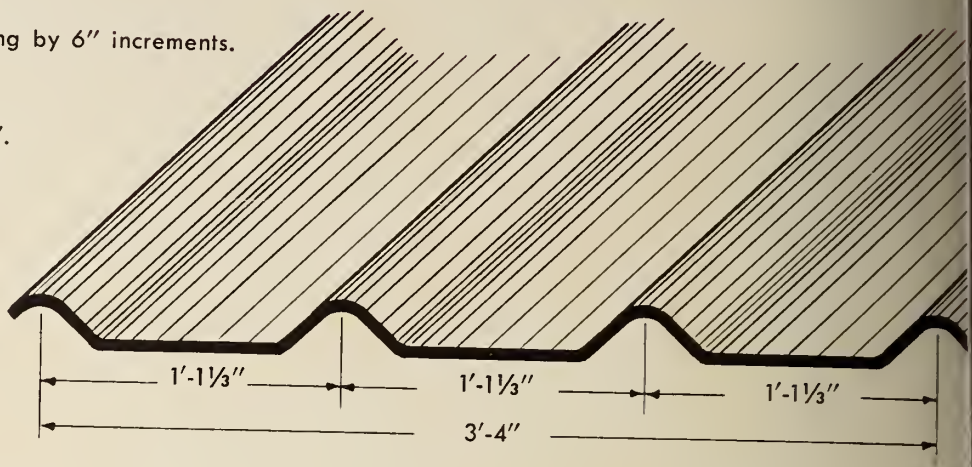
End lap, 6″.

Side lap, 4″ (1 corrugation).

Actual cover of 8′ tile as laid, 7′ 6″ x 3′ 4″ — 25 sq. ft.

Weight—Approx. 3 lbs. per sq. ft., uncrated.

DIAGRAM SHOWING SECTION OF TURNALL TRAFFORD TILE



Weight of 100 sq. ft. of laid roofing, approx. 351.8 lbs.

118 sq. ft. of tiling covers 100 sq. ft.

SPRAYED LIMPET ASBESTOS

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Briefly it has six major uses and is equally efficient regardless of the primary function for which it is applied.

Thermal Insulation
Fire Protection
Sound Absorption
Anti-Condensation
Dust Exclusion
Anti-Corrosion

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Thermal Insulation:—Thermal Conductivity (K) 0.33 B.T.U.s sq. ft/1 hr./°F./in.

Fire Resistance: Complies with requirements of the B.R.S. Fire Test. (Full details will be supplied on request.)

Specific Heat: 0.2.

Condensation: Under peak conditions "LIMPET" Asbestos Spray, roughly pressed, will absorb more than its own weight of water.

Can be applied to all building materials.

Can be flattened or moulded up to two hours after application.

Dries out sufficiently for all practical purposes in 24 hours.

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Can be reinforced if required.

Plaster type finish gives surface only slightly less hard than ordinary plaster.

Subject to its particular function, it can be decorated.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Canada's century. D. M. Lebourdais. Toronto, Methuen, 1951. 214 pp., illus. $4.00.

The exact quality of this book which gives one at once pride and excitement in the thought of Canada as a developing country, is rather difficult to define, but it is definitely present.

In spite of the fact that this volume is packed full of factual information, one quickly finds oneself becoming completely absorbed in it, and one's perspective gradually changing.

How many of you realize that our Mackenzie River is comparable in size to the Mississippi, and flows northwestward into the Arctic Ocean, as does also the mighty Yukon into the Bering Sea. Likewise the greater part of our prairie land is drained by the Saskatchewan and Red rivers, which flow northward into Lake Winnipeg, which is in turn drained via the Nelson River into Hudson Bay.

And although you do really know it, the author will also bring to your mind that the two most easterly airports in North America are in Newfoundland, and our Maritime ports are a full day's sailing time nearer Europe than any others on the coast. Except for the experienced engineer having some connection with the so-called "new developments" in Canada, such names as Seven Islands, Chibougamau, Burnt Creek, Knob Lake, the Canadian Shield, Spruce Lake, Precambrian Bridge, Norman Wells, Kitimat and Whitehorse, are familiar names, perhaps vaguely connected in your mind with a company or a mineral deposit. *Canada's Century* will change this vague acquaintance into an intelligent and compelling interest.

You will also find yourself fascinated with Canada's forest resources, the annual destruction wrought by fire, and insects, and what our government is doing about it. Perhaps one of the best compliments a reviewer can pay to a book, is sincerely to want a large number of people to read the book in question for the enjoyment that they will most surely get out of it.

That is our wish for *Canada's Century*.

—E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

The ABC of gliding. Fox Geen. London, Allen & Unwin, Toronto, Thomas Nelson, c1952. 103pp., illus., $3.00.

This primer makes no pretense at being an authoritative work on the art of gliding, but it does try to be helpful. It is intended as a supplement to proper instruction on the flying-field. More than half of the book is concerned with slides, hops, turns and circuits on a primary glider. The pupil is then transferred to an intermediate sailplane and is given simple advice and explanations about the machine itself, instruments, spoilers, advanced manoeuvres, soaring, winch driving and care of aircraft. No technical education is required for complete understanding of this work by the student.

Adhesives for wood. R. A. G. Knight. New York, Chemical publishing co., 1952. 242pp., illus., $5.00 (U.S.).

After dealing with natural and synthetic adhesives, the author has devoted chapters to such factors in gluing technique as pressure, moisture, contamination of wood, preparation of surfaces, acidity and alkalinity, temperature penetration into wood and permeability of glue. Next follow chapters on the conditions under which adhesives are used, on the testing of adhesives, on their durability and on the bonding of wood to other materials. Containing numerous tables, bibliographical references and illustrations as well as a glossary and a detailed index, the present work will be useful both as a textbook and reference book.

Electric fuses: a critical review of published information. H. Lāpple. Toronto, Butterworth, 1952. 173pp., $5.00.

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Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

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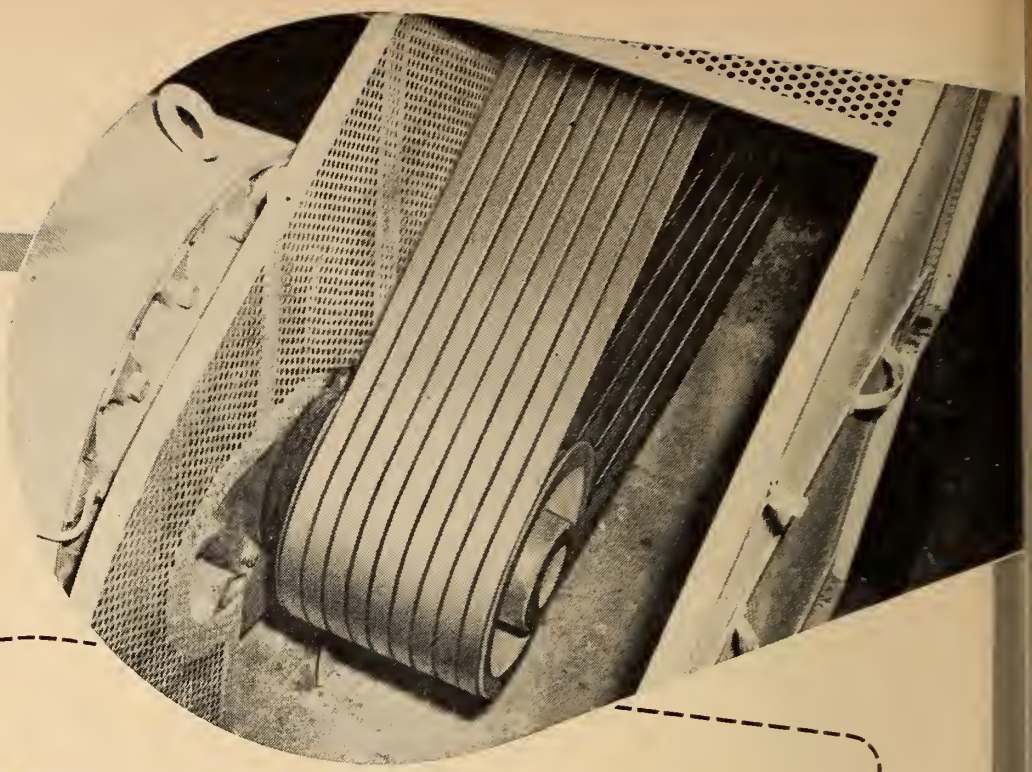

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The present work covers the historical development of various types of fuses including those used at the highest voltages. It discusses physical aspects, circuit-breaking problems, breaking-capacity, deterioration and time-current characteristics and makes a critical examination of several basic formulae from various sources. Its outstanding feature is a chronological list of two hundred and sixty-seven references, giving, in each case, an abstract of the article. The book is indexed but not illustrated.

Electrical engineer's reference book, 6th edition, ed. E. Molloy. London, Newnes, Toronto, British book service, 1952. Sectional paging, illus., $12.75.

The fact that this is the sixth edition of this same reference book in seven years is proof of its value and continued usefulness. It contains the most recent information available on new developments in all branches of electrical engineering exclusive of radio and telecommunications.

Detailed information on transformers, rectifiers, protection, and sub-station equipment is included for transmission and distribution engineers, and industrial executives will find a comprehensive survey of the newest in applied electrical engineering.

New articles cover operational methods for transients, power station cabling and gas turbine power plants, street lighting, electrode steam boilers, electrolytic production of hydrogen and oxygen, geiger tubes, ultrasonics, magnetic amplifiers, and the d-c. bias system of control. In addition, the articles on Electricity in automobiles, and road traffic signalling have been entirely rewritten, as has the section entitled Progress.

Section thirty-one, entitled Electrical Literature, is an invaluable collection of periodical titles, and bibliography of both magazine articles and books, arranged according to subject, which is followed by a short description of the Universal Decimal classification in the field of electrical engineering, and is well indexed.

This volume merits the attention of all our electrical members.

Essentials of microwaves. R. B. Muchmore. New York, Wiley, c1952. 236pp., illus., $5.40.

This is an excellent survey for anyone who wants to improve his knowledge of microwaves. In the first chapters, the fundamental empirical laws are given, explained and applied to the phenomena that they govern. Subsequent chapters take up electronic devices such as multiple-stream tubes and klystrons and discuss such illustrative applications of microwave equipment as microwave radio systems and radar. Appendices give the "Physical meaning of the mathematical symbols in the text" and a quantity-symbol-unit table. The book is indexed and illustrated with a few photographs and many line drawings.

Metal industry handbook and directory, 1952. London, Louis Cassier, 1952. 448pp., illus., £2.12.0.

This directory is divided into four sections. The first section (almost two-thirds of the volume) gives, among other things, the properties of metals, metal statistics, tables of expansion of alloys, a list of proprietary alloys with suppliers, and lists of British Standards, D.T.D. Specifications and Admiralty Specifications with abstracts and explanations. The second section gives tables and data on weights and measures, conversion factors, hardness, gauges, prices, etc. The third section deals with electroplating, polishing and finishing, while the fourth contains directories of associations and societies, technical institutions, a subject directory for buyers and a list of addresses of advertisers. This directory is remarkable for the hundreds of tables that it contains.

Plastics in building. J. B. Singer. London, Architectural press, Toronto, British book service, c1952. 192pp., illus., $3.75.

The aim of this book is to provide, from a practical point of view, technical guidance for the use of plastics in the building industry. It is written by an architect and gives a good understanding of the architectural potentialities and limitations of this material. The author has divided the book into four parts. The first gives general and historical outlines and deals with merits and limitations, raw materials and processing. The other parts cover exterior and interior work and discuss possibilities. Drawings, photographs, a glossary of trade names, a short bibliography and an index further the usefulness of this book.

Proceedings of the United Nations scientific conference on the conservation and utilization of resources, 1949. Volume 2, Mineral resources. New York, United Nations, Department of economic affairs. Toronto, Ryerson, 1951. 303pp., illus., $3.00.

This is one of the eight volumes of Proceedings of the conference held at Lake Success 17 August-6 September 1949. This volume contains papers on mineral supplies and their measurement, the outlook for future discovery, increasing mineral resources by discovery, conservation in mining, milling and manufacture, conservation by corrosion control and substitution, and on inorganic fertilizers in conservation. Many of the articles are illustrated. Each one is preceded by an abstract and followed by a bibliography and a discussion.

Proceedings of the United Nations scientific conference on the conservation and utilization of resources, 1949. Volume 3, Fuel and energy resources. New York, United Nations, Department of economic affairs, Toronto, Ryerson, 1951. 333pp., illus., $3.00.

This is also one of the aforementioned volumes of Proceedings. It contains papers on techniques of oil and gas discovery and production, new techniques for increasing production of oil and gas, oil chemistry, coal mining, coal preparation, underground gazification of coal, coal carbonization, conservation in utilization of fuel for space heating, the integrated power system and new developments in production and utilization of energy. As in the previous volume, most papers are illustrated, each also being preceded by an abstract and followed by a bibliography and a discussion.

Sound insulation and room acoustics. P. V. Bruel. London, Chapman, Toronto, British book service, 1951. 275pp., illus., $7.00.

The object of this survey is to give civil engineers and architects a better knowledge of the laws of acoustics, enabling them to share in the progress that has been made in the practical application of these laws. The main chapters deal with fundamental ideas, physiological acoustics, fields of sound, absorbents, sound insulation, damping of noise and room acoustics. The book will be valuable to all concerned with the design, repair or modernization of auditoria and meeting halls. It contains a very extensive bibliography, is indexed and adequately illustrated.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Advanced mechanics of materials, 2nd ed. F. B. Seely and J. O. Smith. New York, Wiley, 1952. 680pp., illus., $8.50 (U.S.).

This textbook is intended for advanced undergraduate and first-year graduate students and continues the subject beyond the usual course in strength of materials. It aims to show the limitations of the ordinary formulae, to consider the conditions under which the limitations are significant, and to extend the subject to more complex topics. It also endeavors to give a more comprehensive view of the fundamental concepts and methods used in stress analysis. In addition to extensive revision throughout, two new parts have been added: influence of small inelastic strains on load-carrying capacity of members, and introduction to instability —buckling loads.

Elasticity in engineering. E. E. Sechler. New York, Wiley, c1952. 419pp., illus., $10.20.

This book is intended to fill the gap between strength of materials and theoretical elasticity, bringing into one volume the material the engineer needs for a background in the fundamental theories of stress and deformation of elastic bodies under load. The first section establishes the equations and assumptions underlying the whole field; the second illustrates the use of these principles in solving the problems of stable (non-buckling) structures; and the third treats instability (buckling) problems. The last two sections discuss approximate methods of solving problems too complex for formal proof.

Physical metallurgy for engineers. D. S. Clark and W. R. Varney. Toronto, Van Nostrand, 1952. 567pp., illus., $7.25.

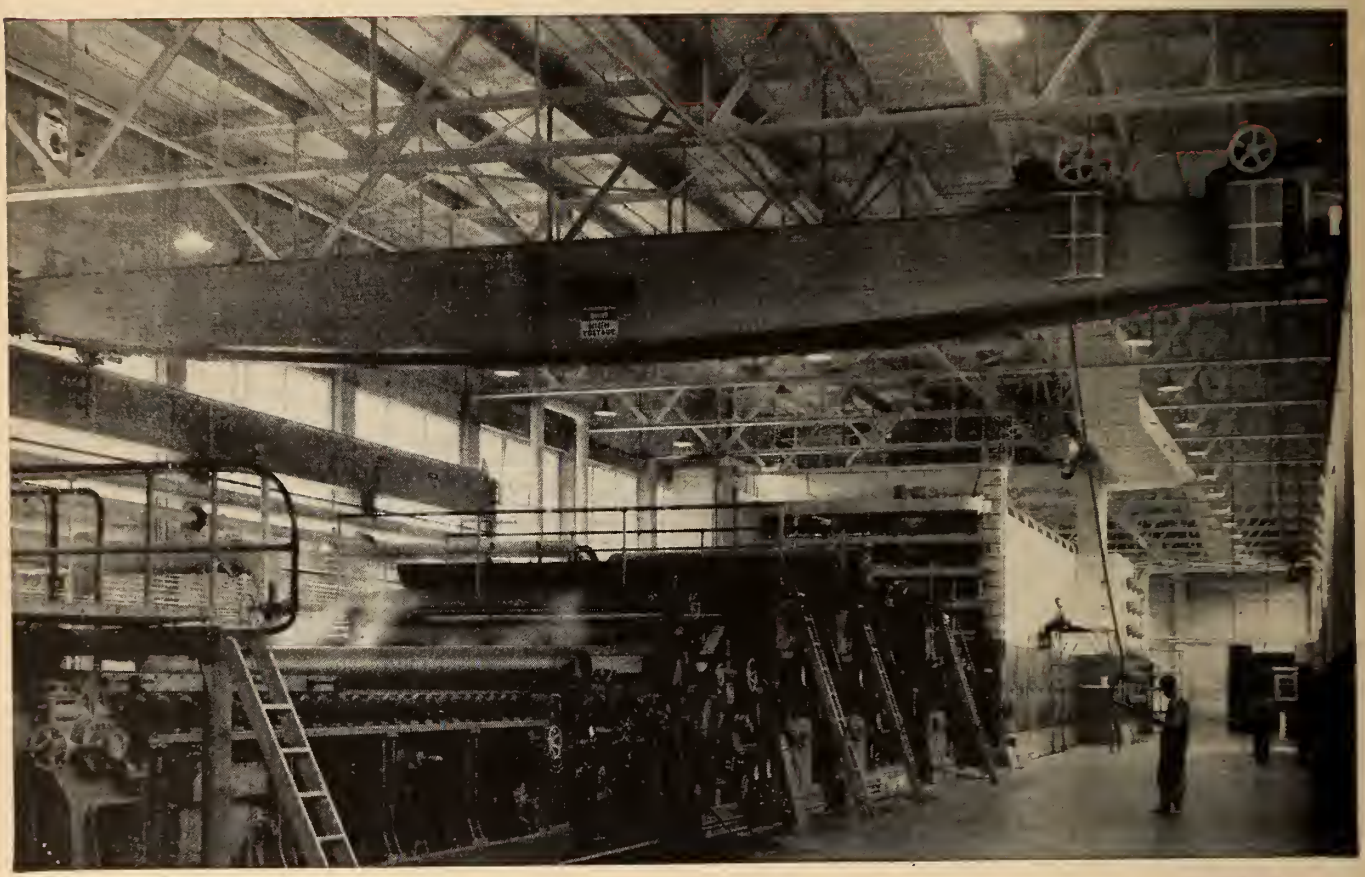
This basic textbook for undergraduate engineering students is intended to be correlated with courses in design. Only the most elementary principles are included to give the student an understanding of the materials with which he will deal. Both ferrous and nonferrous metals are covered. Special properties, heat treatment, corrosion, casting, mechanical working, and joining methods are dealt with as well as basic metallurgy. Questions are included at the end of each chapter to serve as a study aid.

ASTM standards on metallic electrical conductors. Sponsored by ASTM Committee B-1 on Wires for Electrical Conductors. Philadelphia, American Society for Testing Materials, 1952. 245pp., illus., $3.00 (U.S.).

This publication contains the various ASTM standard and tentative specifications and methods of test pertaining to metals used as insulated and uninsulated electrical conductors. Copper and copper alloys, copper-covered steel, aluminum, galvanized steel core wire, and other galvanized iron and steel wire are among the metals and metal products included. General test methods are given for the determination of resistivity of electrical conductor materials, tension testing of metallic materials, and Rockwell hardness and superficial hardness of metallic materials.

Double Trolley CRANE

10 TON 60 FT. SPAN



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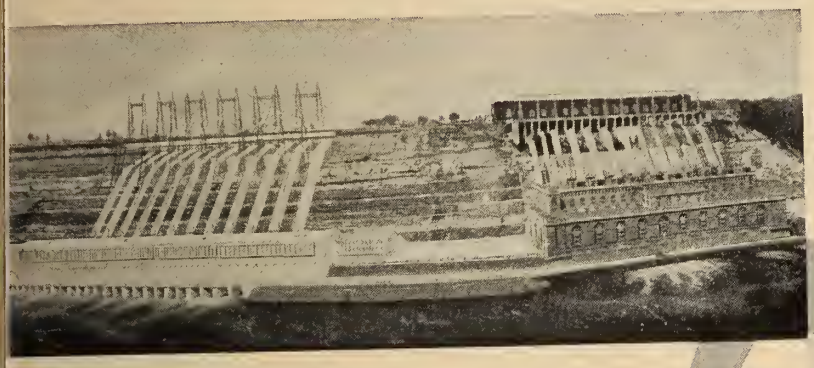
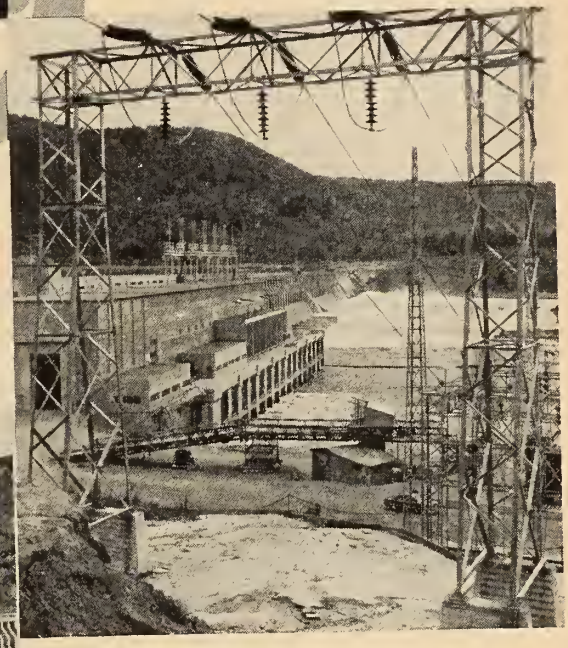
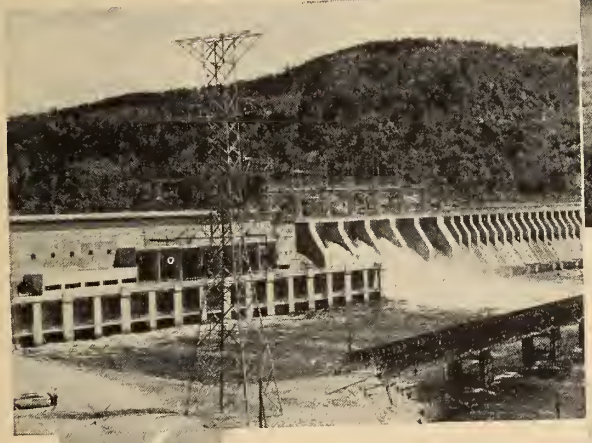


Ontario Hydro's Sir Adam Beck generating station at Niagara. When completed, this new project will generate 1,200,000 h.p.

When completed, the Otto Holden generating station on the Ottawa River will harness a total of 942,000 h.p.

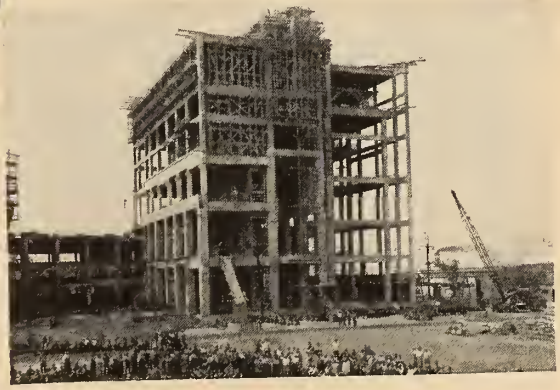


Concrete continues to be the choice of engineering and construction authorities in the harnessing of Canada's waters. In the building of dams and bulkheads, sluices and flood channels, penstock casings and gate houses concrete plays a leading part, adding further horsepower to Canada's installed capacity.



With the completion of expansion projects now underway, a total of 124,700 h.p. will be generated at the Pine Portage plant on the Nipigon River.

The J. Clark Keith generating station (steam), Detroit River, near Windsor, Ont., produces 160,000 h.p. from two units. Photo taken during construction, May 1950.



CANADA CEMENT COMPANY LIMITED

CANADA CEMENT COMPANY BLDG., PHILLIPS SQUARE, MONTREAL

SALES OFFICES MONCTON QUEBEC MONTREAL TORONTO WINNIPEG CALGARY

ASTM standards on paint, varnish, lacquer, and related products. Prepared by Committee D-1 on Paint, Varnish, Lacquer and Related Products. Philadelphia, American Society for Testing Materials, 1952. 784pp., illus., $5.75 (U.S.).

Over 200 standards are included in this compilation of specifications, test methods, and lists of definitions under the following categories: pigments; drying oils, paint, driers, and thinners; shellac, varnish, and varnish materials; lacquer and lacquer materials; naval stores; and miscellaneous. Traffic paint service tests and paint weathering tests are covered. Twenty-three new standards have been added covering tests for properties of various solvents and coatings, specifications for calcium carbonate pigments and certain emulsions, and measurements of both wet and dry film thickness.

STANDARD REVIEWED

British Standards, British standards institution, 24-28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian Standards association, National research building, Ottawa, Canada.

B.S. 499: 1952—Glossary of terms with symbols) relating to the welding and cutting of metals. 21/-

This publication is fully illustrated with sketches and line drawings; the section on radiographic examination includes reproductions of radiographs and the scheme of symbols is profusely illustrated with examples showing its application. The largest sections are naturally those relating to welding with pressure and to fusion welding. An index is included.

B.S. 1904: 1952—Commercial platinum resistance thermometer elements. 2/6.

This British standard specifies requirements for temperature-sensitive resistance elements made of platinum foil, strip or wire, usually contained in a sheath forming a thermometer bulb, and used with suitable electrical indicators, recorders and controllers for a variety of industrial purposes. Tests for stability and behaviour under vibration are included.

B.S. 1906: 1952—Hose couplings (Air and water) (⅛ in. to 1¼ in. nominal sizes) 10/-.

This new British standard covers the following types of hose couplings: "Light" series (coned type), "Medium" series (flat and coned types), and "Heavy" series (flat and coned types). B.S.P. Whitworth threads are specified for the "Light" and "Medium" series of couplings, and the Unified form of thread for the "Heavy" series of couplings.

Canadian Standards, Canadian standards association, National research building, Ottawa, Canada.

CSA A101: 1952—Mineral wool thermal building insulation. 75 cents.

This specification provides minimum requirements for the three types of mineral wool used as insulation for dwellings and other heated buildings. These three types are batts, loose fill and granular or nodular fill. Physical requirements, methods of sampling, marking and testing are given for all types.

CSA S6: 1952—Steel highway bridges, 4th ed. $1.25.

The present work applies primarily to simple-span highway bridges of 300 feet or less, including those carrying street cars or freight cars with locomotives in addition to the regular highway traffic. It may be used, however, in designing simple-span bridges of greater length than 300 feet, as well as other types of bridges.

CSA W117: 1952—Code for safety in electric and gas welding and cutting operations. $1.25.

This standard deals with the protection of persons from injury and illness and the protection of property (including equipment) from damage by fire and other causes arising from electric and gas welding and cutting equipment, its installation, operation and maintenance. No attempt has been made to deal with all hazards inherent to special industries.

BOOKS RECEIVED

Annual report of the Board of regents of the Smithsonian Institution, 1951. Washington, U.S. govt. pr. off., 1952. 449pp., illus., $3.00 (U.S.).

Architectural graphics. C. L. Martin. Toronto, Macmillan, c1952. 213pp., illus., $4.00.

Atmospheric pollution: its origin and prevention. A. R. Meetham. London, Pergamon, 1952, 268pp., illus., $7.00.

The BEAMA catalogue, 1952-53, 2nd ed. British electrical and allied manufacturers' association. London, Iliffe, c1952. 1003pp., illus., Private distribution.

Le calcul des tuyaux en béton armé et non armé. A. Guerrin and G. Daniel. Paris, Eyrolles, 1952. 316pp., illus., 3,300 fr.

The chemical revolution: a contribution to social technology. Archibald Clow and N. L. Clow. London, Batchworth, Toronto, Ambassador books, c1952. 680pp., illus., $10.00.

Control of electric motors, 3rd ed. P. B. Harwood. New York, Wiley, c1952. 538pp., illus., $7.50 (U.S.).

Designing by photoelasticity. R. B. Heywood. London, Chapman, Toronto, British book service, 1952. 414pp., illus., $13.00.

Electrical measuring instruments. Part 1: General principles and electrical indicating instruments, 2nd ed. G. F. Tagg. London, Chapman, Toronto, British book service, 1952. 598pp., illus., $15.00.

Electricity meters and instrument transformers. S. James. London, Chapman, Toronto, British book service, 1952. 467pp., illus., $10.00.

Fault calculations. C. H. W. Lackey. Edinburgh, Oliver & Boyd, Toronto, Clarke, Irwin, c1951. 296pp., illus., $6.50.

Heat transfer and fluid mechanics institute. Preprints of papers 1952. Stanford, University press, 1952. 186pp., illus., $4.00 (U.S.).

Heat transfer phenomena: the flow of heat in physical systems. R. C. L. Bosworth. New York, Wiley, c1952. 211pp., illus., $7.20. (U.S.)

High fidelity simplified. H. D. Weiler. New York, Rider, c1952. 208pp., illus., $2.50 (U.S.).

High voltage A.C. circuit-breakers. S. Gerszonowicz. London, Constable, Toronto, Longmans, Green, c1953. 454pp., figs., $12.50.

Laboratory manual of material testing R. T. Liddicoat and P. O. Potts. Toronto., Macmillan, c1952. 239pp., illus., $4.00.

Mechanical world electrical year book, 1953, 46th ed. Manchester, Emmott. 360pp., illus., 3/-.

Mechanical world year book, 1953, 66th ed. Manchester, Emmott. 268pp., illus., 3/6.

Metallurgie, 65th ed. R. Cazaud. Paris, Dunod, 1953. 324+XLVIIIpp., illus., $1.50.

Paper and paper making. F. H. Norris. Toronto, Oxford university press, 1952. 353pp., illus., $6.50.

Parachutes. W. D. Brown. Toronto, Pitman, c1951. 322pp., illus., $7.20.

The petroleum dictionary. L. P. Boone. Norman, University of Oklahama, c1952. 338pp., $5.00 (U.S.).

Pneumatic tyre design. E. C. Woods. London, Institution of the rubber industry, 1952. 96pp., illus., 21/-.

Proceedings of the American power conference, March 26-28, 1952, Volume 14. Chicago, the conference, 1952. 483pp., illus., $6.00 (U.S.).

Radio and television workshop manual. S. A. Dimond and D. M. Andersson. New York, Prentice, 1952. 301pp., illus., $4.50 (U.S.).

Road engineering, 3rd ed. E. L. Leeming. London, Constable, Toronto, Longmans, Green, c1952. 308pp., illus., $6.00.

Standard metal directory, 13th ed., 1952. New York, The directory, c1952. 926pp., $15.00 (U.S.).

Strength of materials, 10th ed. Arthur Morley. Toronto, Longmans, Green, c1952. 583pp., diags., $4.50.

Water supply and purification, 3rd ed. W. A. Hardenbergh. Scranton, Penna., International textbook, Laurel, 1952. 516pp., illus., $6.50 (U.S.).

Wood's register of Canadian manufacturers, 1952, Volume 1—Eastern Canada. Montreal, Wood, 1952. 2 volumes. $75.00 per volume, including monthly change bulletins.

PAMPHLETS RECEIVED

Bronx park and the Saint-Lawrence seaway. C. E. Campeau. Montreal, Association canadienne d'urbanisme, 1952.

Caustic soda. Dow chemical of Canada. Montreal, the company, 1952.

Parking—How it is financed. Automotive safety foundation. Washington, the foundation, 1952.

(*Continued on page 344* (*122*)

ADEQUATE HEATING

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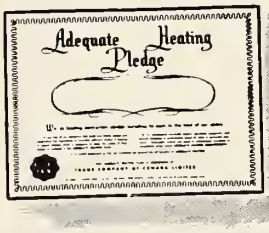

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A General Motors Diesel locomotive has more than THREE TIMES THE THERMAL EFFICIENCY of a modern steam locomotive. It saves money with every turn of its wheels.

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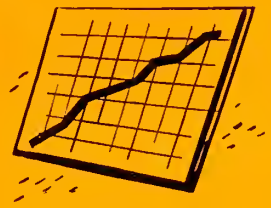
G. M. locomotives cost only half as much to maintain as steam locomotives! G. M.'s complete parts inventory, "Unit Exchange" plan and "Factory Rebuild" methods assure maximum savings.



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Compared with steam power, General Motors Locomotives are more efficient. They can pull longer trains at higher speeds. They can do twice as much work at half the cost!

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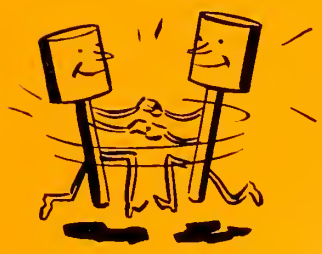
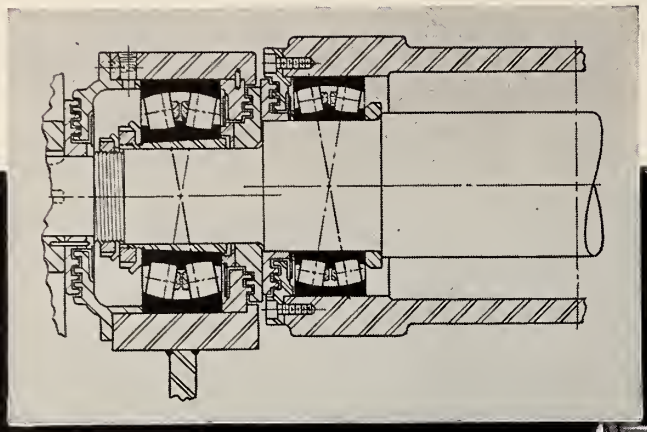
Improvements in materials, design and manufacture — the result of constant General Motors research — have achieved phenomenal parts life; e.g., G. M. pistons, without replacement, now travel a million locomotive miles.



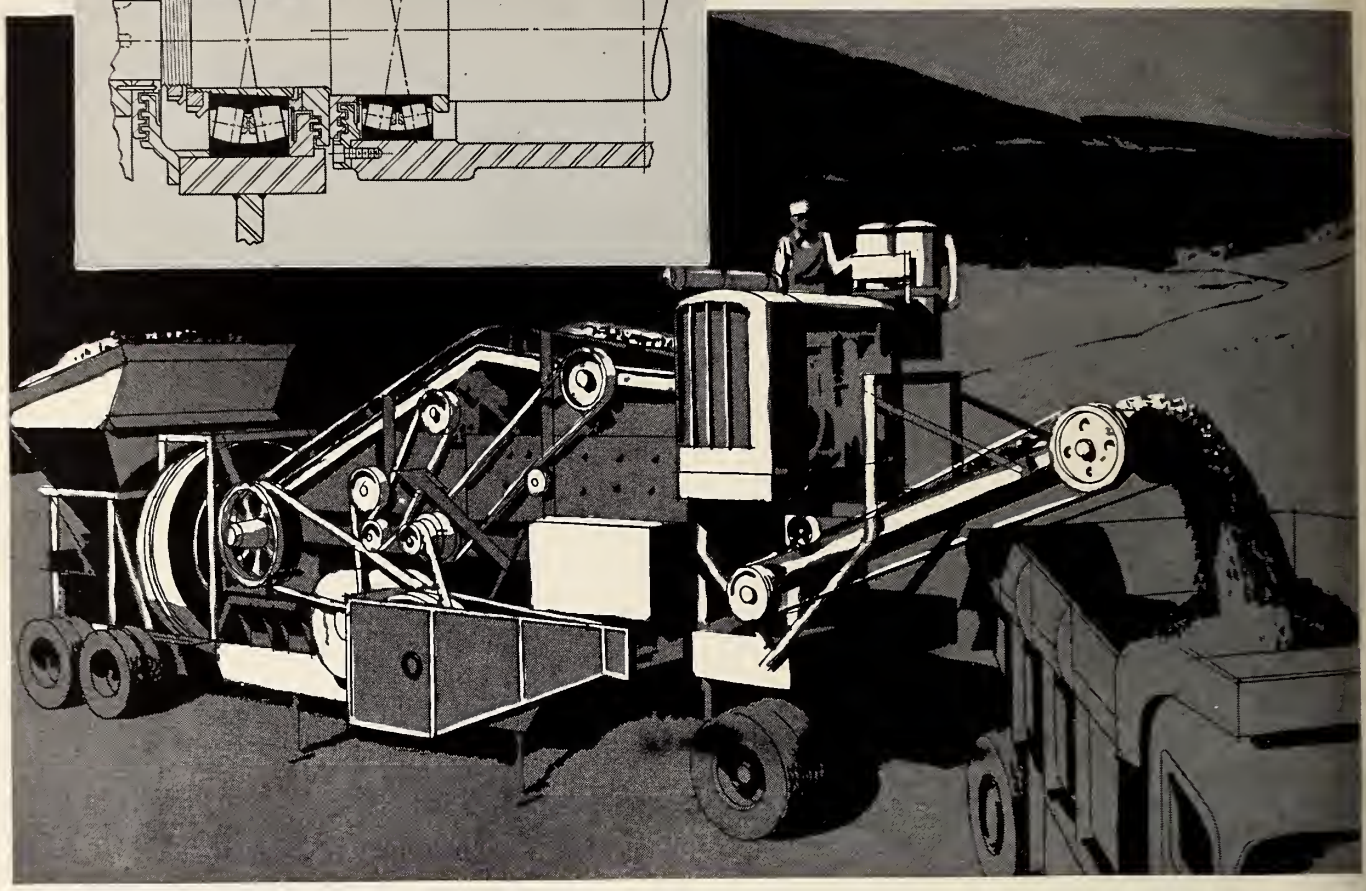
GENERAL MOTORS LOCOMOTIVES

ENERAL OFFICES AND PLANT: LONDON, ONTARIO

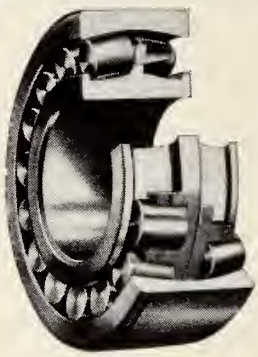
Sales Headquarters: INTERNATIONAL AVIATION BUILDING, MONTREAL, QUEBEC



The bearings in the screen and jaw crusher units of the Cedarapids Commander are self-aligning TORRINGTON Spherical Roller Bearings.



Capacity up!



Cost down!

TORRINGTON Spherical Roller Bearings contribute greatly to the outstanding performance of the Iowa Manufacturing Company's Cedarapids Commander unit. They enable this portable crushing and screening plant to keep "capacity up and operating costs down".

The bearings are manufactured from bearing-quality electric-furnace alloy steels. The land-riding cages are machined from solid cast-bronze rings. The accurate geometrical conformity of rollers and races provides capacity for heavy radial and thrust loads.

That's why major equipment manufacturers specify TORRINGTON Bearings for crushers, vibrating screens, hammermills and pulverizers.

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2 STOREYS . . . OR 32

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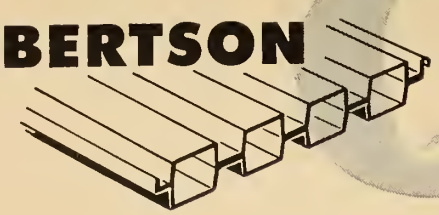

Robertson Q-Floor is a load-bearing, cellular steel sub-floor, so strong and light that it can save 20% to 35% in the weight of structural members and foundation. It is designed to meet ALL load and span requirements.

Q-Floor units are welded to the steel framework of a building as fast as the structural steel goes up. Q-Floor does NOT increase the total cost of a building, but DOES increase its investment value and earning power.

No building with Q-Floor can ever become electrically obsolete, electrical maintenance is low.

Everything about Q-Floor works to save you time, money, trouble. So, whether you are putting up 2 storeys or 32 . . . or are adding new height to an old building, it will pay you to get ALL the Q-Floor facts. Ask your architect or nearest Robertson-Irwin representative.

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Q-Floor is in the towering Bank of Nova Scotia Building, Toronto. Architects: Mathers & Haldenby, and Associates—Beck & Eadie—and in many other large Canadian buildings.

. . . best for smaller buildings, too

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Western Canada Representatives: **WESTERN BRIDGE & STEEL FABRICATORS LTD., VANCOUVER, B.C.**
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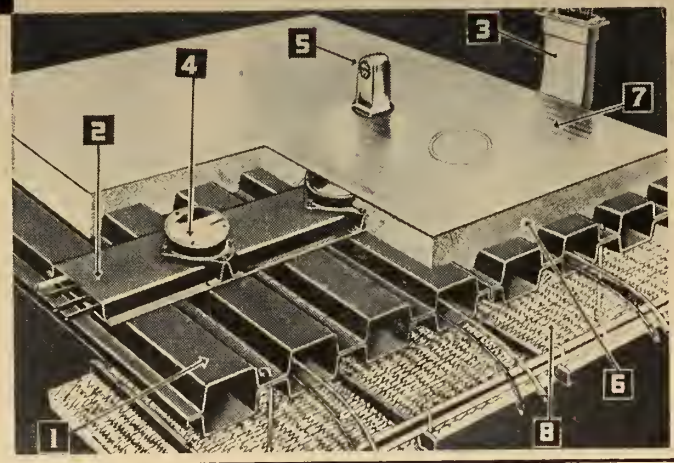
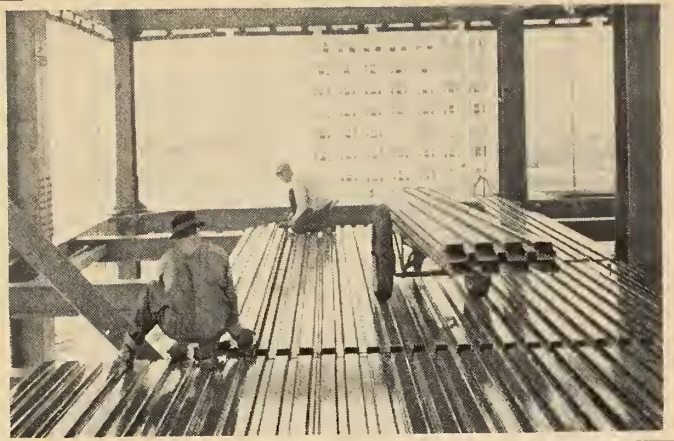
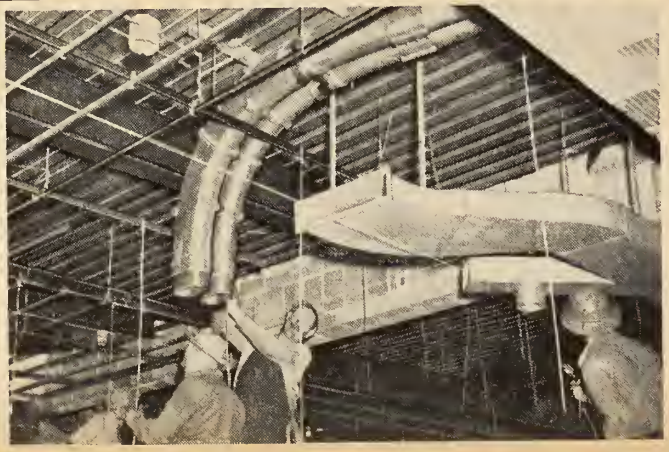


What Q-Floor is: Diagram shows construction: (1) Each cell is a raceway for electric wiring. (2) Raceway carries wiring across and into cells, to and from (3) telephone cabinet. (4) Junction units give access to Q-Floor wiring. (5) Telephone outlet is easily, quickly moved. (6) Concrete fill (usually 2½″) can be covered (7) with any floor surface material. (8) Suspended ceiling.

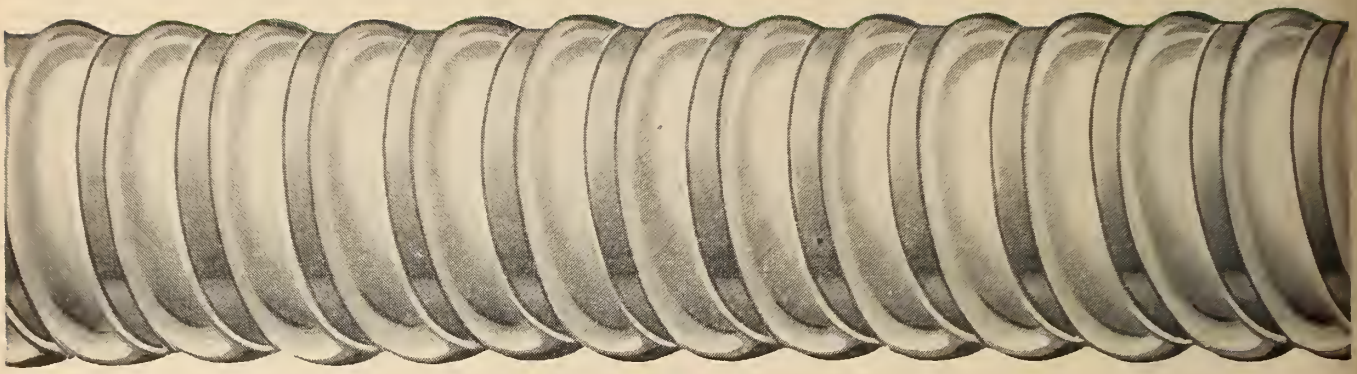


Q-Floors save time. Two men can lay 32 square feet of Q-Floor in one-half minute. Construction is faster than conventional methods. Building can be occupied by tenants 15-20% sooner. Pipes, ducts, and ceiling hang from floor. No pre-set inserts required.



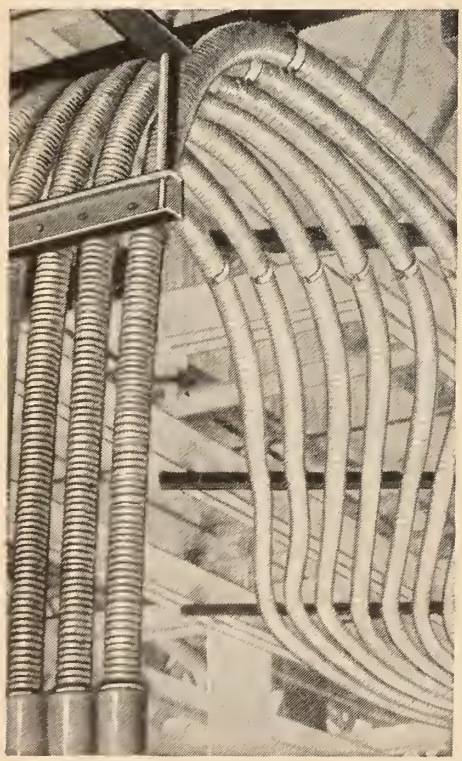
Q-Floor is modern construction. Other trades are not delayed. Q-Floor provides an immediate working platform with no temporary planking necessary. Bad weather cannot cause floor delays because Q-Floor is dry, clean construction. There is no danger of construction fires, for Q-Floor is non-combustible.

Save up to 25% on power



GENERAL ELECTRIC

VC INTERLOCKED ARMORED CABLE



Initial material costs and installation time costs are cut by as much as 25% when plant power distribution systems are built of VC Interlocked Armored Cable.

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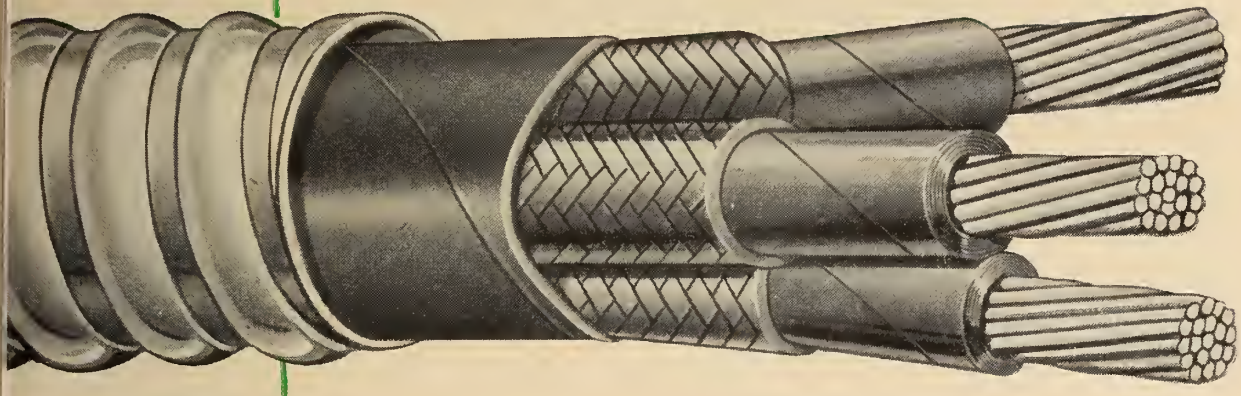

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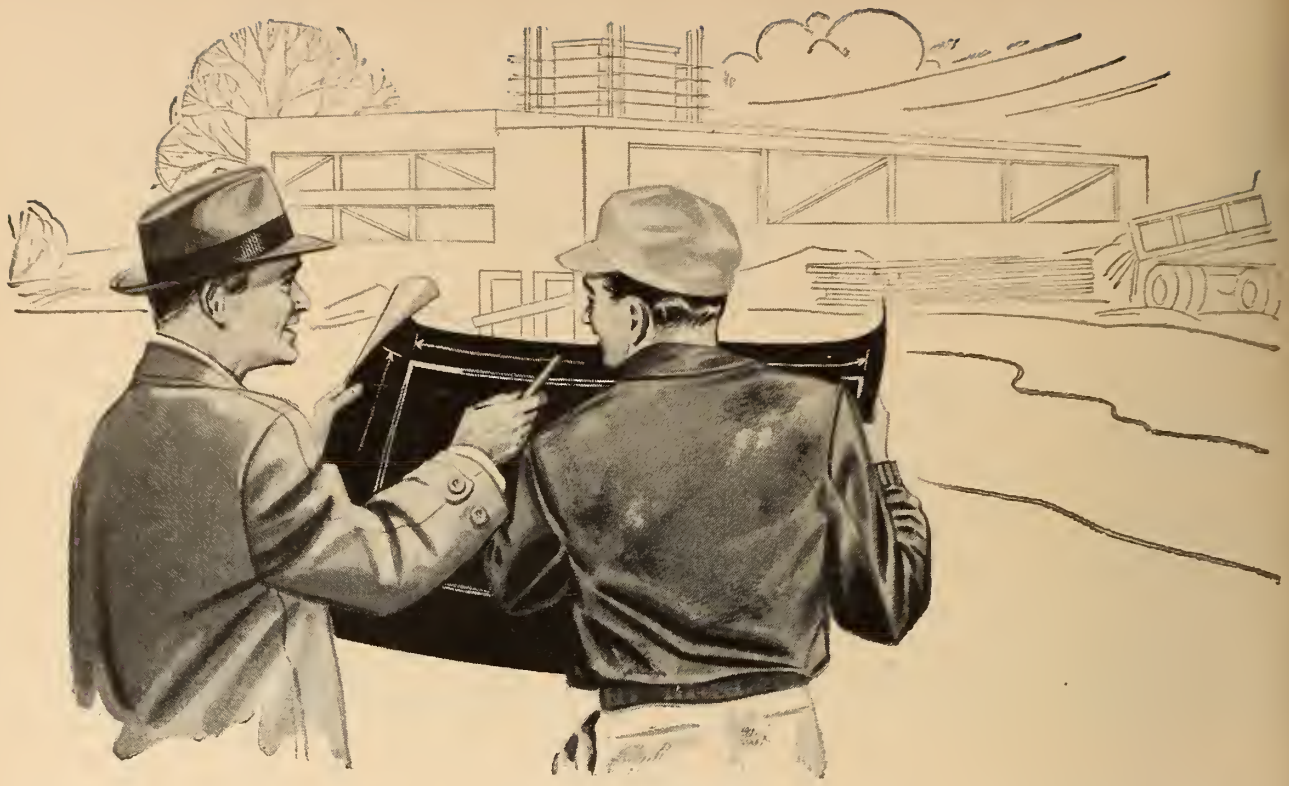

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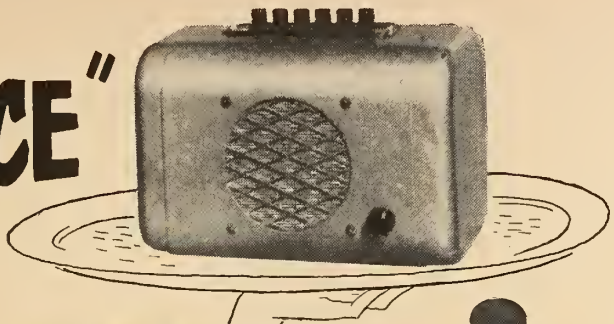

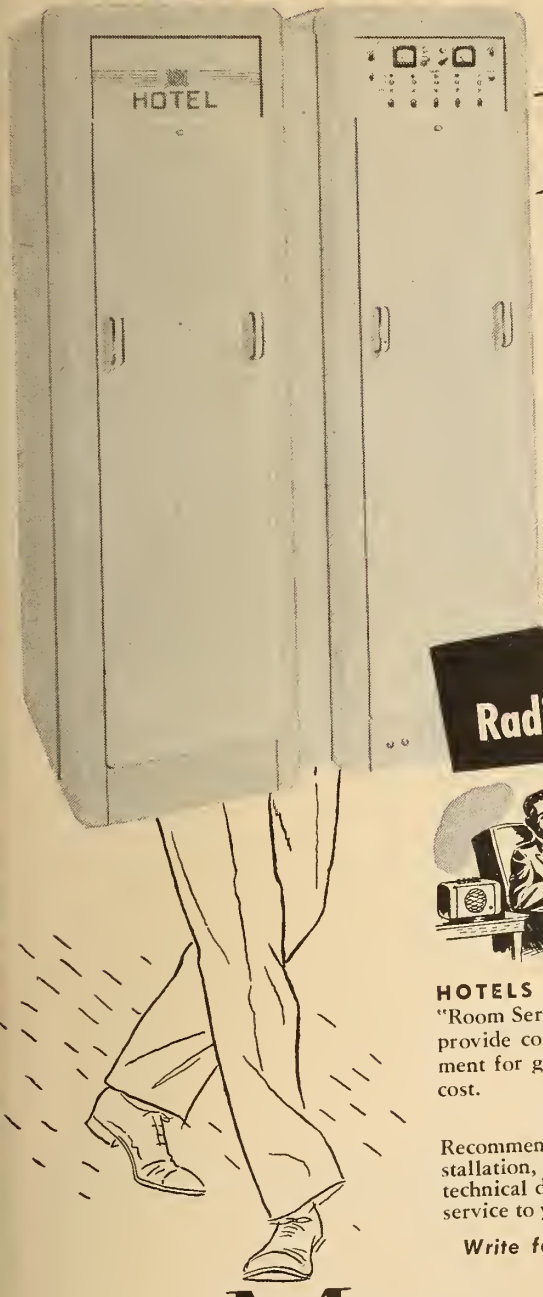

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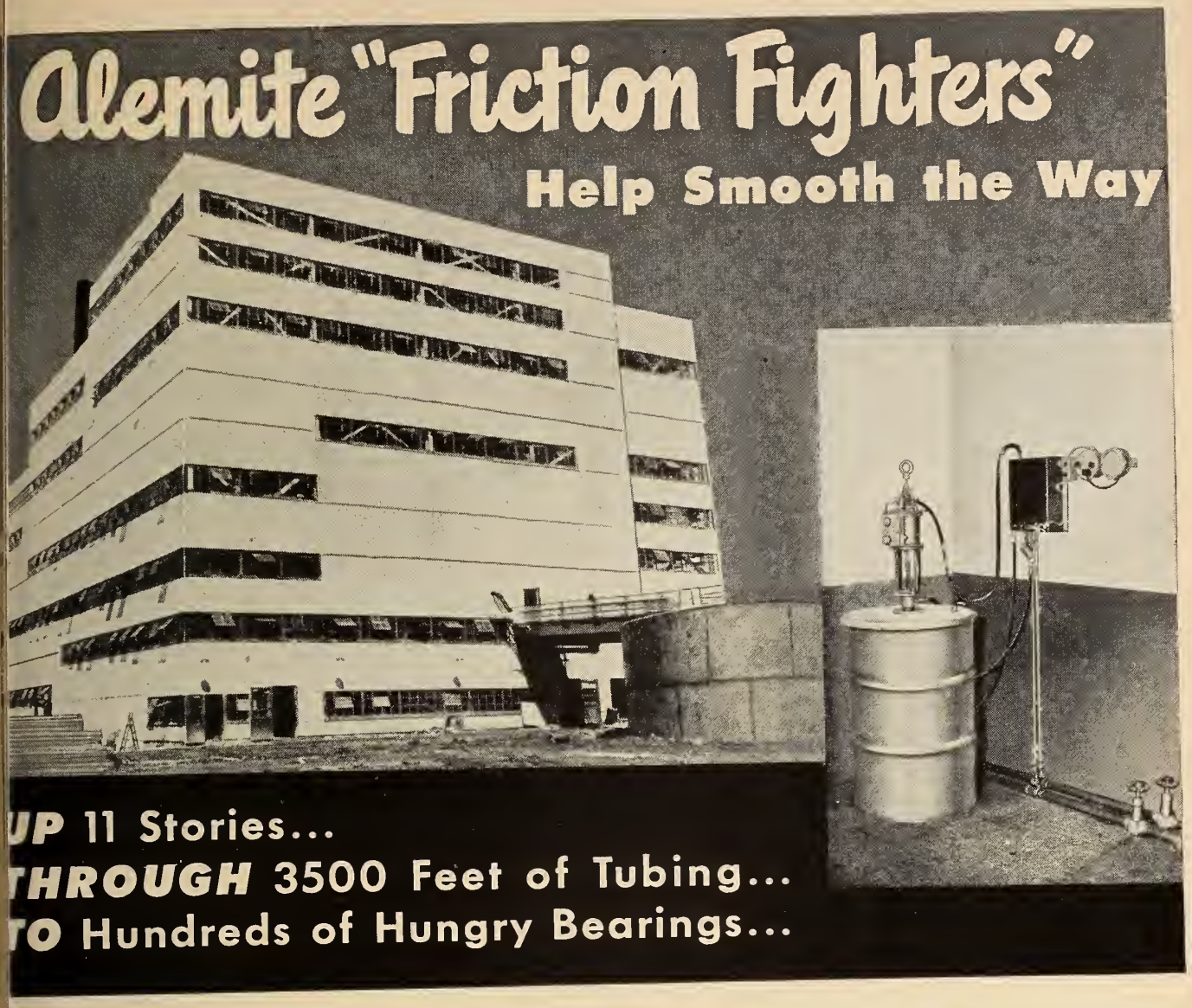

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With continuous lubrication, by keying timed lubrication to timed mechanisms automatically, Alemite Centralized Lubrication Systems avoid costly breakdowns—eliminate downtime for lubrication—help increase tonnage.

Check today for full information on the system best for your specific lubrication problems. Write Alemite, Division, Stewart-Warner Corporation of Canada, Limited, Belleville, Ontario.

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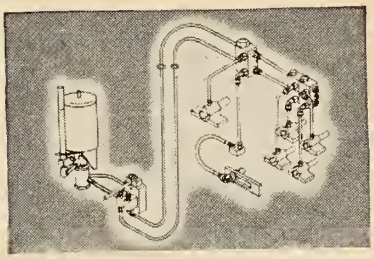


The Alemite Type II Accumeter Centralized Lubrication System consists of a pump, a distribution tubing system, and force feed valves at bearings.

Lubrication Methods that Cut Maintenance Costs

ALEMITE
DIVISION
STEWART-WARNER CORPORATION
of Canada, Limited
BELLEVILLE ONTARIO

A PRODUCT OF SW STEWART WARNER

Close-up of the striking Canada Decal transfer which we produced for the H. J. McFarland Construction Company of Picton, Ont. It appears in the main picture on the tractor cab door. Design gives a powerful presentation to the McFarland name, suggesting the building and construction business, with well-placed pictorial graphically illustrating two big units being hauled to a job. Good example of clever identification by a prominent construction firm.

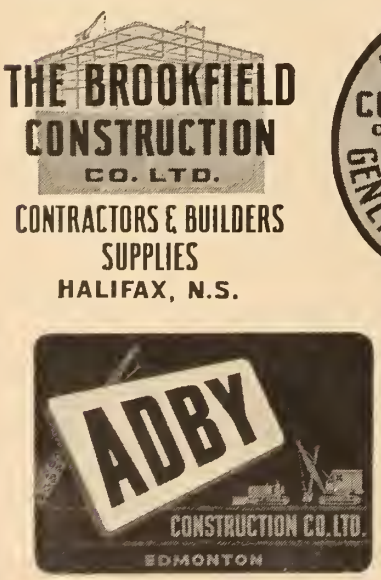
For Efficient Equipment Lettering Construction Companies depend on CANADA *Decal TRANSFERS

On road construction machinery and other heavy equipment, Canada Decal Transfers provide long-lasting, low-cost identification for the operating companies. This is yet another of the tough jobs our transfers are asked to do . . . standing up under all kinds of weathering and exposure. What's more, they can be quickly and easily applied to your equipment when it is in the garage or the paint shop during the "off" season.

Canada Decals save time, labour; eliminate protruding edges, sharp corners; require no screws, rivets or bolts for application. They provide a method of marking that is durable, colourful, legible, uniform, flexible, economical.

We invite construction companies to write us about their problems on equipment lettering and identification. We will gladly submit ideas and designs without obligation. Address Dept. EC-64, Canada Decalcomania Company Limited, 507-11 King Street East, Toronto 5, Ont.

*Trade-name 'Decal' is registered



Underfloor Distribution... by WALKER

"Preset locked-in" underfloor electrical distribution systems provide all the electrical outlets that will ever be needed for power, light, telephone and signal circuits. Changes in layout of office or factory can be made with a minimum of electrical expense because the outlets will be where they are needed. Walker underfloor duct is an all-metal system providing safe permanent raceways and continuous grounding. New and old buildings can be modernized with the Walker system of underfloor distribution.

Write to-day for a copy of Nor-lectric Bulletin W6-1.

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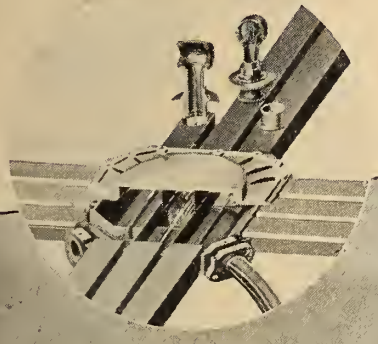
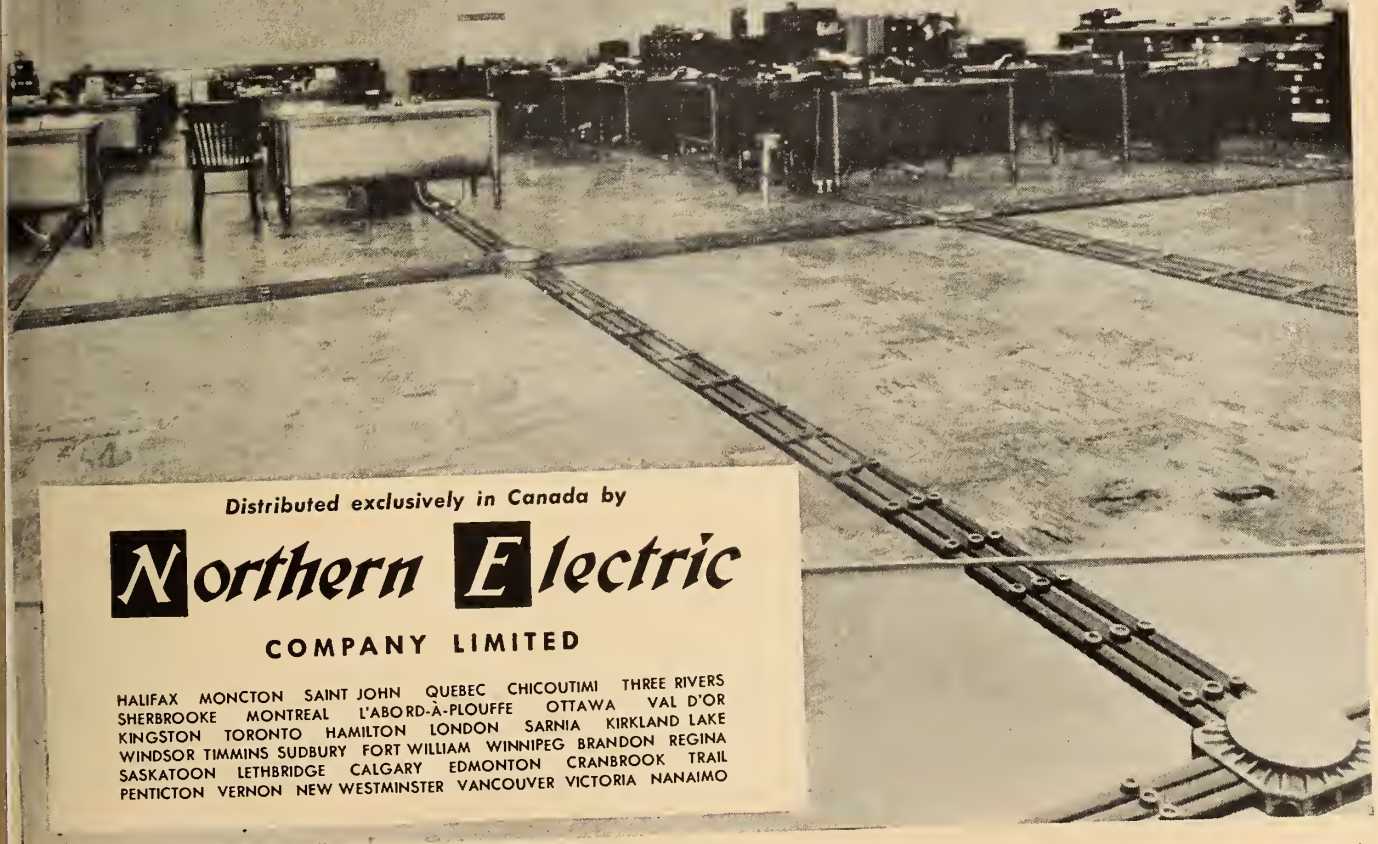


Phantom view of a Walker Underfloor wire distribution system.



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Punched and formed pieces of tough, resilient National Vulcanized Fibre reinforce spectacle case to provide lasting shape retention and serviceability.

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National Laminated Plastics
nationally known—nationally accepted

This practical use of National Vulcanized Fibre by American Optical Company in their attractive spectacle cases is typical of the countless contributions National Vulcanized Fibre—*the material of a million uses*—makes to industry and business.

National Vulcanized Fibre applications, both mechanical and electrical, are varied and extensive. In mechanical applications it is desirable because it possesses exceptional tensile and crushing strength, toughness, density and resistance to wear—coupled with ease of fabrication. It actually improves with age; for many mechanical purposes it is better, more durable than metal.

In the electrical field National Vulcanized Fibre has been the standard insulation for years. It has high dielectric strength and, when subjected to hot electrical arcing, it evolves neutral gas which extinguishes arc without "tracking." Many electric appliances find National Vulcanized Fibre to be the *one best material* for one or more of their parts.

Available in various grades and colors; and in sheets, rods, tubes and special shapes. Write for detailed literature and engineering service information—

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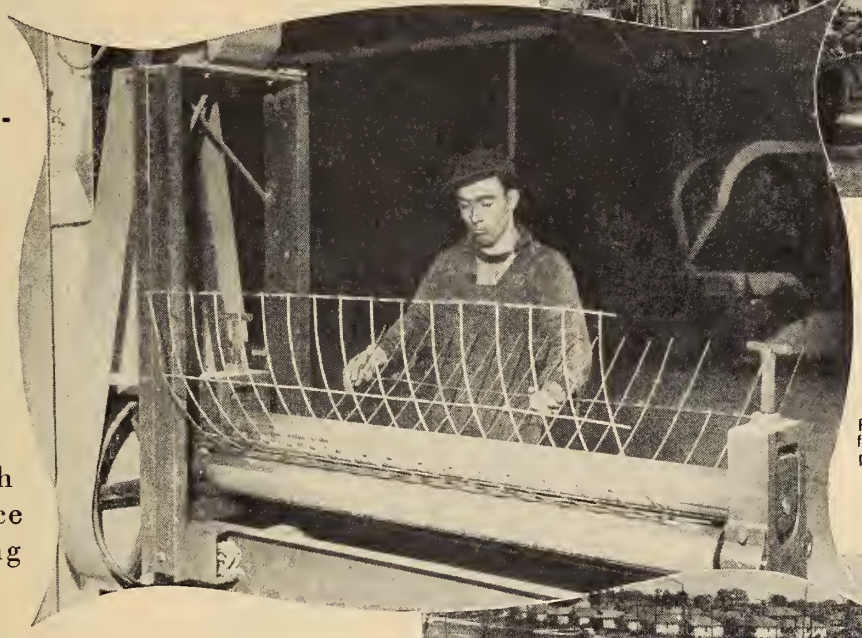
to supply all your CONCRETE PIPE needs ...when you want them!

Latest design Concrete Pipe Machine. Capacity 6″ to 54″ diameter in 4 foot lengths.

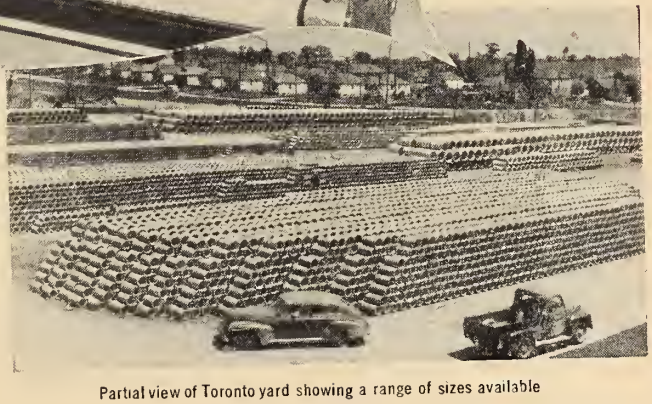


Fabricating the steel reinforcements of a concrete pipe.

We have the facilities to meet your needs for pipe. In our modern plants we have the most up-to-date equipment available to the concrete pipe industry, and a staff of engineers well qualified through years of experience in manufacturing concrete pipe.

These men and machines working together have developed for us a well-earned reputation for producing dependable, long-lasting concrete pipe . . . of all types!

Our whole organization is geared to meet just one goal—to produce the best concrete pipe for your requirements. So if you need *any* concrete pipe for municipal, highway, railway construction projects or any other jobs—Concrete Pipe Limited can supply it to you . . . when you need it!



Partial view of Toronto yard showing a range of sizes available

CPL 5302

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MANUFACTURERS OF: PIPE FOR STORM AND SANITARY SEWERS • HIGHWAY CULVERTS AND SUBWAYS • RAILWAY CULVERTS AND UNDERPASSES • INDUSTRIAL PLANT STORM DRAINAGE • TOWNSHIP DRAINAGE SYSTEMS

Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

Consolidated Paper Appointments. — Consolidated Paper Corporation Limited, Grand'Mere, Que., has made the following changes. W. Beverly Scott is now assistant to the vice-president in charge of manufacturing. Frederick W. Bradshaw, M.E.I.C., is acting division manager of the Laurentide division. Edward T. Buchanan, M.E.I.C., acting chief engineer of the Corporation. (See "Personals")

•

Karl S. Howard

Karl S. Howard.—Karl S. Howard has been appointed Assistant Vice-President, Foundry Division, Canadian Car and Foundry Company Limited, Montreal.

•

Dugald Cameron Appointment.—R. A. Oldham has been appointed a director of Dugald Cameron Associates Limited, Malton, Ontario. The Company fabricates "Fur-nail" steel partitions and is Canadian agent for a wide range of British products. Mr. Oldham is chief engineer of the Federal Wire and Cable Company, of Guelph, Ontario. (For further details see "Personals".)

•

Erratum

Through error in the February issue the wrong photograph was used in connection with the announcement of the appointment of E. W. Moodie, to the position of chief engineer of the Square

E. W. Moodie

D. Company Canada Limited. The photograph used was that of Charles H. Jackson, president of Atlas Asbestos Co. Ltd. The correct photograph appears above this item and we offer our apologies to Messrs. Jackson and Moodie for any embarrassment which may have been caused. (See "Personals" for a news item re Mr. Jackson.)

•

T. A. Crane Appointment.—T. A. Crane Limited, 2 May Square, Toronto, has been appointed exclusive Canadian distributor for the Fermex Company of Newark, N.J.

•

W. O. Bovard.—After more than forty-two years of association with the cement industry in Canada, W. O. Bovard, has retired as vice-president and director of sales of the Canada Cement Company Limited in Montreal. Mr. Bovard will remain on the directorate of the Company.

•

C. D. McLeish.—H. P. Petersen, president, and A. E. R. Turner, managing

W. O. Bovard

director of The John Bertram & Sons Co. Limited, jointly announce the appointment of C. D. McLeish, formerly machine tool division works manager as general manager. R. W. Smith, formerly machine tool division Superintendent is now works manager, machine tool division.

•

Goodyear Changes.—Mr. C. B. Cooper, general sales manager, has announced the following five appointments in connection with the reorganization of the mechanical rubber goods department of The Goodyear Tire & Rubber Company of Canada, Limited.

Owing to the tremendous growth and development of the pulp, logging and mining industries, and large power and industrial projects, the department has been split into two divisions—sales and operating.

G. V. Davis has been appointed manager—sales division—industrial rubber products and S. G. Nicholls, manager of the operating division.

The sales organization for industrial rubber products has been divided into three Canadian regions, with regional managers who will report directly to Mr. Davis. A. E. Smith has been named manager—western region, and will be responsible for all western provinces. W. Roe is manager—central region, which

Bridging the Years
1882–1953

1886

While the Dominion Bridge Company Limited, during its long history has become pre-eminent in many new types

1914

1938

of steel fabrication, it is still the leader in its original field – bridge building. We illustrate some of the notable

1946

1950

engineering achievements of the past seven decades.

1886 – First C.P.R. Lachine Bridge. When built this was the largest of its type in the world.

1938 – Lions Gate Bridge, Vancouver. Largest suspension bridge in the British Empire.

1950 – First Aluminum highway bridge in the world, at Arvida, P.Q.

1914 – Cisco Bridge, over Fraser River near Lytton, B.C.

1946 – Ste. Rose Bridge near Montreal. Believed to be the longest continuous welded girder bridge in the world.

1929 – Jacques Cartier Bridge across the St. Lawrence river at Montreal.

1929

STRUCTURAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED

*Other Divisions:
MECHANICAL
PLATEWORK
WAREHOUSE
BOILER

Plants at: MONTREAL · OTTAWA · TORONTO
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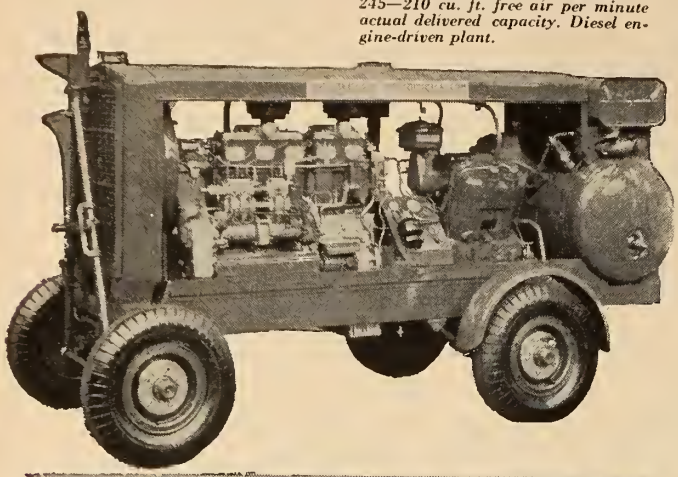
FOR AIR COMPRESSORS
large or small, portable or stationary...

"Broomwade" Class 210, Model SV 245—210 cu. ft. free air per minute actual delivered capacity. Diesel engine-driven plant.



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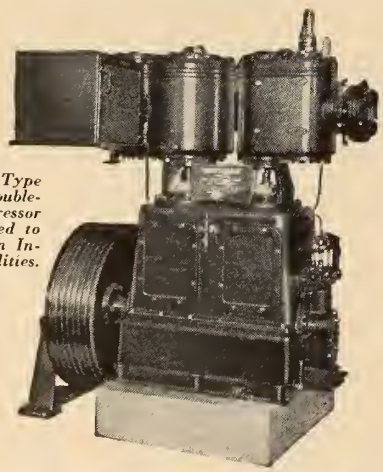
"BROOMWADE"



"Broomwade" Type TS-B 2-stage double-acting air compressor — as supplied to many Canadian Industries and Utilities.

Available from stock and serviced all over Canada, the world-famous Broomwade Air Compressors are built in a wide range of types and sizes, to work pneumatic equipment at maximum speed and efficiency.

Whether you're looking for portable or stationary compressors and tools, you'll find the Broomwade line has everything you ever wanted in air compression equipment — the most up-to-date improvements . . . low fuel consumption . . . and above all — reliability!

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	Sheridan Equipment Company Limited, 33 Laird Drive (Portable)
WINNIPEG:	Medland Machinery, 576 Wall St.
VANCOUVER:	B.C. Equipment Co. Ltd., 551 Howe St. 5213

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"I've done business at the Trade Fair which otherwise would have been impossible. My prime interest was jewellery, but there seemed to be almost everything on display . . . a buyer's paradise."

CANADIAN JEWELLERY BUYER

Already Exhibitor bookings for the 1953 Trade Fair are large. Plan now to attend! There is no easier or more economical way for *you* to see a world of new merchandise and make new, valuable contacts.

There were 1272 Exhibitors from 29 countries at the 1952 Trade Fair—of whom many were Canadian. Merchandise ranged from precious stones to the most modern construction equipment, affording buyers the greatest opportunity yet offered by any previous Canadian International Trade Fair.

Write for information *now* to The Administrator, Canadian International Trade Fair, Exhibition Park, Toronto 2-B, Ontario.

Sixth
CANADIAN International TRADE FAIR

TORONTO, JUNE, 1-12 1953

OPERATED BY THE GOVERNMENT OF CANADA TO PROMOTE YOUR BUSINESS

)vers Ontario, and J. W. Wright, heads ıe eastern region which comprises Quebec, the Maritimes and Newfoundland.

R. A. Crichton

R. A. Crichton.—E. E. Orlando, M.E.I.C., general manager of the Canadian Westinghouse Company's newly-formed District Apparatus Division, has appointed R. A. Crichton, as sales manager of the Toronto district.

●

Dr. W. Howard Rapson.—The appointment of Dr. W. Howard Rapson as professor of chemical engineering at the University of Toronto has been announced by president Dr. Sidney Smith. Dr. Rapson will head the department's activities in pulp and paper research.

●

B.C. Research. — The British Columbia Research Council, at the University of British Columbia, has announced the following new appointments in the Metallurgy Division. I. D. G. Berwick, J G. Parr and J. E. Srawley.

●

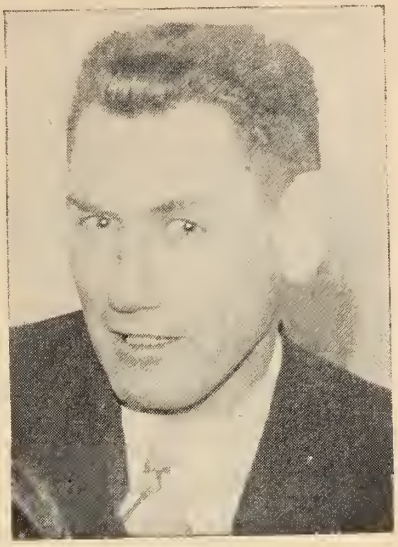
Aerovox Appointment.—Walter H. Furneaux, vice-president of Aerovox Corporation and Aerovox Canada Limited, has announced the appointment of J. Harvey Pickett as assistant director of engineering, at Aerovox Corporation, New Bedford, Mass. Mr. Pickett is a graduate in engineering from the University of Toronto and has been with Aerovox of Canada as chief engineer for the past fifteen years.

John Lucyk, M.E.I.C., has been appointed chief engineer at the Canadian plant (see "Personals").

●

L. J. Topshee.—L. J. Topshee has been named maritime regional manager of Canada Creosoting Company Limited—a division of Dominion Tar & Chemical Company, Limited. Mr. Topshee will make his headquarters at Truro, Nova Scotia.

●



L. J. Topshee

●

Westinghouse Stoker Appointments. — Combustion & Power Equipment Limited, Montreal, and Power Plant Contractors, Limited, Toronto, have been appointed eastern and western distributors, respectively, of Westinghouse industrial stokers for Canada.

The Montreal firm will provide sales and engineering service for Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. The

ONLY

Josam NON-CLOG FLOOR DRAINS have all these features

Series No. 5420

Triple drainage is found only in floor drains having a sediment bucket for intercepting debris from waste water, and auxiliary drainage combined with the well-known double drainage feature of Josam drains.

Main flow of water discharges through grate slots into sediment bucket and then into the waste pipe. When the sediment bucket becomes completely filled, the surface drainage is still maintained through the holes in the auxiliary drainage surface.

The auxiliary drainage surface consists of drainage holes so located in the top rim surface of the drain that they afford a by-pass for draining surface water when the sediment bucket becomes clogged. A positive guard against carelessness is the fact that the grate cannot be returned to proper position until sediment bucket has been set in place in drain body.

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Halifax, N.S.

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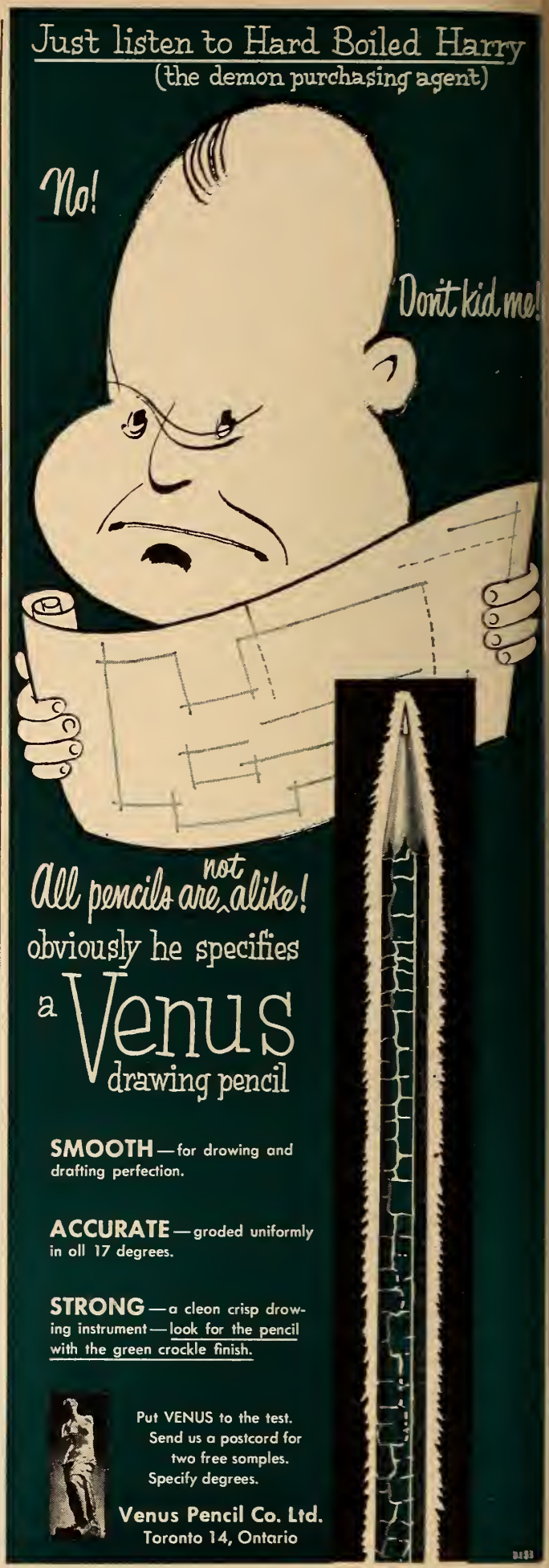
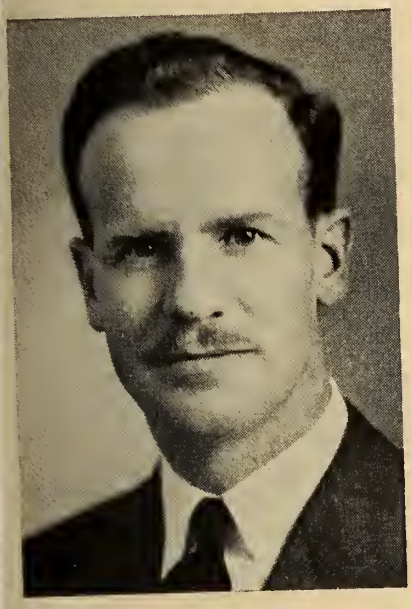


oronto company will serve Alberta, ritish Columbia, Manitoba, Ontario, askatchewan, Yukon and the North-est Territories.

The new agreement will enable both ompanies to offer complete equipment nd engineering service for coal-burning s well as oil-burning steam plants.

●



R. M. Mitchell

R. M. Mitchell. Richard M. Mitchell has been appointed sales manager of C. A. Dunham Company Limited.

●

R. S. Robertson. — R. S. Robertson. works manager, has been named a director of the Pilkington Glass Manufacturing Company, Limited.

●

Wallace Barnes Purchasing. — F. M. Buckingham, president of Wallace Barnes Company Limited, recently announced the appointment of Roy Ronald as assistant purchasing agent.

●

Shawinigan W. & P. Director.—W. F. Macklaier, Q.C., B.C.L., partner in the Montreal law firm of Hugessen, Macklaier, Chisholm, Smith and Davis, has been elected a director of The Shawinigan Water and Power Company.

●

R. G. J. Nisbet.—R. G. Jackson Nisbet, has been appointed Canadian general manager of Wolf Electric Tools Limited. Mr. Nisbet will make his headquarters at the Company's office, 2271 Bloor Street West, Toronto 9.

●

D. A. Golden. — The Rt. Hon. C. D Howe, Hon. M.E.I.C., has announced the appointment of Dr. D. A. Golden as assistant deputy minister and general counsel, Department of Defence Production.

●

G. H. Elliott.—George H. Elliott, president and senior partner, George H. Elliott & Company, New York, management consultants, has been elected president of Leetham, Simpson Limited, management consultants, Montreal and Toronto.

●

Norman T. Finlayson. — After almost forty-eight years of close association with the machinery industry in Canada and the United States, Norman T. Finlayson of The John Bertram & Sons Company, Limited, has announced his retirement. After serving his apprenticeship Mr. Finlayson advanced rapidly becoming successively plant engineer, machine shop foreman, production planning department manager, general manager and vice-president. Since 1941 he has been a director of the company.

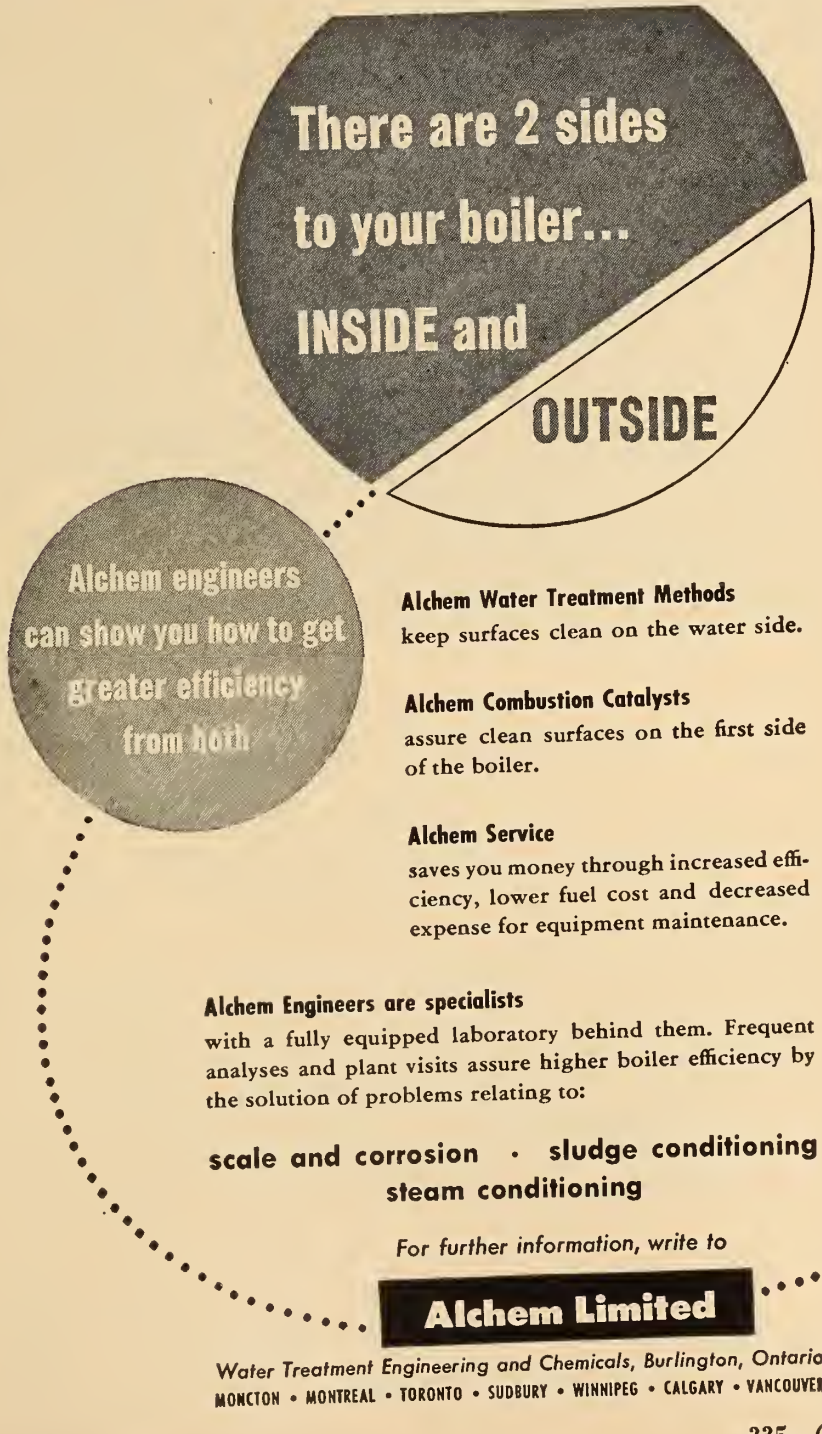
●

Stewart-Warner Distributor. —Stewart-Warner Corporation of Canada, Limited, Belleville, Ontario, manufacturers of "Alemite" lubricating equipment for the automotive, industrial and farm fields, radio and TV sets and Bassick Casters and Glides, announce the appointment of Alemite Lubricator Company Limited, Belleville, Ontario, as the local distributor for Alemite products covering eastern Ontario from Pickering to Brockville inclusive.

Ralph Ketcheson, has joined the Alemite Lubricator Company and will continue to handle Alemite sales and service requirements in the territory.

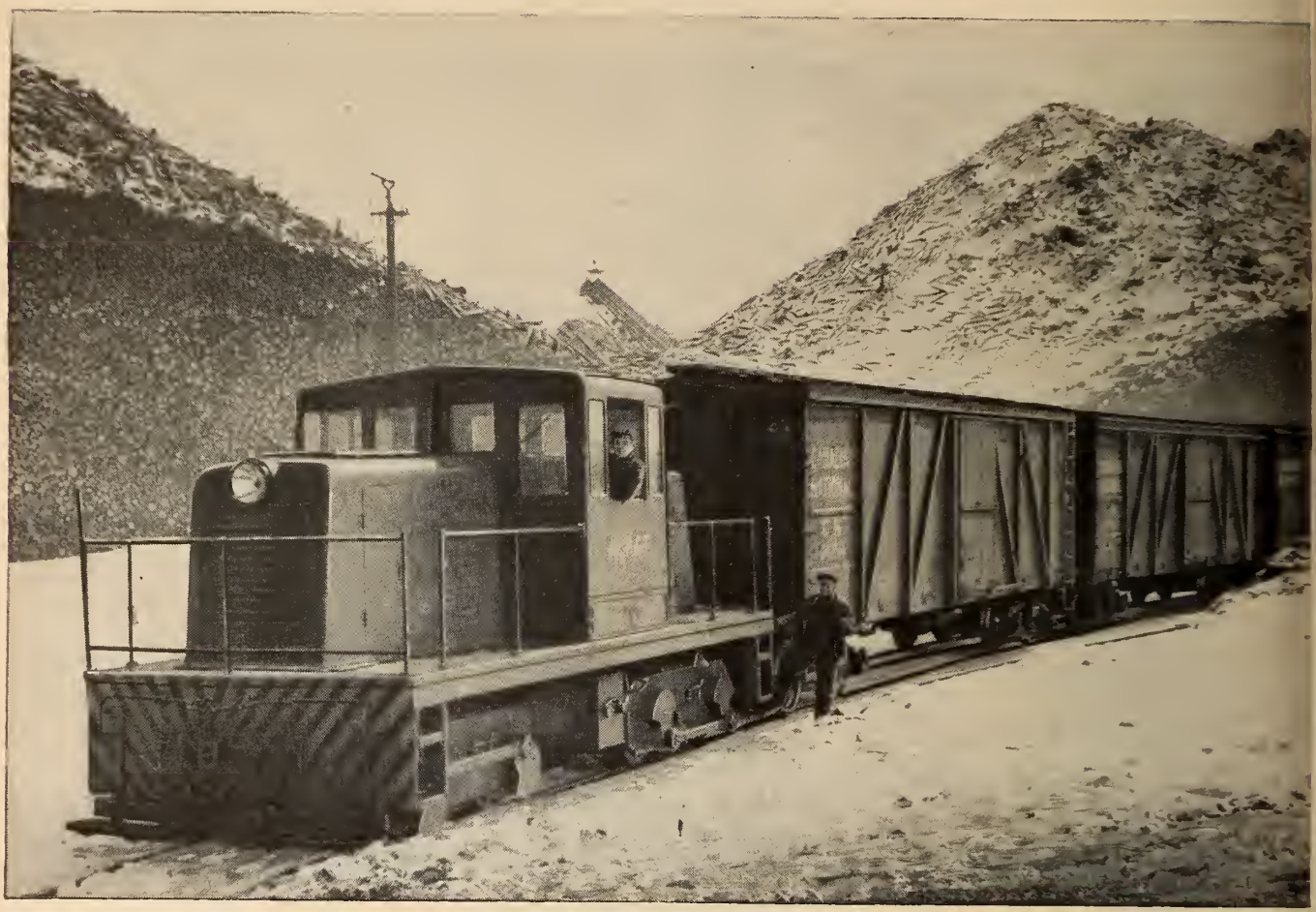
●

Francois Roy.—Francois Roy, member of the transmission-line staff of The Shawinigan Water and Power Company since 1915, and mayor of Shawinigan Falls since 1946, has been appointed as



ANGLO-CANADIAN PULP AND PAPER MILLS LIMITED . . .

Saves $13,100 YEARLY



GENERAL ELECTRIC

DIESEL-ELECTRIC LOCOMOTIVE

● This thrifty, hard-working 50-ton G-E Diesel-Electric industrial locomotive is effecting an annual fuel saving of $9,400 over the old-style coal-burning locomotive. As well, a yearly saving of $3,700 is resulting from lower labour costs . . . and there are still further savings from lower repair and daily servicing costs.

Ready to go at the touch of a button, this G-E Switcher has demonstrated its high availability. It also handles twice the tonnage of the old steamer on an existing 5% grade.

Similar records for economy and availability are being tallied up daily in many other industrial plants across Canada. Your nearby C-G-E representative will be pleased to show you how a G-E Diesel-Electric Locomotive can work best for you.

APPARATUS DIVISION

CANADIAN GENERAL ELECTRIC COMPANY
LIMITED

Head Office: Toronto — Sales Offices from Coast to Coast

AAD-04301

sistant vice-president of the Company. is headquarters will continue to be in awinigan Falls.

•

.G.E. - Wilson Lighting. — Canadian eneral Electric Company has recently ompleted arrangements with J. A. Wilon Lighting and Display Limited, Toto, for the latter firm to take over s tooling equipment, dies and mechanil parts involved in the manufacture f fluorescent fixtures. As a result the Vilson firm will produce fluorescent xtures under its own trade name which ere previously manufactured by Genral Electric. This will assure continuity f supplies for this type of fixtures.

The wholesale division of the CGE ill continue to act as distributors for hese Wilson products and lines from ther manufacturers as they have done n the past.

•

New Equipment and Developments

Imperial Oil Expansion. — Dr. J. L. Huggett, general superintendent of Imperial Oil Sarnia refinery announced a construction program which will cost about $6,000,000.

Three new projects were listed by Dr. Huggett—a quality control laboratory—a mechanized packaging and shipping plant—and centralized mechanical shops.

Dr. Huggett stressed that the new facilities were in addition to the fourteen million dollar construction program just being completed at the refinery. This program includes Canada's largest catalytic cracking unit and an atmospheric and vacuum distillation unit—the largest refinery unit of any kind in Canada.

Due to the expansion of the refinery, however, the laboratory, packaging and maintenance facilities are being rebuilt to keep pace with the greater flow of products.

•

C.I.T.F. — The machinery and plant equipment section of the Canadian International Trade Fair is already well ahead of last year in both size and variety of exhibits, as well as in the number of countries represented.

Space bookings in this section, to date, total almost 110,000 square feet, while tentative application has been made for another 14,000 square feet. This exceeds the total for the section at the 1952 Fair by approximately 55,000 square feet.

This year's Trade Fair — Toronto June 1st to June 12th, will be by far the largest yet held. Approximately 25 countries are expected to be represented.

In the machinery section, nine countries are so far represented. Five other countries have expressed their intention of showing products within this classification. Canadian manufacturers will have approximately half the space in this section, and Britain will be the second-largest participating country.

•

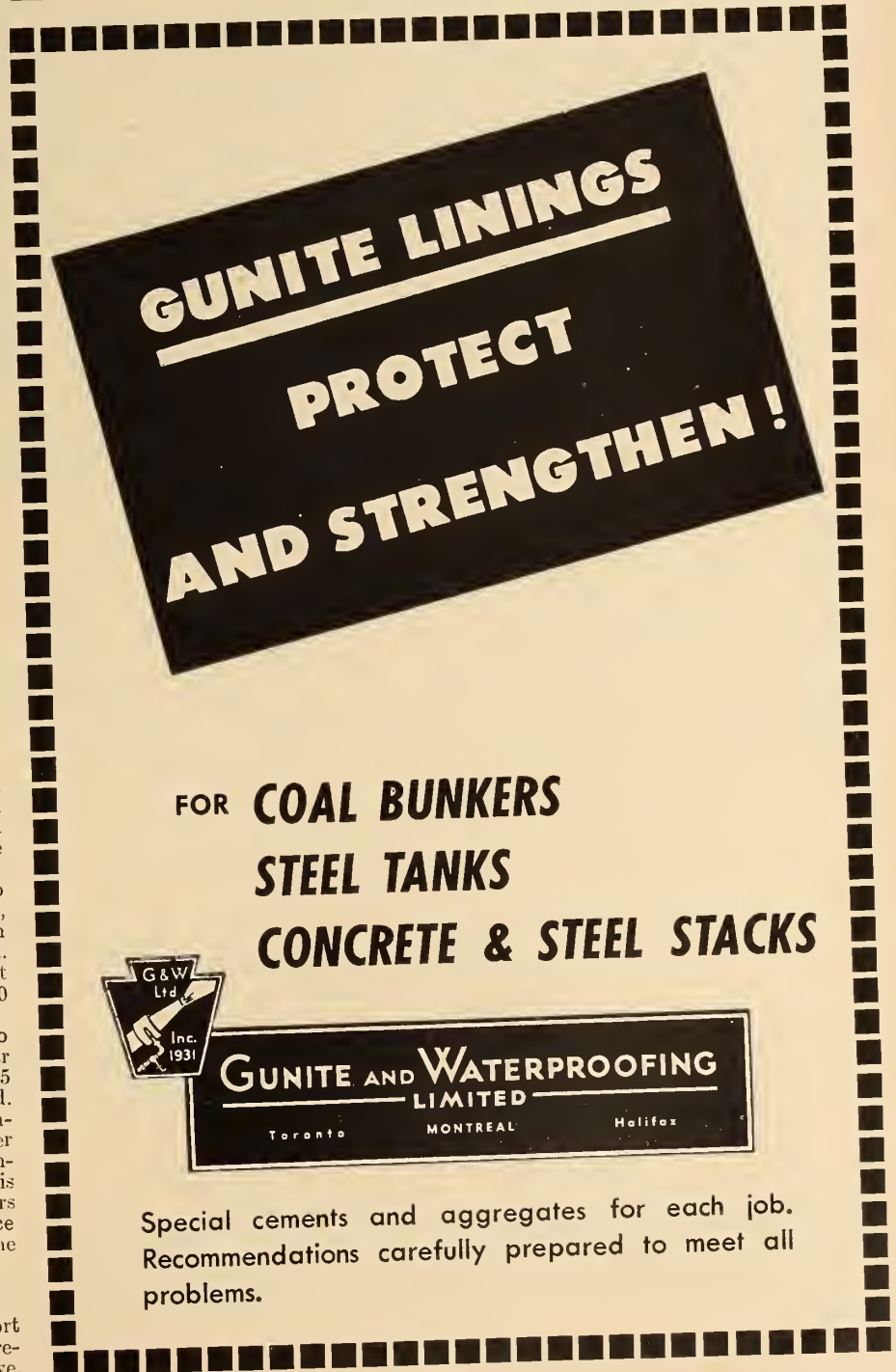
1953 Outlook.—According to a report tabled in the House of Commons, recently, by the Right Hon. C. D. Howe, HON. M.E.I.C., private and public outlays for new construction and for machinery and equipment in Canada are likely to be 6 per cent higher this year than in 1952.

The report states that capital expenditure in 1953 will probably reach a total of $5.4 billion, compared with $5.1 billion in 1952. These estimates are based on a survey of some 17,000 business establishments across Canada and upon surveys of proposed expenditures by governments, institutions and private house builders.

The 1953 capital expenditures program, shows in some sectors a levelling off. In other sectors there is further increase in outlays directly associated with the defence effort and with strategic development.

Outlays in manufacturing, as a whole, will likely be 5 per cent below those of 1952. Increased expenditures in such industries as transportation equipment, non-ferrous metals and petroleum refining will be more than offset by marked declines in pulp and paper products, iron and steel and chemicals. The rapid growth in the mining industry is likely to continue through 1953, with capital expenditures showing a further increase of 18 per cent over the previous record of 1952.

New housing outlays are expected to amount to $981 million which is 15 per cent higher than the $850 million spent in 1952. Capital expenditure for new facilities in trade, financial and service groups in 1953 are estimated at $431 million which is more than one-third greater than the outlays in the previous year. Expenditures for the building and



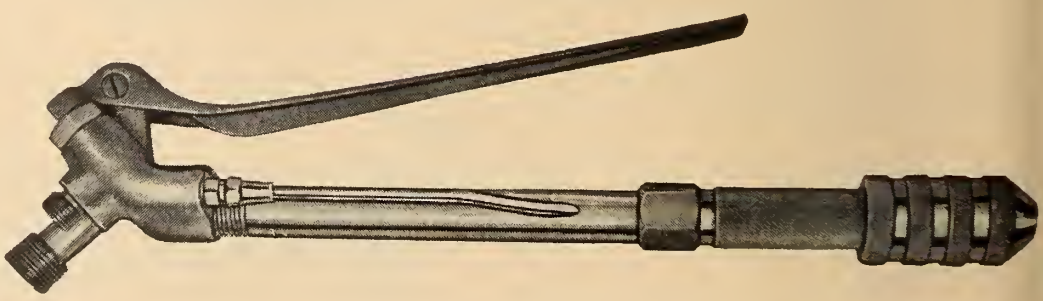
PRODUCING AGAIN...
13 HOURS SAVED

Powder-lancing pierces blast-furnace salamander in only ½ **hour**

That's just one case. Other steel mills have gone back into production just as quickly—thanks to the efficient use of powder-lancing.

Powder-lancing is a new idea for increasing the efficiency of oxygen lance operations. By introducing powder into the oxygen stream, an exothermic reaction results producing extremely high temperatures. Holes are easily pierced not only in salamanders, but in concrete, cinder block, fire brick, aluminum, and other materials at speeds up to 11 in. per minute. And lance pipe needs no threading. A twist seals it into the holder.

An OXWELD ACL-1 Powder Lance automatically adds to the oxygen stream the correct amount of powder for best results. For further details, telephone or write to-day. DOMINION OXYGEN COMPANY, LIMITED, General Offices, 40 St. Clair Avenue East, Toronto 5. Ontario. Sales offices in Montreal, Toronto, Winnipeg and Vancouver.



OXWELD ACL-1 Powder Lance can be used with any standard pipe.

LOOK TO *Dominion Oxygen* know-how . . . show-how . . . products and processes FOR WELDING, CUTTING, TREATING, FORMING METALS

"OXWELD" is a trade mark of Dominion Oxygen Company, Limited.

quipping of institutional structures are xpected to total $305 million, compared ith $255 million in 1952.

Outlays for engineering and marine onstruction are likely to increase by per cent and expenditures for machinry and equipment by one per cent.

Readers who are interested in reading he complete report should apply to the nformation Branch of the Department f Trade and Commerce, Ottawa, for Private and Public Investments in anada—Outlook 1953".

●

Stelco Ladder Rungs.—The Steel Company of Canada, Limited has announced a new product "Galvanized Hi-Bond Ladder Rungs". The company claims that these ladder rungs will be highly suitable for embedment in concrete or masonry, also suitable for manhole steps, smoke stack, wharf, canal bank, dam and lighthouse ladders. Because of their heavy galvanized surface they provide the following advantages: They have a non-skid surface and have adequate protection against corrosion.

As the rungs have no hooks on the ends of the legs, they can be easily placed and positioned. New steps may be added to existing concrete by drilling and grouting. Hooks are not required as better bond is obtained due to the nature of the surface of these rungs.

The rungs with 6" embedment in good concrete will support the heaviest man and manload without danger of failure. They are made from ¾" diameter intermediate grade steel and have high impact resistance.

●

Rapid Construction. — A 13,000 square-foot manufacturing and warehouse building and office has been erected in Vancouver in 15 working days. It is the new headquarters of two Vancouver firms, Keystone Industries Limited and Overseas Commodities Limited at 750 Industrial Avenue. The all-steel unit is British Columbia's first long-span multiple quonset-type building.

●

Foxboro Canadian Expansion—A plant extension by the Foxboro Company Limited, Montreal, has more than doubled its instrument facilities in Canada. The recent expansion, second in the past five years, reflects the ever growing demand for indicating, recording and controlling instruments by Canadian industry.

Matching the original building in arrangement and appearance, the new section is of modern steel and brick construction, with spacious window area and sawtooth skylights. It adds 23,000 square feet of factory space for production, assembly and storage. Additional facilities have been provided for a cafeteria and for a training school for customers' men. Under-floor ducts have been installed to eliminate overhead piping of air, water, gas and electricity.

Canadian representatives of Foxboro Company Limited, are Peacock Brothers, Limited. Another associated company is Foxboro-Yoxall, Limited, with factories in London, England.

●

Westinghouse "Synchronograph".—For experimental use Westinghouse Electric Corporation engineers have constructed the "synchronograph" a repetitive surge generator that makes a simulated bolt of lightning "stand still", so that its effects on electric power lines and equipment can be studied.

The new instrument was described in a technical paper delivered at the winter general meeting of the American Institute of Electrical Engineers by James M. Clayton, Westinghouse engineer. To obtain copies of the paper communicate with Canadian Westinghouse Company Limited, Hamilton, Ont.

●

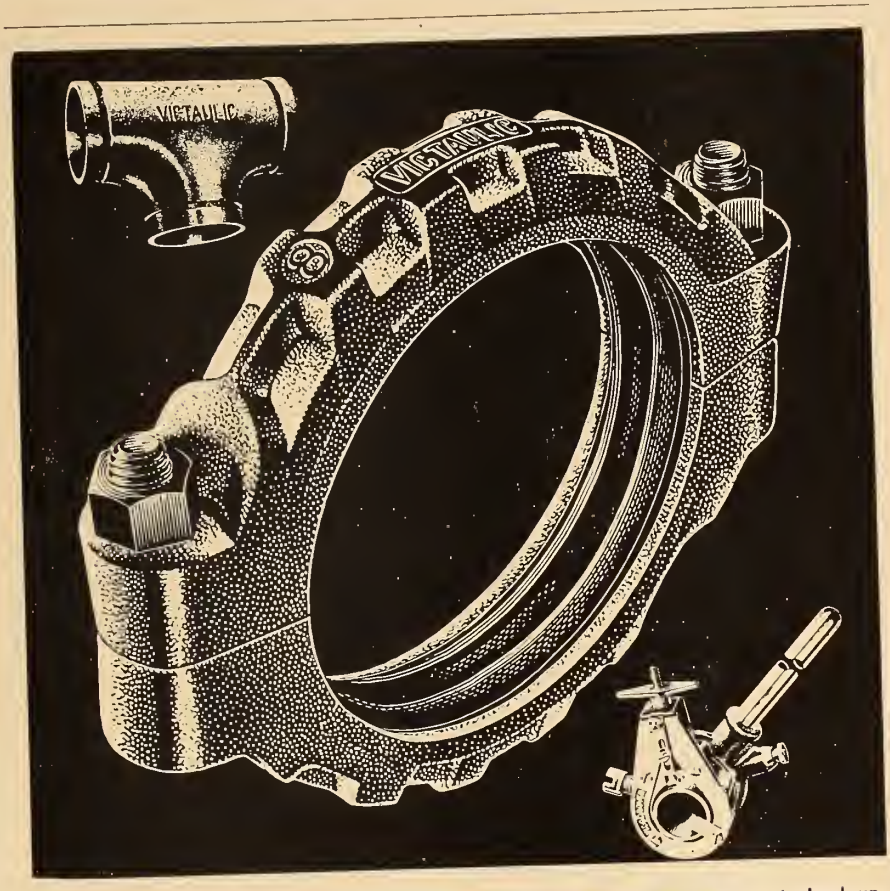
"Metalastic" Products. — Armstrong Beverley Engineering Limited, 6820 St. Urbain Street, Montreal, are introducing into the Canadian market the products of "Metalastik" Limited, of Leicester, England.

The products consist of an extensive line of anti-vibration devices to control shocks and vibration in all phases of engineering and road and rail transport.

●

A-C Network Analyser. — The Franklin Institute, Philadelphia, Pa., has signed contracts with seven major power companies in Pennsylvania, New Jersey and Delaware for the installation of an A-C Network Analyzer in the industrial research laboratories of the Institute. This device, it is claimed, will assist engineers in the solution of the problem involved in maintaining and expanding power systems.

The $400,000 analyzer is being built by Westinghouse Electric Corporation and will be installed in a specially-fitted



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room at the Institute. The power companies which have contributed have agreed that if they do not require all the time allotted to them they will put the device at the disposal of other utilities.

The analyzer is actually a power system in miniature, with a typical scale factor of 1 to 100,000.

●

Marking Device. — A new, light-weight, applicator for applying lane marking tape to industrial and commercial floor areas, has been announced by Minnesota Mining and Manufacturing of Canada Limited, London, Ont.

Trade-named "Scotch" brand lane marking applicator, the new unit is designed to semi-automatically apply strips of "Scotch" brand plastic film tape No. 471 to mark trucking lanes aisles, storage areas and safety zones on floors. To apply the tape to the floor the services of only one man are required. The new tandem wheeled applicator, consisting of one guide, and one pressure wheel, requires no skill for operation as the user simply pushes it along the floor with the aid of a waist-high handle. The tape is fed off a roll holding attachment, under the pressure wheel, and applied to the floor in a continuous strip.

●

Drill Bits. — Diamond drill bits and reaming shells used in the big blasthole mining program of the International Nickel Company of Canada Limited at its properties in the Sudbury district are manufactured in the Company's own casting shop at the rate of 100 a day.

●

"Freedom" Diesels.—In introducing the new "Freedom" series of Diesel engines to the market, a director of R. A. Lister & Company, Limited, parent company of Canadian Lister-Blackstone Limited, 1510 Drummond St., Montreal, said "Freedom may be described as an antidote to frustration". The Company claims that the new engine is, to a great extent, free from the drawbacks so often associated with the modern *high-speed* Diesel engine.

The "Freedom" series consists of a range of one, two, three, four and six-cylinder high-speed oil engines, suitable as prime movers in a great variety of trades and industries. Excepting the single-cylinder, the engine develops 9 hp. per cylinder at 1800 r.p.m., or 8 hp. at 1500 r.p.m., and is thus suitable for coupling to alternators of 60 and 50 cycles.

The power ratio has been kept as low as possible without sacrificing robustness, durability and long life.

The engine has been specially designed for running at high speeds without impairing the standard of reliability—it is claimed. At 1500 r.p.m. the piston speed of the "Freedom" is only 3 per cent higher than, for example, the Lister "J.P." at 122 r.p.m.

A six-cylinder "Freedom", developing 48 hp., is one-third lighter than a four-cylinder "J.P." developing 40 hp.

All working parts are totally enclosed but are readily accessible. A standard type of wet liner chrome hardened with the patented "Listard" process has been adopted, giving, what is claimed, "the best wear-resisting surface known".

To conform to British Standards Specification 649: 1949, the engine will develop its rated horsepower for twelve hours continuously and 10 per cent overload for one hour.

The new "Freedom" is probably the first engine on the Canadian market which uses the unified threads system adopted between the U.K., the U.S.A. and Canada. This will enable service work to be carried out anywhere on the North American continent with standard wrenches. All models of the new engine are available in Canada through Lister Blackstone's five representatives. B.C. Equipment Co. Ltd., Vancouver, B.C., Medland Machinery Limited, Winnipeg, Man., Bruce Robinson Electrical Co. Ltd., Edmonton and Calgary, Alta., Russell Hipwell Engines Ltd., Owen Sound (Ontario) and Halifax, N.S. and Consolidated Engines & Machinery Co. Ltd., Montreal.

●

Western Oil Plant.—Engineering design for western Canada's large-scale lubricating oil plant is now in hand, according to information released by H. H. Moor, superintendent of Imperial Oil's Edmonton refinery.

Preliminary estimates of cost are in excess of $10 million. The new equipment would make 750,000 barrels annually of high quality automotive and industrial oils from selected Alberta crudes.

The Edmonton plant would be the second largest lubricating plant in Canada. It is expected that construction will begin early in 1954 and the target date for completion will be the middle of 1955. Imperial's operations west of the Lakehead would then be independent of lubricants from eastern Canada or the United States except for certain specialities which are not in large demand.

The complex units of the new plant will include a solvent extraction plant, a solvent dewaxing plant and equipment for finishing and packaging lubricating oils.

●

Thompson Plant.—Manufacturing operations have commenced in the new Thompson Products plant which is located near St. Catharines, Ontario.

Designed primarily as a new manufacturing division for parts for jet aircraft engines, the $6 million plant will start jet part manufacture within the next few weeks. In the meantime, work connected with a Government ordnance contract is now under way.

Several hundred persons will be employed in the new plant as soon as the full production program is under way. The company's major contract is for production of jet engine parts for the British Sapphire engine.

The plant has a floor area of 150,000 square feet.

●

New Welding Heads. — Thirteen new welding heads that fit interchangeably on Purox W-202 and W-201 blowpipes have been announced by Dominion Oxygen Company, Limited, Toronto.

No wrench is needed to get a firm, gas-tight seal between the blowpipe handle and welding head. The new heads snap in or out of either blowpipe with one easy hand motion. Two synthetic rubber "O" rings eliminate all metal-to-metal gas seals between head and blowpipe and make this quick-changing feature possible.

For further details, communicate with the Company.

●

British Industries Fair. — The Castle Bromwich, Birmingham, section of the British Industries Fair, which is being held from April 27 to May 8, will have a greater appeal to the Canadian buyer than ever before because of Canada's current industrial expansion. Already 96 per cent of the indoor space of the Birmingham Section has been booked by more than 1,200 engineering, electrical and building firms and demands for outside exhibition space are also very heavy.

This year, the Canadian buyer will find that he can not only get many of the products of the United Kingdom heavy industry manufacturer at lower prices than before, but he will find that delivery is much quicker. Great emphasis is being placed on competitive prices.

In the engineering section 450 manufacturers will take 130,000 sq. ft. of space to display everything from abrasives to wood-working machinery. Among the new equipment to be exhibited is a hand spot-welder shaped like a sub-machine gun which literally shoots spot-welds into metal at the rate of 500 shots an hour.

●

G.E. Welding Transformer. — A new 300-ampere a-c welding transformer, featuring stepless current selection from 40 to 375 amperes, has been announced by Canadian General Electric Company's, apparatus division.

The new welder, for practically all applications from light duty, low-current sheet metal work to heavier-duty, high-current industrial jobs, incorporates an enlarged scale and finely threaded screw adjustment to facilitate easy current selections. It accomodates electrodes from 3/32 to 1/4 in. diameter and has a handy range switch which enables the operator to change quickly from high to low, or low to high range. Arc-stabilizing capacitors in the redesigned equipment contribute towards increased production. Extra protection against high temperature coil failure is provided by silicone insulation. To further protect the coils from hotspots, they are ventilated by a forced-draft fan rated for continuous duty.

The new welder is 36-in. high, 21 in., in diameter and weighs approximately 328 lb.

●

Montreal Growth.—Gordon MacL. Pitts, M.E.I.C., acting chairman of the City Executive Committee of Montreal told the City Council that Montreal is on the threshold of the greatest material advance in its history.

●

Detergents.—Vosco Industrial Chemical Products Ltd, Montreal, claims to be producing detergents in Canada, for the first time, according to an entirely new sulfonation process. The inventor of this process is O. V. Vrany, M.E.I.C., president and manager of the Company.

The Canadian organization will produce different types of detergents, such as, Alkyl-Aryl, Lauryl, High Alcohols and Fatty Condensate types, all of which will be produced in Liquid, Slurry and Powder form. Vosco produces basic detergent materials only and not finished products. In addition to the standard types produced, orders will be accepted according to customers own specification.

●

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Safety Record.—According to statistics, one of the safest places in which to work is an oil refinery. The Montreal East Refinery of Shell Oil Company of Canada finished 1952 with a record of 1,473,395 hours of accident-free performance. Some 700 employees at this refinery had worked 380 days without a mishap that caused lost time.

●

Sykes Tool Corporation. — The Sykes Tool Corporation Limited now have a wide range of gear-cutting machines and other machines and other machine tools on display, both in Toronto and Montreal. These machines can be sold directly from the floor. They are completely equipped and ready for delivery. The range display includes Sykes gear-cutting machines and metal and wood working products made by such British and Continental manufacturers as: Scottish Machine Tool Corporation, Denham's, Wilson and others. And, as a service to all customers, Sykes maintain a complete Canadian staff of trained technicians and engineers. This staff is available for help in tooling up, installation and servicing of machines.

The Toronto show room is located at 123 to 131 York Street and the Montreal demonstration centre at 515 Bisson Street.

●

Western Wood. — Hammering on the theme "The Trend is to Western Woods", the forest industries of British Columbia embark this spring on an intensive half-million dollar, two-year promotional program to secure a larger share of Canada's construction dollar by demonstrating that *"no other building material offers all the advantages of wood."*

Encouraged by the phenomenal success of their first all-wood "Trend House" introduced to home builders in Toronto last year, the British Columbia forest industries' three major associations have combined forces again and completed plans for a $500,000 sales promotion campaign. The campaign will include the erection of ten demonstration "Trend Houses" in key Canadian cities from coast to coast. On display will be British Columbia's colourful quartet of popular home building softwoods, Western Red Cedar and Pacific Coast Hemlock lumber, Red Cedar Shingles and Shakes and Douglas Fir Plywood.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Valve Data.—Peacock Brothers Limited, Box 6070, Montreal, Que., offer copies of new data sheets on Jerguson Liquid Level Gages—Reflex Type. These sheets replace Unit No. 81.

●

Metal Coating. — Dominion Oxygen Company, Limited, 40 St. Clair Avenue, East, Toronto 5, offer a booklet describing the features of a new service—the application of undiluted coatings of powdered metals, such as tungsten carbide, to metal parts. This new 12-page illustrated booklet, entitled "Flame-Plating", has been offered to Journal readers without charge.

Ask for booklet No. 8065.

●

Jeffrey Catalogue.—Jeffrey Manufacturing Co. Ltd., P.O. Box 428, Montreal, Quebec, has just released a new "Jeffrey Spiral Conveyor" Catalogue. This publication is designated as Catalogue No. 851 and contains illustrations of spiral conveyor equipment for handling such bulk materials as cement, chemical products and lime and many others of the multitude of products which may be conveyed by spiral conveyors.

The first portion of this catalogue deals with engineering, and it contains capacity charts, tables for selecting the proper type of spiral, complete with horsepower recommendations.

The catalogue may be obtained by writing to the head office in Montreal or to the Company branch offices at

Toronto, Hamilton or Halifax, or to Jeffrey distributors in key cities across Canada.

●

Minneapolis-Honeywell Bulletin. — Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto, 17, Ontario, offer copies of Bulletin No. 15-16. The bulletin contains technical data on the application of power measurement transducers to process control. The information was written by M. C. Carpenter and H. T. Streitz of the Company's Industrial Division Engineering Department. Technical application data on all subjects such as salt operation, pulverizing, clay mixing sodium production and measurement and control of a-c. power plus the measurement and control of d-c power was covered technically Engineering descriptions of applications of thermal converters, solenoidplunger ammeter, torquemeter, vacuum thermocouple, rectifying current system, precision shunt, saturable reactor and magnetic amplifier are covered.

Write to the Company for copies.

●

Monsanto Facts. — Monsanto Canada Limited, 425 St. Patrick Street, LaSalle, Montreal, Que., offers Journal readers a "Facts Book". The publication, which is in pocket size, gives details on the Monsanto Company, its products and its personnel. This publication will be most useful to readers who are interested in the chemical industry and its products. For copies apply to Donald R. Dawson, manager of public relations, at the address given above.

●

LIBRARY NOTES

Continued from 314 (92)

BULLETINS RECEIVED

Bell telephone system. Monographs:

No. 2005—Experiments with linear prediction in television, by C. W. Harrison. No. 2006—A carrier telegraph system for short-haul applications, by J. L. Hysko and others. No. 2007—Photoelectric properties of ionically bombarded silicon, by E. F. Kingsbury and R. S. Ohl. No. 2008—Statistics of television signals, by E. R. Kretzmer. No. 2009—Efficient coding, by B. M. Oliver.

British electrical and allied industries research association. Technical reports:

No. S/T57—The measurement of lightning currents. A survey of the present state of knowledge, by R. H. Golde and T. J. Brown. No. Z/T89—Fuel cells. A non-technical outline of their development, by A. P. Paton.

Canada. Dominion coal board. Reprints:

Coal in Canada, 1951: industrial requirements and supply, by C. L. O'Brian. (Reprinted from Mining Society of Nova Scotia, Transactions, Volume 55, 1952, pp. 282-291). Coal preparation and its relationship to mineral dressing, by E. Swartzman and L. E. Djingheuzian. (Reprinted from Canadian mining journal, January and March, 1952).

Canada. National research council. Associate committee on soil and snow mechanics. Technical memoranda:

No. 25—Soil mechanics papers presented at the building research congress, 1951.

Canada. National research council. Canadian government specifications board. Specifications:

No. 3-GP-2A-Oil; Fuel. No. 20-GP-6A-Tubes, inner; vehicle and mobile ground equipment. No. 42-GP-11-Jugs; Aluminum, institutional. No. 42-GP-12-Pots, tea; Aluminum, institutional. No. 42-GP-13-Pots, coffee; Aluminum, institutional. No. 42-GP-14-Pan, steam table; Aluminum. Pan, bake; Aluminum. No. 42-GP-15-Plates, pie; Aluminum. No. 42-GP-16-Ladles; Aluminum, institutional.

Illinois. Department of registration and education. State water survey division. Circulars:

No. 41—Feed water treatment at the Illinois state institutions, by R. W. Lane.

United States. National research council. Highway research board. Current road problems:

No. 1—R. rev. ed.—Curing of concrete pavements.

United States. Department of commerce. National bureau of standards. Building materials and structures reports:

No. 121—Investigation of failures of white-coat plaster.

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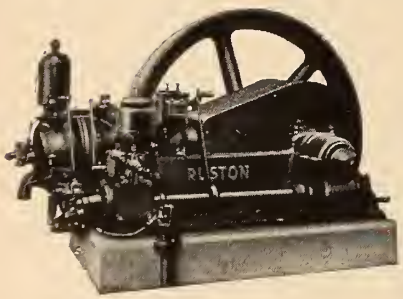

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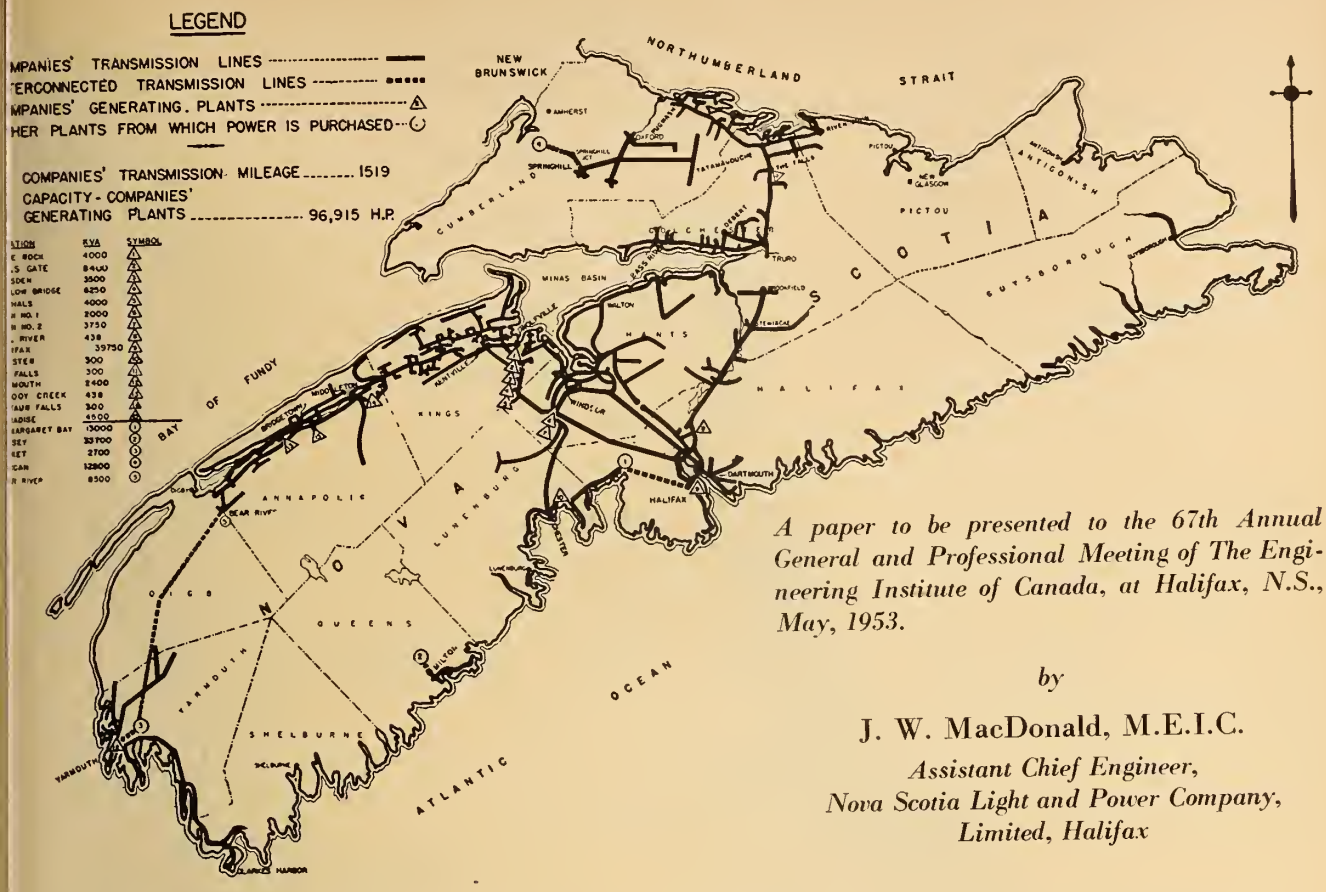

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by

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STEAM GENERATION OF POWER

at

Nova Scotia Light and Power Co., Limited

This paper records the post-war growth in demand for power in the areas served by the Nova Scotia Light and Power Company's interconnected system, and how it is being met. Higher fuel prices made economical the development of several previously marginal hydro sites, the fourth and last of which was brought into service last year. Concurrently, the 20,000-kw. addition to the Company's steam plant, described in this paper, was placed in operation in 1951. Addition of a further 22,000 kw. unit is now under way, scheduled for operation late in 1953. Another 25,000-kw. unit is on order for delivery in 1955, while a sixth unit is contemplated for completion about 1958.

The geography and topography of Nova Scotia is such that there are no large and elevated catchment areas, no large rivers nor high waterfalls. Such attributes to potential hydro-electric power are found therefore only in relatively small sites, and most of these are already developed and in production.

Balanced against this deficiency in water power resources, the Province has an abundant and widely distributed supply of coal, well suited to the production of electricity in thermal plants. This is the principle natural endowment therefore, — at least until atomic energy revolutionizes the technique, — which can supply light and power to new homes and new industries. A number of relatively large and modern steam stations, already establishing this trend, have been brought into production during the past two to three years. One of these was the 20,000-kw. addition to the plant of Nova Scotia Light and Power Company, Limited, at Water Street, Halifax, bringing the installed total there to 32,500 kilowatts.

Seven years ago, (October, 1945), a paper was published in the *Journal* of the E.I.C. describing the first modern steam plant to be added to the interconnected system of Nova Scotia Light and Power Company. This plant, installed for unit operation, consisted of a boiler of 110,000 lb. per hour continuous steaming capacity at 600 p.s.i.g.,

Fig. 1 (above). Transmission system and area of Province served by Nova Scotia Light and Power Company, Limited.

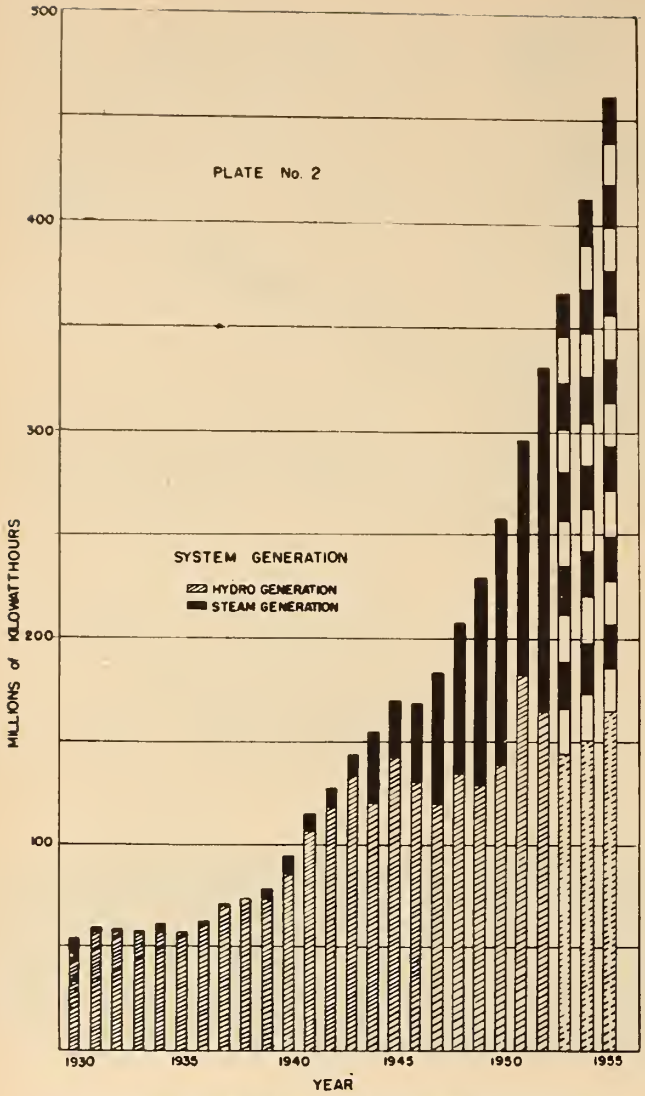


Fig. 2. Yearly generation of k.w.h. on the system.

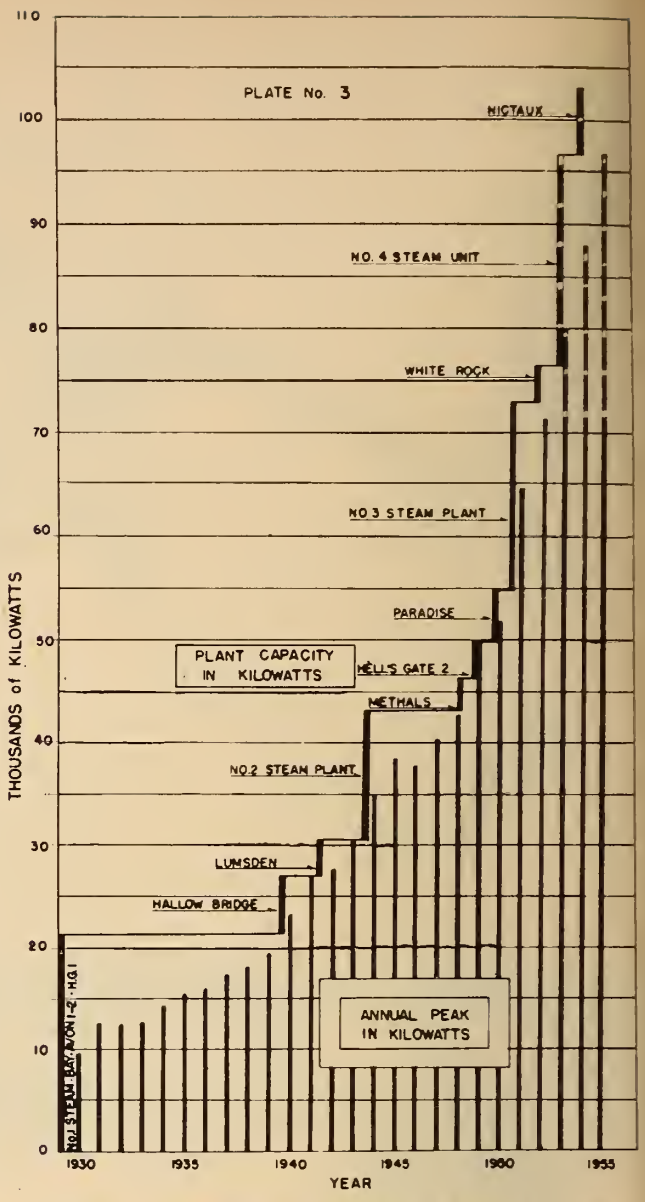


Fig. 3. Annual peak loads and system capacity.

815 degrees F. and a 12,500 kw. turbo-generator, with conventional feed-water heating equipment. As then described, the demands of the system were supplied largely from the Company's hydro-electric plants supplemented by power purchased from The Nova Scotia Power Commission's St. Margaret's Bay Hydro System.

When this steam unit came on the line it was, by comparison, over twice the capacity of the next smallest unit. The addition of such a substantial increase in productive plant in late 1944, left the Company in the apparent position, at War's end, of having a margin of spare capacity which would last for several years. The heavy increment of national defense load would drop off, it was felt, leaving an indefinite time interval for natural growth to recover. That this pattern of electric load did not develop nationwise as predicted is history today, and this paper describes measures taken to provide for the rapid recovery and the surprising continued growth of load up to the present. Areas of the Province served by the Company are indicated on the map shown in Fig. 1.

Growth trend on the system is shown graphically in Figs. 2 and 3. The former shows annual generation of energy in kilowatt hours, and the latter, annual peak load and plant capacity in kilowatts. It should be noted here that, as the price of fuel increased, certain hitherto marginal hydro sites became attractive economically, and three plants totalling just under 14,000 hp. were added from 1948 to 1952 to the Company's hydro capacity.

A new plant of 9,000 hp. under construction at Nictaux Falls and scheduled for operation in the fall of 1953, will practically complete the development of the Company's hydro potential. While these relatively small units were being added to the system, the work of planning for and installing new steam plant capacity was resumed in 1948, and is still in progress.

This steam plant program required a 20,000-kw. unit to be in service in the fall of '51, which date was met. Present work is on a 22,000-kw. unit which is to be in service in the fall of 1953, and on the drawing board, and already ordered, is a 25,000-kw. set planned for operation in the fall of 1955. Reference to the capacity curve (Fig. 3) indicates the times and amounts of spare capacity on the

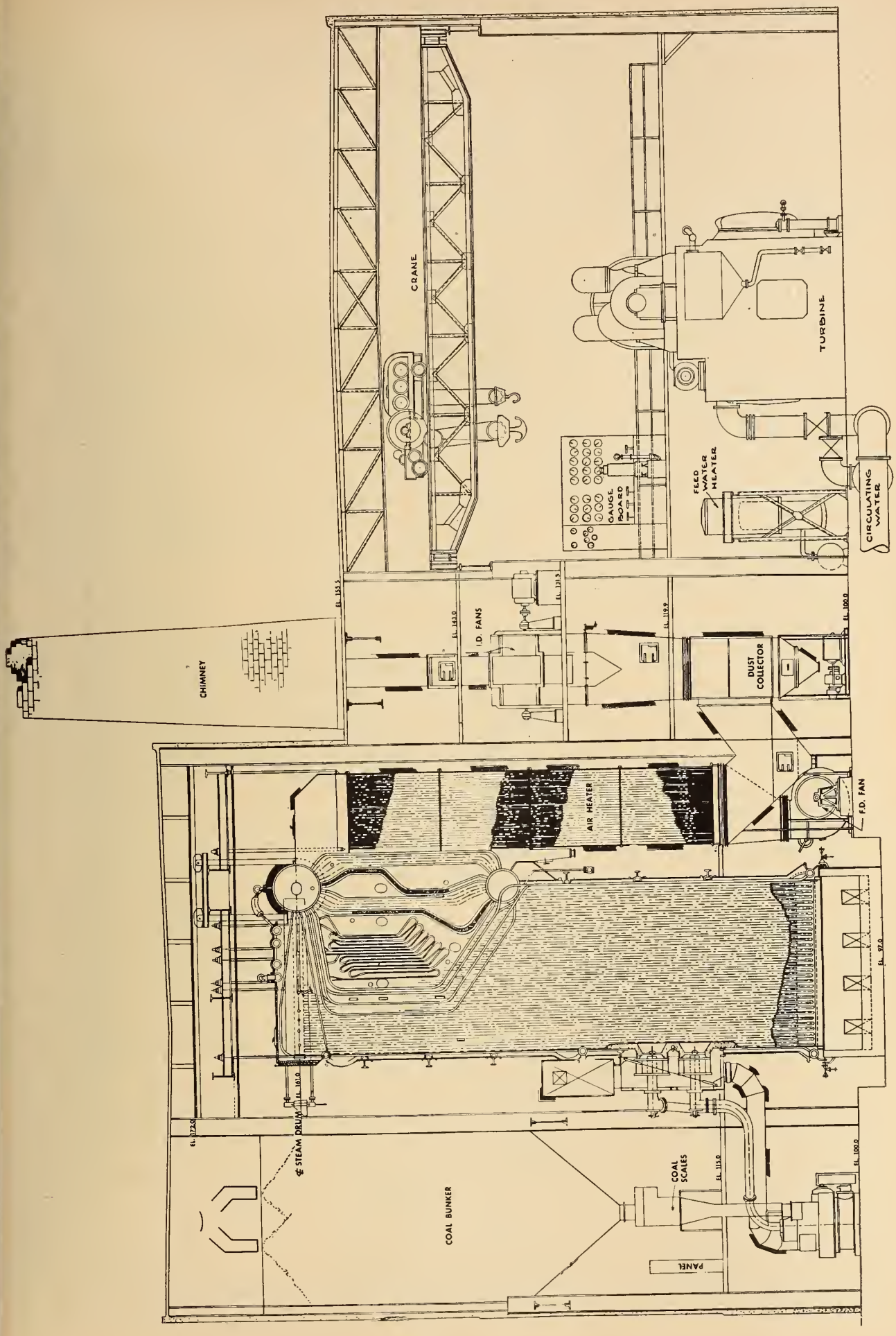


Fig. 4. Sectional elevation of No. 3 plant.

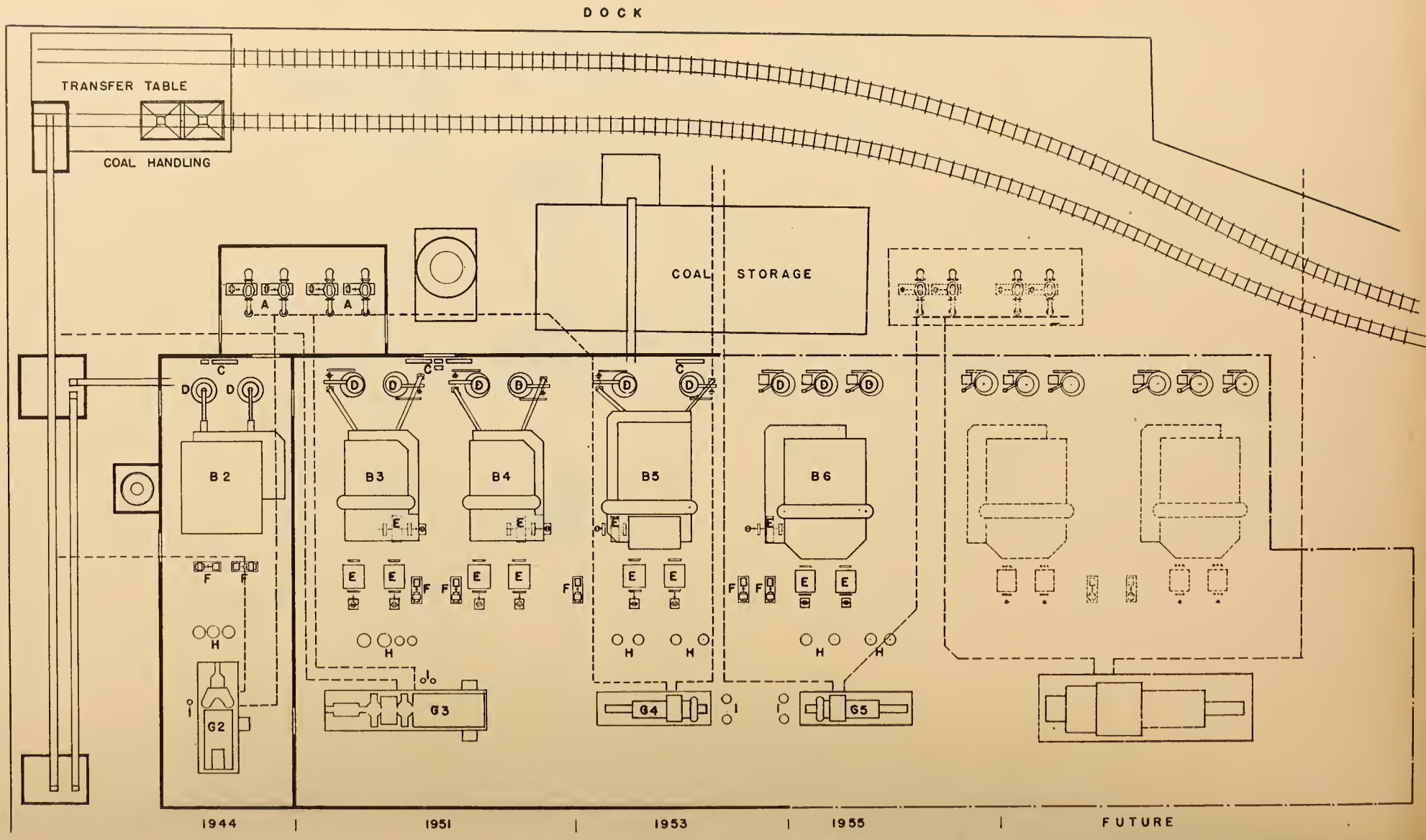


Fig. 5. Plan of power house arrangement.

system with this schedule as a pattern.

This paper describes principally the 20,000-kw. addition designated by the Company as No. 3 Plant. The station is located on the Harbour front, near the south Ocean Terminals, at the site of the original steam plant, built over fifty years ago.

Cooling water conditions are almost ideal, and both ocean and rail freighting facilities are available for delivery of fuel. Whereas the 1944 plant was built on vacant space on the plant property, subsequent expansion has encroached upon the old low pressure plant, until now it is all gone except for a 3,000-kw. set. This feature complicated the program of construction, as it was necessary to protect and keep in operation, the remnant of old boiler and turbine plant. However, such basic consideration as proximity to load, rail and water freight facilities, excellent cooling water, and utilization of operating staff, encourages development at this site to at least 125 mw. before starting at a new location.

Fuel Handling

Over the past fifty years, during which time the use of coal has grown from two or three tons per day, to over four hundred, delivery has been by water freight. Large coal ships bring the fuel from Cape Breton to the Dominion Coal Company's pier, where it is transferred in about 2,000 ton lots, to a barge lighter and towed to the steam plant wharf. There it is unloaded by grab bucket into a hopper, and conveyed by elevators and belts to the boiler bunkers.

Economics of land versus ocean freight, considering the short haul, and the elimination of several handling operations, indicated last year that land freight would effect some saving. Rail sidings and unloading equipment were designed as an alternative facility, and are now under construction. Two rail lines will enter the plant property, the incoming one terminating on a transfer table over a hopper where the coal will be dropped. The empty car will then be transferred sideways to the outgoing track. An apron feeder and series of belt conveyors will take coal from the dump hopper and deliver it to the boiler room bunkers. This equipment is designed to handle coal at a rate of 200 tons per hour.

The transfer table, hopper and car shake-out will be completely housed, to protect operating equipment from the corrosive salt air, and to minimize the dust nuisance from unloading operations. Yard area at this site limits car standage to 7 or 8 cars and with this limitation in mind, all tracks, transfer table and bridging have been designed to handle 70 ton cars so that a shunt of five to six hundred tons can be delivered. Maximum storage at the plant site, including boiler room bunkers, will be under ten thousand tons.

Oil storage and pumping facilities are not yet installed, although the boilers are suitable, and partially equipped, for oil firing. Studies are being made of the practicability of converting to oil storage, the water tanks of the Company's gas holders now no longer in use. Provision will be completed for switching to oil as an emergency or standby fuel, to back up the limited coal reserves, but in the interest of Provincial economy, coal will be the basic fuel while it remains competitive in price.

Power House

At this site, rock lies from 15 to 25 feet below low tide level. Timber water-front structures protect from erosion the overburden of made ground on which the plant is located, and it was necessary to drive piling for both building and machinery foundations. For the so-called No. 3 Plant extension, red pine piles treated with 12 lb. per cu. ft. of creosote were used, sized according to C.S.A. specifications and driven with a steam hammer. For design purposes a loading of 30 kips per pile was assumed with a pile spacing of 2 ft. 6 in. between centres.

For the extension presently in progress, boiler and bunker column loadings were so heavy that it was not possible to get the required number of wood piles into the space available, so steel piling was used. Standard 12 in. x 12 in. pile sections of 53 and 65 lb. were used, the latter loaded to 80 kips in design. Further, because of heavy rock fill in the area of the turbine foundation, steel piles were used there as well. The piles were driven to bed rock with No. 11 hammer. Conventional concrete capping was used to provide foundations for the building structural steel columns.

The building itself presents no particularly distinctive features. With the exception of its temporary south face of asbestos sheets, the wall and floor slabs are of reinforced concrete. The central bay supports the chimneys, dust collectors and fan equipment. The present turbine room extension will carry on the roof, a terminal tower for 69-kv. transmission lines and two 69-kv. air blast breakers.

The general layout of equipment in the building is as shown in Figs. 4 and 5. Maintaining the same east-west building dimension as established for the 12,500 set, it was necessary in placing the 20,000-kw. machine to adopt the lengthwise arrangement. A width of 60 feet is provided for the turbine room; 20 feet for an auxiliary or central bay; 40 feet for the boiler and 20 feet for bunker, boiler control and pulverizers. The turbine room is 55½ feet, and the boiler room 94 feet in height. No partition walls are used. The space occupied (Fig. 4) provides approximately 35 cu. ft. per kw. of plant capacity. A 50-ton cab-controlled crane serves the present turbine room, and will travel over future sets handling all parts with the possible exception of the last generator stator, which can be cribbed into position.

Considering the plant load factor, price of fuel, size of units, and capital cost of equipment, it was considered economical to continue with the steam conditions established when the 12,500-kw. set (No. 2) was installed in 1944, namely 600 p.s.i.g., 815 degrees F. T.T. Future units Nos. 4 and 5 are being built for the same conditions.

Boilers

Two bent tube, two-drum water tube type pulverized coal fired boilers supply steam at 600 p.s.i.g., 815 degrees F. to the main steam header. Each boiler is capable of delivering 150,000 lb. per hour when using coal with an ash softening temperature of 1,875 degrees F., or 187,000 lb. per hour with 2,000 degrees F. ash. Each boiler is fired by four burners supplied from two ball bearing type pulverizers. Figure 4 indicates in section the general arrangement of one of these boilers. Figure 6 shows the boiler panel which mounts the instruments for completely automatic temperature and combustion control.

Coal enters the mills from coal scales mounted directly under the boiler house bunkers. The mills are under pressure of primary air, and the mixture of pulverized coal and 150 degrees F. air is blown into the burners. Secondary air dampers and burner diffusers are adjusted manually to give proper flame travel and combustion. Boiler and superheater tube surfaces are cleaned by retractable soot blowers at

upper furnace and superheater area, and by air-puff blowers in the cooler parts of the tube banks. High pressure steam, and air at about 160 p.s.i.g. are used, and all blowers are operated in sequence automatically.

From the furnace, the gases pass through a tubular (one gas pass) air heater, and then through a cyclone type dust collector, where under normal load conditions some 85/90 per cent of the suspended particles of fly ash are removed. Under extraordinary conditions of soot-blowing, a somewhat higher percentage of the total escapes to the stack. For exhausting flue gases, two motor driven induced-draft fans per boiler are used, each capable of taking the boiler up to 80 per cent of max. continuous rating. The suction sides of these fans are connected to the dust collector outlet, and their discharges are joined to a common breeches section, which delivers directly into the bottom of the individual boiler chimneys which are mounted on the roof. Fan suction is controlled by louvre dampers on the fan inlet.

To prevent settlement of fly ash into the idle fan, and to reduce re-circulation of gas through that fan, a tight fitting butterfly damper is installed in the discharge section between fan and stack. This damper automatically closes when the fan motor is tripped, and opens when the motor is started. Indicating lights on the boiler panel tell the operator of the damper position. Each boiler has one damper-controlled forced draft fan. To assist boiler room ventilation, a stack is arranged on the forced draft fan inlet so that warm air can be drawn from the space above the boilers. All fans and mills are driven by 2,300 volt, drip proof, induction motors.

Chimneys are constructed of radial brick, lined to full height, and capped with a V-shaped cast iron ring designed to prevent heavy build up of fly ash. Chimney height is 70 feet above turbine room roof, or 125 feet above ground level. The chimneys are sized for an exit velocity of 40 feet per second at boiler rating.

A pneumatic dry-ash conveyor system removes ash from the boiler furnace hoppers, rear pass hoppers, and dust collectors, and delivers it to an ash bin outside the boiler room. At present, vacuum is provided by a steam-jet exhauster, but this is to be supplanted soon by a mechanical blower to increase the capacity of the system, and to stop removal of pure steam from the plant cycle.

Feed water enters the boiler at about 325 degrees F., its flow controlled in relation to steam flow from the boiler, water level in the drum, and water flow entering. The superheaters are pendent type. Steam temperature is controlled by a contact type desuperheater, which sprays boiler feed water directly into the steam path before the last pass of superheater. Desuperheating water is controlled by two primary elements, one responding to final steam temperature and the other to air flow through the boiler, the latter to provide quick response to sudden gas temperature changes in the superheater area. With this control, 815 degrees plus or minus 10 degrees is attainable, from maximum down to about 65 per cent of rating, below which the temperature starts to fall out of control.

Because of this introduction of water into the steam path, particular care is taken to guard against dissolved solids, particularly silica, being carried over into the turbines. A battery of four 200,000 lb. per hour centrifugal pumps supply feed water to the boilers. One pump is steam turbine driven; the others are by motor. The feed suction header is connected through a weight loaded valve to the surge tank, so that in the event of extraction pump failure, water is admitted from this reserve, and raw water flows into the surge tank when it falls below a predetermined minimum level providing a further emergency back-up.

The water cycle in this plant is not completely closed. A steam-heating load to the amount of 50,000 lb. per hour in winter months is supplied from the main steam header through a pressure-reducing, desuperheating station, and the bulk of this is sold in metered quantities, at 150 p.s.i.g. 450 degrees F. to Railway and Port Terminal buildings. Of the total, not over half is returned as condensate, consequently, proportionate make-up must be added to the cycle.This make-up demand is further increased by steam consumed by ash exhauster, continuous blowdown, and soot blowers.

Because turbine evaporator capacity is not designed to supply this total make-up, a zeolite demineralizer is used to treat raw water as required. This unit consists of two batteries, each consisting of a cation and an anion exchanger; each battery capable of treating 20,000 lb. per hour, and arranged so that they can be connected in parallel during periods of heavy demand, but normally will operate in series, the freshly regenerated unit serving on the up-stream side to remove silica and other dissolved solids to negligible p.p.m. Treated water passes to a contact type deaerating heater, where it mixes with condensate returns from the central heating load, and from there it is delivered by pump at about 212 degrees F. to the boiler feed pump suction header.

No. 3 Turbo Generator

This machine, which has now been in operation for over a year, has a maximum continuous rating of 20,000 kw. (23,500 kva.). The turbine is a two-cylinder, double exhaust, full reaction machine. The high pressure cylinder has 37 stages, which, at full load operation, reduces the steam to about 10 lb. abs. and 198 degrees F. From the high pressure cylinder the steam passes to the low pressure, where it divides, each half flowing through 8 stages of low pressure reaction blading, thence through double exhaust openings to the condenser. The heat cycle for this unit is the familiar regenerative, or feed heating cycle employing two low pressure, and two high pressure, closed non-contact type heat exchangers. Figure 7 shows this cycle in single line diagram.

All deaeration of feed water is done in the condenser, and, for make-up requirements a 5 per cent capacity evaporator is provided. A noteworthy feature in connection with heat recovery to the water cycle, is the divided air cooler for the generator. One half of this cooler is connected to the circulating water inlet and outlet pipes, and is cooled by sea water; the other half is connected into the condensate line between extraction pumps and L.P. heaters. For loads up to 75 per cent of rating, condensate alone is adequate for cooling. At 16,000 kw., for example, the gain in condensate temperature through the air cooler is approximately 13 degrees F. At higher loads sea water is admitted to the other section as required. The condensate section operates indefinitely without cleaning.

All the essential valves for controlling condensate, feed water, and bled steam are arranged conveniently at control tables, a small control table in front of the gauge board being for auxiliary steam service to auxiliary oil pump, gland seal steam and priming ejector. Two 100 per cent capacity extraction pumps are provided. A conductivity meter

nounted on this gaugeboard checks he condensate leaving the condenser, and actuates an alarm in the event of chloride contamination.

Sea water for condenser cooling is delivered by two 10,200 I.g.p.m. horizontal centrifugal pumps, driven by 100 hp., 2,300-volt drip-proof motors. The 20,000 sq. ft. divided water box surface condenser requires approximately 16,500 I.g.p.m. at 60 degrees F. which temperature is close to the upper summer-time limit. For control of algae in pipes and condenser, chlorination is used from June to November, a residual of .5 (Ortho-tolodine test) having been found satisfactory for this purpose. It does not, however, entirely prevent the growth of mussels on the pipe walls. Consequently some further study is required of the early feeding habits of these organisms which, spawned after the water rises past 50 degrees F., fasten themselves to the interior surfaces of pipes, valves, etc., and continue to grow. Higher residuals, and heavier shock treatment over the first few weeks after spawning are to be tested.

The water intake well is screened by a motor driven revolving screen. This is a relatively simple operation as the variation between high and low tide is only about 7 feet, and the water is very clean.

For turbine control, in addition to the usual gaugeboard showing steam, water and oil pressures, vacuum, etc., a turbine meter panel is provided, having instruments to record and indicate steam flow; feed water, condensate and cooling water temperatures. Motor barring or turning gear, and special bearing oil pump are provided for use during run down or run up of the unit.

There are three 50 per cent duty oil coolers, two normally in service exchanging oil heat to a salt water circuit parallelling the condenser. To make the machine governor responsible to decrease in vacuum, a load suppression device is incorporated in the governor system, the primary element of which is controlled by condenser pressure. When the vacuum falls to 22 inches automatic load reduction commences. If the drop continues the main governor valve finally shuts off completely. This relay feature safeguards the condenser against overheating on loss of vacuum, and limits the amount of steam required to be passed to atmosphere. The atmosphere relief line incidentally in this instance is only 8 inches in diameter.

The generator is rated at 23,500 kva. capacity, 13,200 volts, air-cooled. It has direct connected main and pilot exciters controlled by a panel mounted rheostatic voltage regulator. The short circuit ratio of the generator is .55. Two motor-driven, air ventilating fans circulate generator cooling air through the two-way air cooler described with the turbine. Electrically, the machine is connected by three pairs of 750,000 c.m. cables, through an auto-transformer, to the substation 23-kv. bus. Control of speed, voltage, machine breaker, etc., is located in the substation central control room. Six thermocouples buried in the stator windings indicate temperatures at the turbine gauge board, and a high air temperature alarm is also mounted on the same panel.

Table I

Comparative Operative Performance

	12,500 Unit	20,000 Unit
Average Calorific Value of Coal	12,850	12,850
Millions of B.t.u. Consumed for Generation	97,660	172,941
Total kwh. Generated	7,279,800	14,232,000
Kwh. for Station Service	578,300	967,500
Station Service as % Generated	8%	6.8%
Net kwh. Generated	6,651,500	13,264,500
B.t.u. per new kwh.	14,680	13,020
Load Factor	88	91
Max. Load kw.	11,000	21,000
Vacuum	27.5 - 28	28.5 - 28.8
Steam Temperature	800	800
Steam Pressure	600	600

Substation

Figure 9 shows the electrical arrangement of the substation as at present. No. 2 unit which, until last year, delivered directly to the 4-kv. bus is now connected to the 23-kv. bus through its step-up transformer. The original connection is retained as an alternative direct source of supply to the 4-kv. bus in the event of major trouble on the 23-kv. No. 3 machine delivers to the

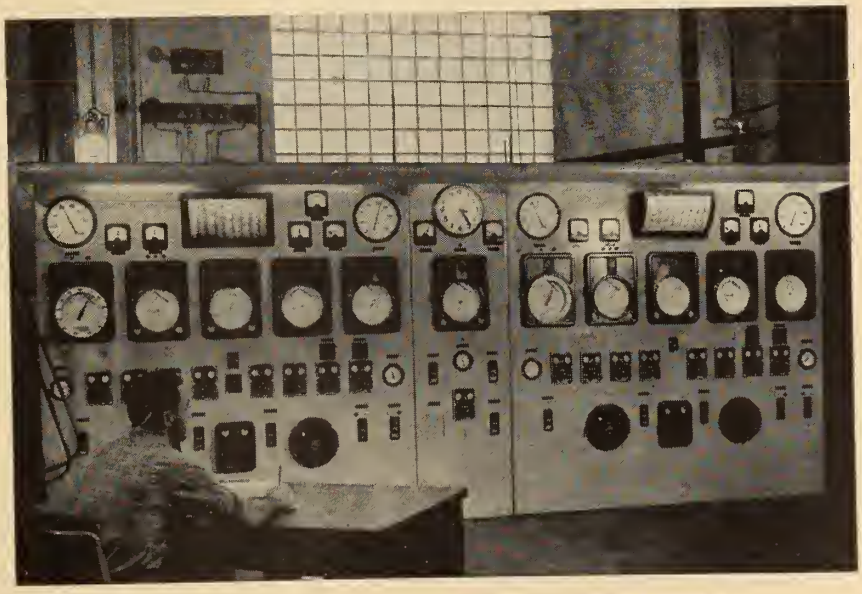


Fig. 6. Boiler control panel for No. 3 and No. 4 boilers.

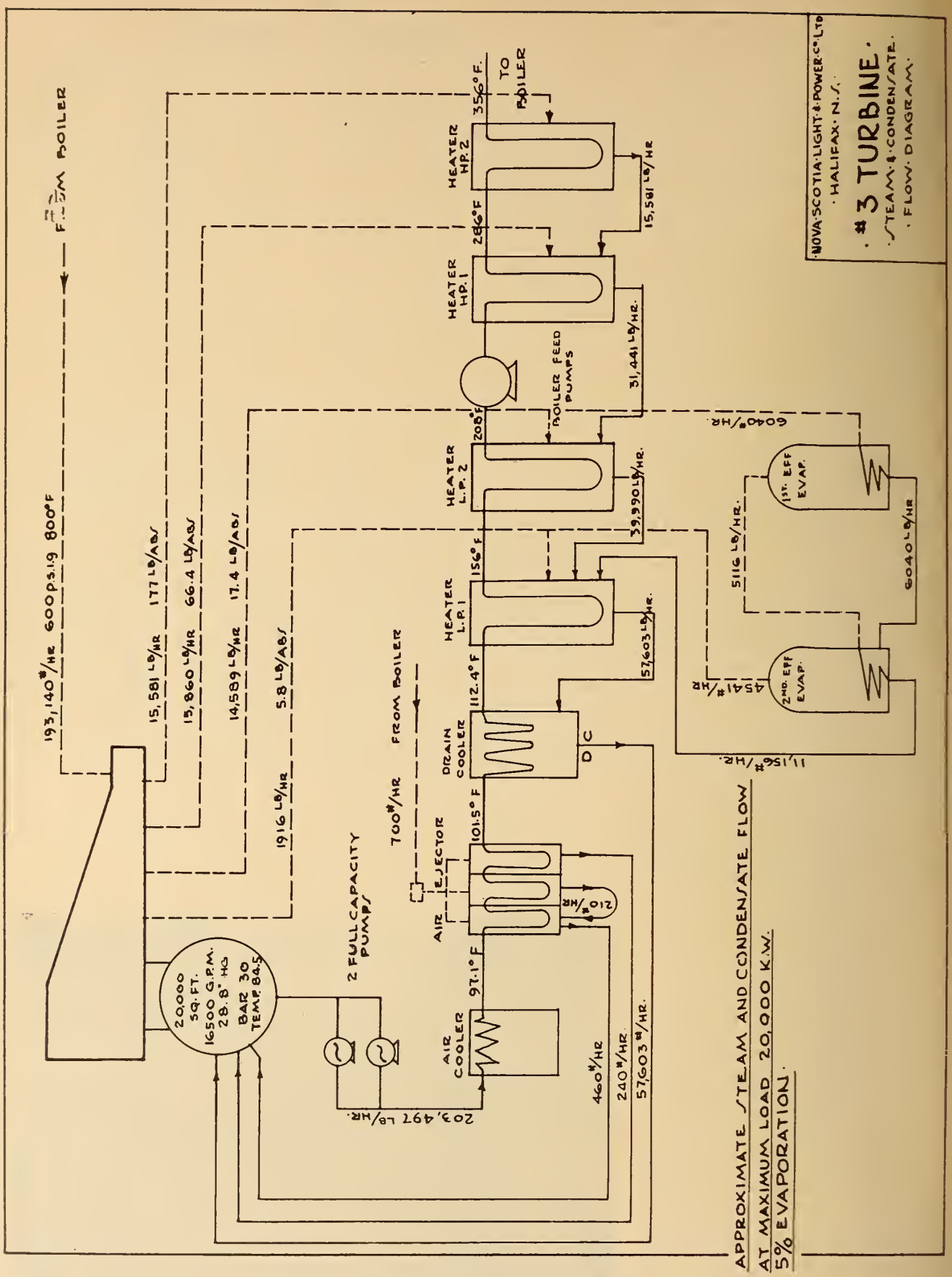


Fig. 7. No. 3 turbine steam and condensate flow diagram.

23-kv. bus through its auto-transformer. Each generator and its complementary transformer is provided with overall differential protection, in addition to the regular generator differential relays. Reverse power, residual, and overcurrent relays complete the electrical protection. Recently installed relays of the latter type have a voltage restraint feature which gives addi-

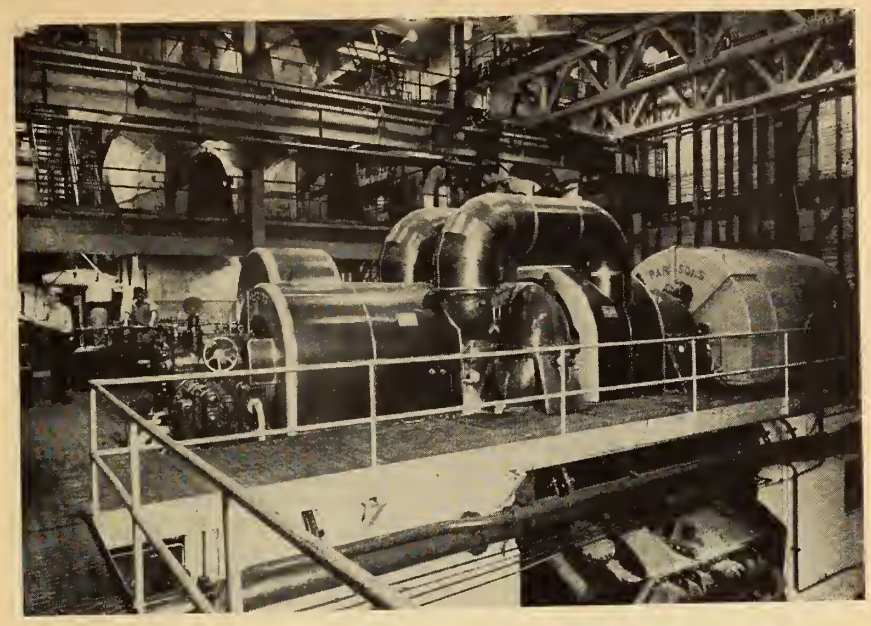


Fig. 8 (right). No. 3 turbine. Looking toward boiler room. Note the two I.D. fans.

Fig. 9 (below). Single-line diagram of Water Street substation.

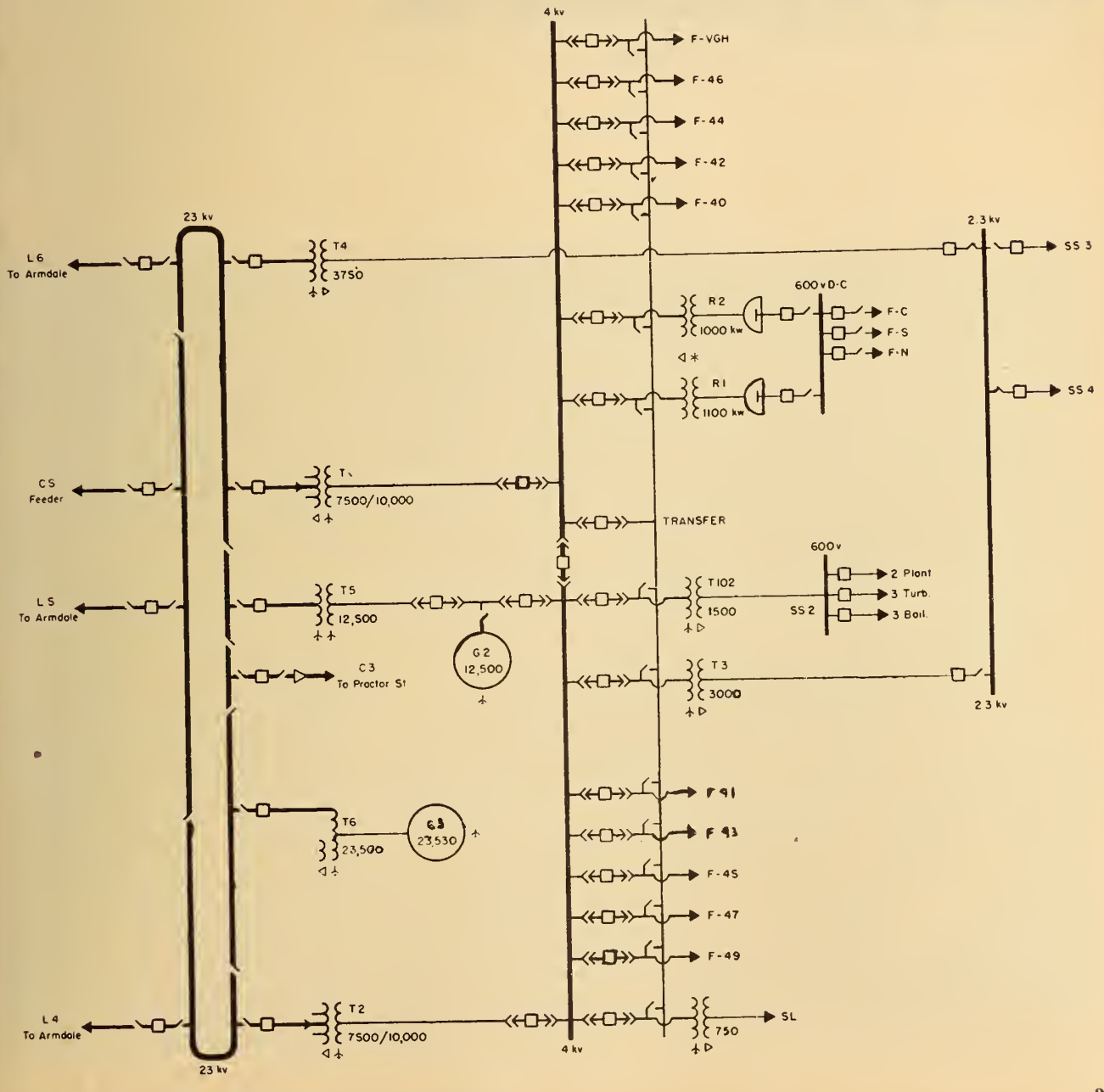


Fig. 10. Yard view of plant showing present extension (No. 4 unit) to the right. The tall chimney extreme right will be demolished with remainder of old plant.

tional assurance against the machine breaker remaining closed and the machine supplying capacity to a nearby fault.

Characteristically, these generators have high synchronous reactance, and low steady state short-circuit current, and conceivably could pump into a nearby fault without operating a conventional over current type relay. With the voltage restraint feature, a drop in generator voltage lowers the current required to operate the relay. A mechanically actuated relay trips the machine breaker when condenser vacuum fails and 2-lb. gauge pressure is reached in the condenser shell.

As stated, all large auxiliary motors are 2,300 volt. Station service is supplied from the 2,300 volt bus, through metal-clad switches backed up by current limiting fuses, and the 2,300 volt bus in turn is fed through step-down banks from the 4,000 volt bus. Ultimate arrangement of the station will provide an alternative supply from the 23-kv. bus. As the planned arrangement of the sub-station develops transmission level will be raised to 69-kv. and a 23/69-kv. transformer will make the initial tie. Subsequent generators will go directly through their transformers to the 69-kv. bus.

Two 69-kv. transmission lines of 363,000 c.m. aluminum cable, steel-reinforced, will leave the substation via a terminal structure located on the turbine roof, where line breakers of minimum oil or air blast type are also to be mounted. These breakers will be rated at 800 amp. with an interrupting capacity of at least 1,500 mva. Outdoor type air-blast breakers will be used for 23 kv. switching. All 4 kv. circuits are protected by metal clad switches, having an interrupting capacity of 250 mva. Ten feeder circuits of 350,000-c.m. cable leave the sub-station underground.

Electrical control of generators and substation switching (as well as remote supervisory of other sub-stations in the Halifax-Dartmouth area), is grouped in a central control room. Communication with key hydro plants on the system is maintained with F.M. radio telephones, as well as regular public telephone. The F.M. system, incidentally, is broadened on another frequency to reach out to line crews, trouble men and others in the operating department.

Operating Experience

Although no official tests have been run on this plant, all pertinent quantities, pressures, and temperatures are metered, and a constant check is kept on overall plant thermal efficiency under actual load conditions. Plant load factor varies over a wide range throughout the year, depending upon system total load, and the most economical disposal of hydro capacity. Normally during fall and early winter months, when water on the hydro system is low, one steam unit can operate under conditions approaching base loading.

During spring run-off when head ponds often overflow for short periods, the steam units might be shut down each night to effect a saving equal to the fuel increment. However, this practice has so far been applied to the smaller machine only, the 20 mw. set being kept on the line at a minimum of about one-third its rating, to assure sufficient capacity being available for the morning demand.

Operating through a month during which load and hydro conditions provide for as near as possible to base loading on the steam units, typical results are as shown in Table I, comparative figures being given for the two units.

Since the units are receiving their steam supply from a common steam header, it is not possible to state unit plant thermal efficiencies. At 155,000 lb. per hour load, Nos. 3 and 4 boilers operate with a temperature leaving the air heater of about 460 degrees F. and a flue gas temperature leaving of 320 degrees F. Boiler efficiency under conditions of fairly steady loading ranges from 85 to 87 per cent for both these units.

The quality and firing characteristics of the coal used in this plant are indicated by the following 'as received' analysis:

Moisture	4.8%
Volatile	30.5%
Fixed Carbon	54.0%
Ash	10.7%
Calorific Value	12,750
Ash Softening	1,950 °F.
Ash Fluid	2,150 °F.

Coals having an ash softening temperature below 1,900 degrees F. are burned at a rating which keeps furnace heat liberation to a figure not over 15,000 B.t.u. per cu. ft. per hour, and which prevents slagging of rear boiler wall and superheater screen tubes. One set of pulverizer balls grinds about 50,000 tons of this coal.

While highly satisfactory overall thermal efficiency has been logged since this plant went into operation, it has had many of the familiar teething troubles common to steam generating equipment. Some of these are attributed to the rigorous temperature cycles imposed upon boiler,

iping, heaters, etc., during periods f two-shift, or poor daily load-actor, operation. This condition, bjectionable from an operating tandpoint at present, will tend to mprove, as system night load grows nd provides full temperature load-ng for successively larger units.

1953 Extension

No. 5 boiler and No. 4 turbo-generator are scheduled for opera-ion in late fall of '52. This boiler s rated at 220,000 lb. per hour with he same steam conditions and of he same general design as the earlier nits. The generator will have a ontinuous rating of 22,000 kw. at 35 per cent power factor and this gain will be an air cooled machine. The turbine is an impulse type single cylinder machine, with re-generative equipment consisting of 2 low and 2 high pressure feed water heaters, and a single effect evap-orator capable of supplying 5 per cent make-up.

A departure from previous prac-tice, in this new addition, is the adoption of all welded main steam and feed-water piping. These lines are to be prefabricated; then field-welded and heat treated in the plant, and wherever practical throughout this new section, flanged joints are being eliminated in a determined effort to reduce outages due to leaking joints. Many of the boiler handhole fittings will be seal-welded after the boiler is proven tight on a substantial test-run. All motors over 100 hp. rating are to be totally enclosed, fan-cooled type.

Though the steam and feed-water piping in this addition is connected to the preceding plant, it is foreseen that this boiler and turbine, with feed-pump and other auxiliaries, will operate much of the time as a unit plant. Whereas No. 2 and 3 units perform in parallel without objectionable condensate handling problems, the addition of a third unit will introduce new conditions which may require expensive and complicated equipment to control.

No 4 generator will produce at 13,200 volts, and will tie to the 23 kv. bus through an auto-transformer with relay and control equipment essentially the same as for No. 3 unit. The location of this extension is shown in plan in Fig. 5 referred to earlier.

Future Additions

No. 5 turbo-generator unit is now being built in England, and is scheduled for operation in the fall of 1955. This machine will be the same type as No. 4 but will have a continuous rating of 25,000 kw. The boiler for this extension, not ordered at time of writing, will have a nominal rating of 300,000 lb. per hour with steam conditions staying at 600 lb., 815 degrees F.

Plant development at Water Street will be complete when No. 6 unit is installed. This addition is not designed, nor is its size finally settled. Its schedule for commissioning will depend upon load trend in the next two years. Today's forecast suggests that it will be required not later than 1958. The trend from basically hydro, toward predominantly steam generating capacity, and the consequent future base-loading of one or more of the steam units, will favour higher steam conditions for this larger unit. ✓

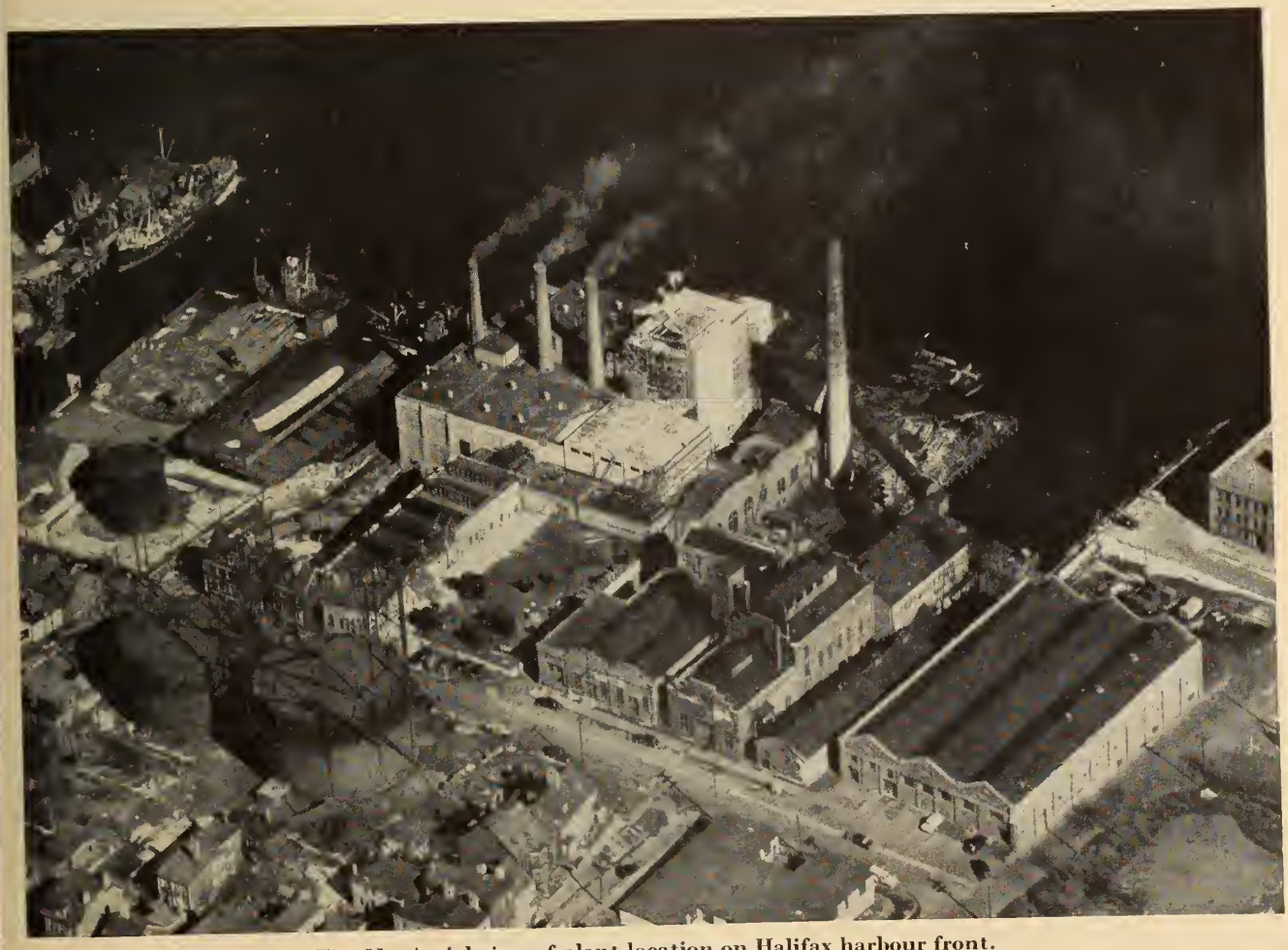


Fig. 11. Aerial view of plant location on Halifax harbour front.

Compacted Earth Fill Dam for Maritime Hydro Project

by

J. V. Daniliauskas, M.E.I.C., and D. F. Coates, Jr.E.I.C.

Power Corporation of Canada Limited
Montreal, Quebec

A paper to be presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May, 1953

The earth fill dam described in this paper is of moderate size in relation to comparable dams built in the West. Yet the problems encountered in its design and construction are of interest, in that they demonstrate the feasibility of this type of structure for many parts of Eastern Canada, where local conditions are favourable and hold promise of savings in cost or in time.

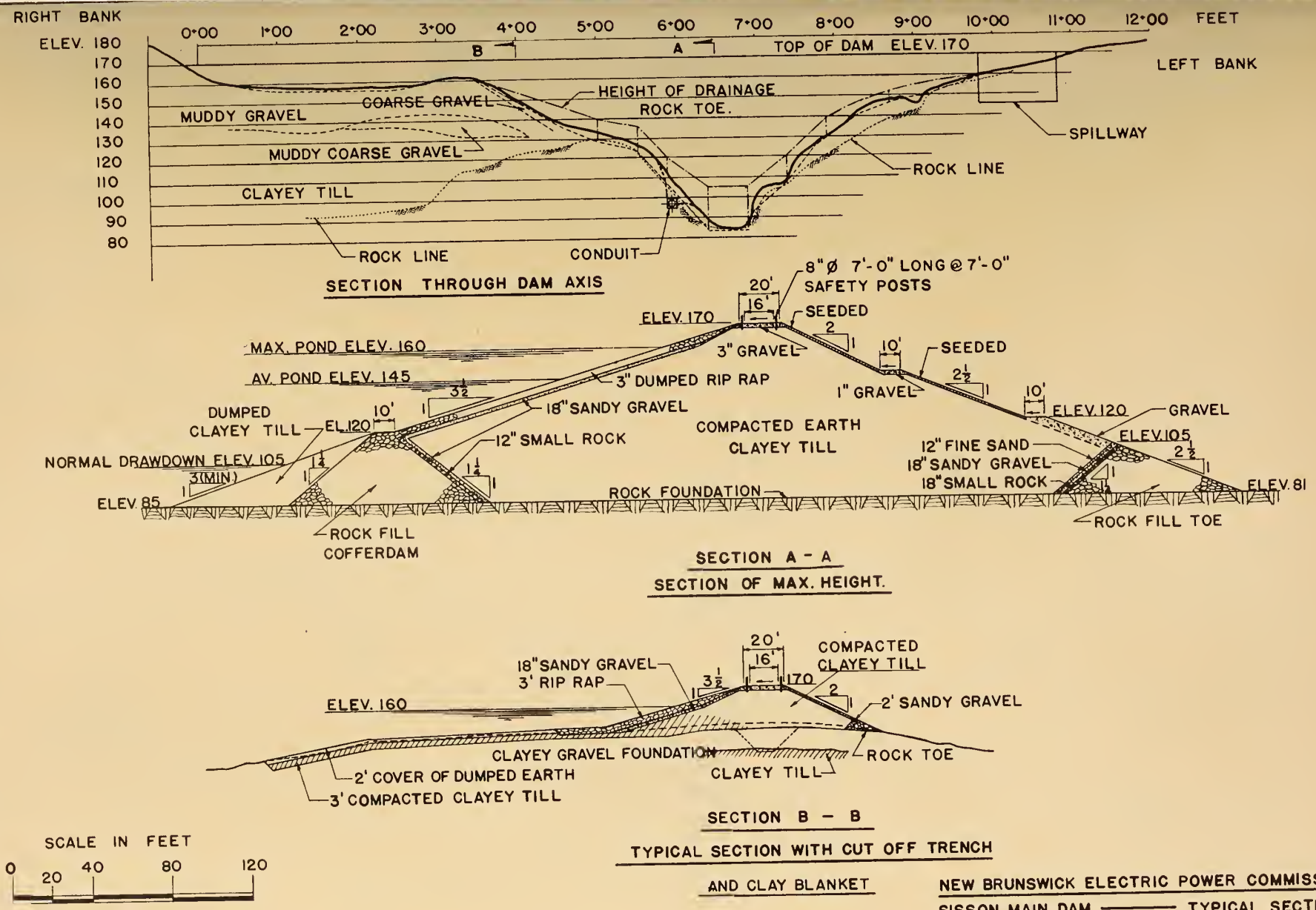
Earth dams are no novelty in the western half of this continent, where they have been used extensively on irrigation projects with success for many years. Many of these were hydraulic fill dams, where an impervious core was either dumped between two semi-pervious banks and consolidated by or under water, or sluiced into place. Only during recent years, as the subject of soil mechanics became better known, and as the production of large "Carryall" scrapers and "off-highway truck" equipment became perfected, has the technique of building compacted earth fill dams become common, at costs which make them often more economical than concrete structures for controlling water.

In Eastern Canada instances of the use of compacted earth as a material for a dam have been rare. For this reason a description of the Sisson dam built for creating storage on the Tobique Narrows project, recently completed for the New Brunswick Electric Power Commission by Power Corporation of Canada Limited, should be of interest.

Original studies of the project made in 1945 showed possibilities existed for economic storage on several of the streams flowing into the Tobique River, a tributary of the Saint John. On one of these, the Sisson River, a suitable site was located within the Fraser Company's pulpwood limits near Plaster Rock, N.B. and some 65 miles northwest of the power plant. Here a massive concrete dam was first visualized for blocking the stream at a deep ravine, where an outcrop of rock existed, with two sluice gates, an overflow section and short earth fills at either end.

Further investigation during the progress of work on the main dam and powerhouse at Tobique Narrows, however, indicated that no suitable aggregates could be found at the Sisson site, and that the most economical source would be the pit at Tobique Narrows, 65 miles away over woods roads. This meant that the plan of developing the storage with a concrete dam would be uneconomical. An earth fill dam was therefore considered. Preliminary estimates indicated substantial sav-

Fig. 1. View of conduit and control tower looking upstream.



NEW BRUNSWICK ELECTRIC POWER COMMISSION.
SISSON MAIN DAM ——— TYPICAL SECTIONS.
POWER CORPORATION OF CANADA. JAN. 1952.

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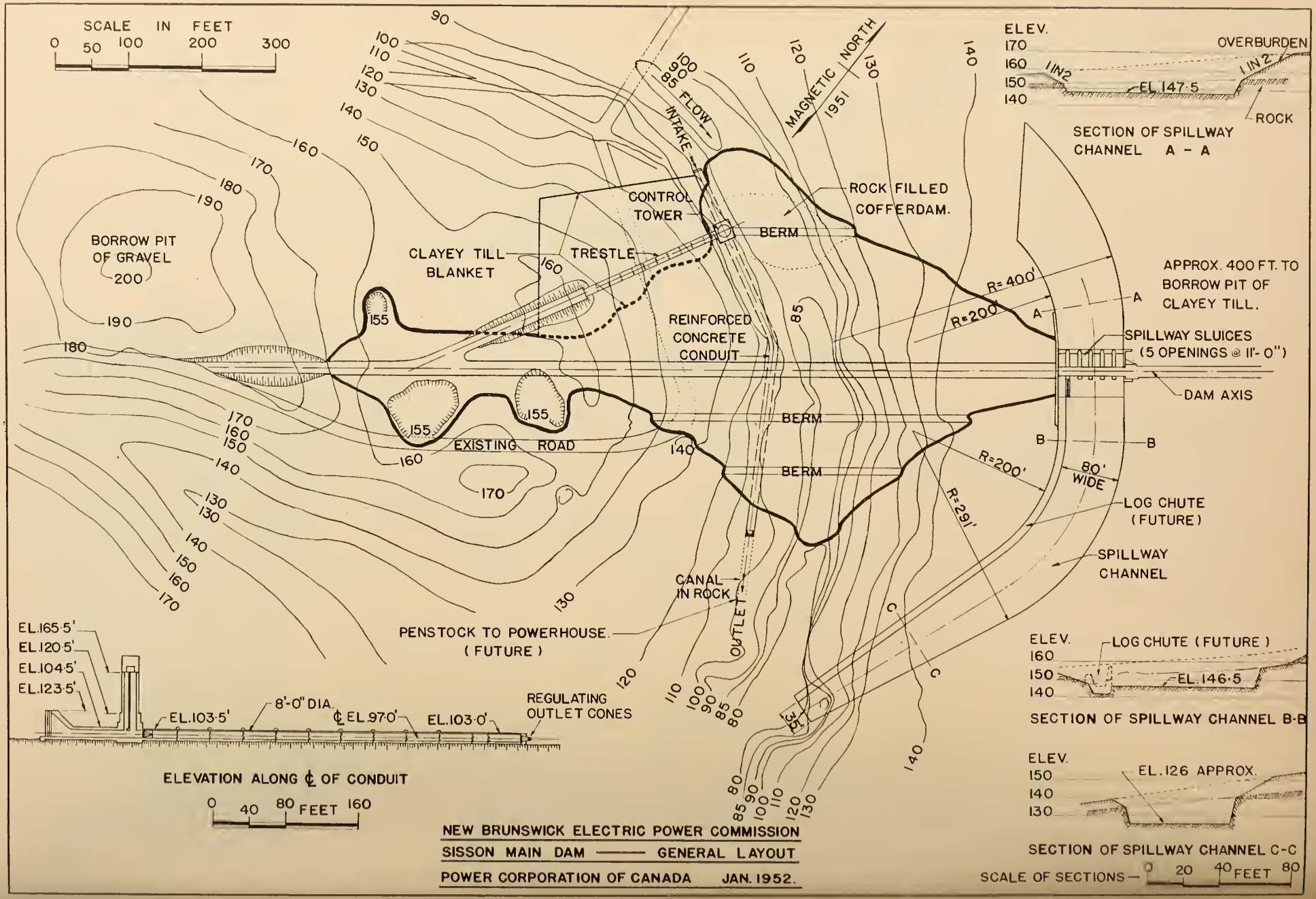


NEW BRUNSWICK ELECTRIC POWER COMMISSION
SISSON MAIN DAM —— GENERAL LAYOUT
POWER CORPORATION OF CANADA JAN. 1952.

ings. Design and test drilling and borings were therefore undertaken concurrently.

Subsurface Exploration

The subsurface exploration of the site consisted of test pits, soundings, auger holes, diamond drill holes, and wash borings combined with diamond drill holes. Drilling disclosed that the foundation in the stream bed was argillite rock, mostly well cemented; on the left bank bedrock was found at most 10 ft. below the surface. On the right bank within 150 ft., of the stream, rock was found close to the surface; owing to a fault the rock surface then dropped abruptly to a maximum of 66 ft., below the surface.

The bedrock was found to contain numerous fissures, faults and cleavage planes. Other than the small calcite veins, there was no soluble material in the rock. Pumping tests revealed, however, that its permeability in the worst cases was roughly equivalent to that of fine sand. No evidence was found to indicate that the surface depressions found on the right bank, were due to solution caverns in the rock.

Auger holes showed that the overburden consisted of glacial till of varying composition, most of it well-graded; percolation tests indicated it to be about as impermeable as clay. However, there were a few lenses on the right bank consisting of sand and gravel. A cutoff trench, as well as a clay blanket, would be needed in the dam section on the right bank to intercept any water that these lenses might carry with the reservoir full.

Suitable construction material was available. A borrow area at the end of the left embankment site was found to contain sufficient well-graded glacial till. A small gravel deposit was found nearby containing sufficient material for the final design. However, a drainage blanket under the downstream embankment was not considered economical, owing to the relative scarcity of gravel and the entire absence of sand.

Soil Tests

At the outset, there had been some misgivings as to whether suitable fill material was available at the site. Surveys were at once made of possible borrow pit areas within reasonable haul distances, and samples of the glacial till were shipped to Toronto for testing. Customary soil analysis at Donald Inspection Laboratories there showed that it was on the average about half gravel, the balance being composed of equal parts of sand, silt and clay, although proportions varied considerably in different areas of the borrow pits. Standard Proctor tests indicated that the optimum moisture content varied between 12 and 18 per cent, and that the optimum dry density was between 109 and 123 p.c.f.

The co-efficient of permeability of the compacted samples was of the order of 10^{-7}cm. per sec., which is about the average co-efficient for plastic clay. Consolidation tests showed that the compacted sample was relatively incompressible. The angle of internal friction on the material passing a No. 4 sieve showed some variation as a result of triaxial and direct shear tests, but was within practical limits. Thus the tests proved that ample suitable fill material was available to build a good tight earth fill dam. In view of the wide gradation of this earth fill material, it was questionable whether a sand filter layer was necessary adjacent to the fill at the downstream rock fill toe. According to the commonly accepted criterion for filter material, anything from a coarse silt to 1½-in. stones adjacent to the fill would have been satisfactory. It was judged that this criterion is not applicable for a fill material with such a wide gradation; consequently it was believed wise to include a sand layer in a two-stage filter at the downstream toe.

Design

The principal features and dimensions of the dam are shown in Fig. 1. Those not shown and possibly of interest are: Drainage area — 125 square miles; Capacity of the reservoir — 98,000 acre feet. The sluiceway was designed for a capacity of 7,000 c.f.s. with the water in the reservoir at El.160, the normal high water level. Five openings of 11 ft. were provided, with sills at El. 148. At El. 165 the sluice capacity will be 12,000 c.f.s., and the additional 5 feet will give 25,000 acre feet of surcharge storage. This will take care of about 10 inches of run-off in one day.

The outlet structure was planned with an intake 80 ft. upstream from the gate tower, equipped with a rack and with two fixed roller gates placed in series in the tower. Two removable steel cones at the outlet end of the conduit are provided for control of the outflow until such time as potential power at the site is utilized. There were three possible positions considered for the tower. A position at the upstream end of the conduit was considered important in case of failure of the conduit. A position within the body of the dam was favored for the protection from the severe frost action which would be expected. The use of a butterfly valve at the downstream end was examined due to the cheaper structure involved and the assured accessibility to the controls.

The factor of safety to the dam weighed most heavily in the final choice. By placing the tower in the centre of the upstream rock toe, only a short section of conduit would remain upstream of the gates. Also, it was hoped to provide partial frost protection for the controls by having the tower somewhat within the fill. The differential earth pressures were not likely to strain the tower and misalign the gates, or to crack the structure, as might be feared if located in the centre of the fill.

The conduit was designed to give a maximum of 600 c.f.s. outflow for 90 per cent of the storage, with a maximum velocity of 12.5 f.p.s. It can later be extended by constructing a wood stave penstock 900 feet long, to develop 6,500 hp. on the 158 ft. gross head available between the reservoir and the river level a quarter of a mile below the dam. The inside is an 8 ft. circle with horizontal invert 3.5 feet below the centre, the outside being rectangular with collars. Structurally it was considered as a fixed arch.

The fill was assumed to have an average density of 125 p.c.f. Vertical loads were calculated by the Marston and other formulae, which increased the loads some 60 per cent to take care of the rigidity of the conduit and the differential settlement in the fill. A layer of fill material over the conduit was placed in a less dense condition to assure more uniform settlement and load distribution.

The design provided for the conditions of (1) maximum internal together with maximum external pressure, (2) maximum vertical and lateral loads with no internal pressure and (3) maximum vertical pressure alone. To seal the contraction joints, paraplastic strips were used longitudinally, and 8 in. by 3/16 in. steel plates laterally at the section joints.

The design of the slopes was more empirical than analytical. The shear strength of the fill was somewhat indeterminate. The slopes adopted have been used on many embankments of similar material. Furthermore, the safety factor against failure by sliding was found, based

Fig. 4 (top). Upstream face showing intake and control tower.

Fig. 5 (centre). Downstream face of Sisson dam.

Fig. 6 (bottom). General view of upstream face of dam.

on conservative assumptions, to be at least 1.6.

Earth Fill Cross Section

The upstream slope is protected by 3 ft. of riprap and 18 in. of gravel. The gravel provides a base for the riprap, as well as some reverse filter action for the water draining from the fill, and some frost protection. Had gravel been more plentiful, the design would have included a blanket on the upper portion of the downstream face to protect it against frost action. However, the permeability of the fill may be too low and the seepage line remote from the surface to permit the accumulation of ice lenses adjacent to this face. Actually small amounts of gravel and surplus rock were placed on the lower downstream slope.

The downstream slope will be seeded during the 1953 season. Here during the autumn a severe rain storm eroded trenches 2 ft. in depth. To prevent recurrence before more permanent protection can be obtained from vegetation, straw and hay were spread and anchored to stakes placed 6 ft. apart.

The relative abundance of rock from the spillway channel permitted its use for rock toes in lieu of other more expense devices. The upstream rock fill, besides being helpful for draining the embankment after drawdown, was used initially as the cofferdam. The downstream rock toe was made large enough to lower the seepage line away from the face of the slope.

From consolidation tests, the maximum settlement was calculated as between 2 ft. and 4 ft. As part of the consolidation could be expected to occur during construction, the fill was built with 2 extra feet on the parapet.

The seepage to be expected through the fill was estimated to be of the order of 1,000 cu.ft. per year. A weir has been installed below the downstream toe to permit the actual losses to be measured.

Fill Specifications

The till in the borrow pit for the main dam contained considerable clay and silt, and even after moderate rain the surface became mucky. Drying of the fill, when necessary, was accomplished by scarifying with rakes attached to bulldozers, by grader rakes or by 16 inch harrows. Heavier 18 to 20 inch harrows would have given better results. Drying was slow and alternate borrow areas had to be prepared in advance for machines to move to. Sprinkling was sometimes necessary after a clear dry spell of weather, partic-

ılarly when higher percentages of coarse material were encountered n the borrow pit.

Specifications called for compaction by six passes of sheepsfoot rollers with not less than 400 p.s.i. on six inch layers. The optimum moisture content based on laboratory tests was found to be from 12 to 18 per cent. Portions of the borrow material had a higher optimum moisture content than test samples. The specifications were therefore altered on the job. The natural moisture content ranged up 31 per cent, consequently without extensive drying operations, for which the contractor was not adequately prepared, and for which time was lacking, material had frequently to be placed on the wet side of optimum to assure completion of the dam in one season.

It appears that when using a heterogenous fill material, narrow limits on moisture content should be avoided, and a minimum density or percentage of maximum Proctor density specified. Densities well above the minimum objective of 100 p.c.f. could still be obtained with nine or ten passes of the roller. When material cannot be kept at or below optimum moisture content, it would appear to be more economical to design the slopes for smaller strength, thus increasing the quantities, for the sake of obtaining maximum speed of construction.

Equipment

Most of the fill material was placed with a string of one 12-yard and three 20-yard carryalls, and three 10-yard self-propelled scrapers. These scrapers were found more economical than the carryalls on the haul, which averaged about 1,700 ft., as they were faster and operated under their own power. Twelve-yard two-wheeled self-propelled scrapers were also tried, but were found impractical on the steep gradients, due to their lack of braking capacity.

Sixteen 3-ton trucks, loaded by three shovels, were used for excavating and placing some of the earth fill, gravel facing, rock fill toes and riprap. The rock came from the spillway channel on the left bank below the dam, while the gravel came from a pit on the right bank above the south end of the fill.

Two heavy water-ballasted sheepsfoot rollers with foot pressures of 450 p.s.i., hauled by tractors, were used for compacting the main dam fill. These gave the minimum required density when moisture was close to optimum, with six passes of the roller. To obtain 100 per cent Standard Proctor density, 10 or more passes were needed.

Three sets of lighter rollers with foot pressures of 200/300 p.s.i. were also used as auxiliary equipment on both main dam and dykes where conditions permitted. It was found that rollers with less than 250 p.s.i. foot pressures were rather light for compacting this soil, particularly with very dry or very moist material. A 50-ton pneumatic tire roller was also tried out, but was found unsatisfactory, being too slow and bulky for use in the limited area, though it would be more suitable on gravelly soil.

Sequence of Construction

Construction of the reinforced concrete conduit by Power Corporation of Canada forces was commenced in the dry late in the fall of 1951 in a deep rock trench, and completed in March, 1952. During April, May, and June, the roads were impassable and the site inaccessible. Placing of concrete was resumed in July for completion of the gate tower and sluiceway structure.

A contract was awarded in March, 1952, for excavation of the rock sluice channel, and for the compacted earth fill with gravel facing and riprap for the main dam, as well as for three dykes at spillover points some four miles north. Quantities included some 100,000 yards of foundation excavation and borrowpit stripping, and 300,000 yards of earth fill, gravel facing and rock excavation.

The contractor brought equipment in during April and commenced clearing and grubbing at the sites. During May and June, some 6 to 9 inches of topsoil was removed from the borrowpit areas. In June, foundation excavation up to 18 inches in depth was undertaken, the rock bed of the river channel being cleaned with picks and water jets.

No temporary diversion tunnel or canal was considered necessary. Precipitation records showed that the heaviest rainfall that had occurred during summer months over the past 30 years, if repeated, would raise the pond level only to El. 120 with the conduit wide open, or 25 feet above the river bottom. Early in July the stream flow was backed up by building the upstream rock toe of the dam to El. 120 and covering it with a clay blanket, diverting the flow into the conduit. Actually June rains raised the pond to El. 106 only. Due to seepage through seams in the rock foundation it was found necessary to build a low concrete wall across the channel downstream from this rock toe (cofferdam) to catch leakage of some 500 g.p.m., which was then pumped into a flume.

Placing of fill in the main dam got under way about the middle of July, backfilling around the conduit being brought up concurrently, tamped with air tampers weighing 34 lb. These were found more efficient than the heavier paving breakers equipped with tamping pads.

A target had been set for a rate of placing of 16,000 yards per week on an average, based on a single 10-hr. shift operation for equipment. Since it was imperative, in the event of delays or shut down, to make sure the dam would not be overtopped by a spring flood in 1953 before completion, it was calculated that by placing half the yardage, the top could be built to El. 135, at which elevation any expected spring flood flow could be handled without overtopping, by leaving the conduit gates wide open. No serious delays occurred, however, and the main dam and dykes were completed to full height by October 15, 1952.

During most of the construction period the contractor worked on a single 12-hour shift, though during August a small scale night shift was used to ensure completion on time. The maximum rate of progress attained in placing was 28,000 yards per week of compacted fill and 3,000 yards of gravel facing and rock.

The first frost occurred on September 8 and recurred thereafter about once a week. The frost did not penetrate deeply into the fill material and the lightly frozen surface could readily be broken up with the sheepsfoot rollers by scarifying with grader rakes, or scraped away with bulldozers.

Acknowledgments

Design of the structure was by Power Corporation of Canada, Ltd. E. M. Fucik, vice-president of Harza Engineering Co. of Chicago, acted as consultant. J. V. Daniliauskas, M.E.I.C., was resident engineer on the earth dams. √

Electrical Engineering and Operating Aspects

This paper is complementary to the paper by F. L. Lawton and J. S. Kendrick, published in the September 1952 issue of *The Engineering Journal*, which gave a general outline of the Kitimat Project.

Here the author covers the electrical engineering and operating aspects of the project, giving detailed descriptions of the equipment to be supplied by various manufacturers in each case, cables, protective devices, communications, metering and transmission, on this largest hydro power development ever financed by private enterprise.

Transmission lines will have the highest voltage power cables in North America, and the transmission line conductors will be the biggest ever fabricated.

The Nechako-Kemano hydro-electric power development and the aluminum reduction works at Kitimat are located in an area adjacent to the West coast of British Columbia, about 400 miles north-west of Vancouver.

Referring to Fig. 1, the plan involves:

1. A power station having an ultimate capacity of 2,240,000 hp. in 16 units and housed in a hole in the ground 1,135 ft. long, 81 ft. wide, 134 ft. high and located 1,400 ft. from the face of the mountain.

2. 300,000 volt power transmission lines from Kemano to Kitimat, a distance of 49 miles.

3. The reduction works at Kitimat, including a high-voltage substation, and rectifier stations for the aluminum smelting and associated operations.

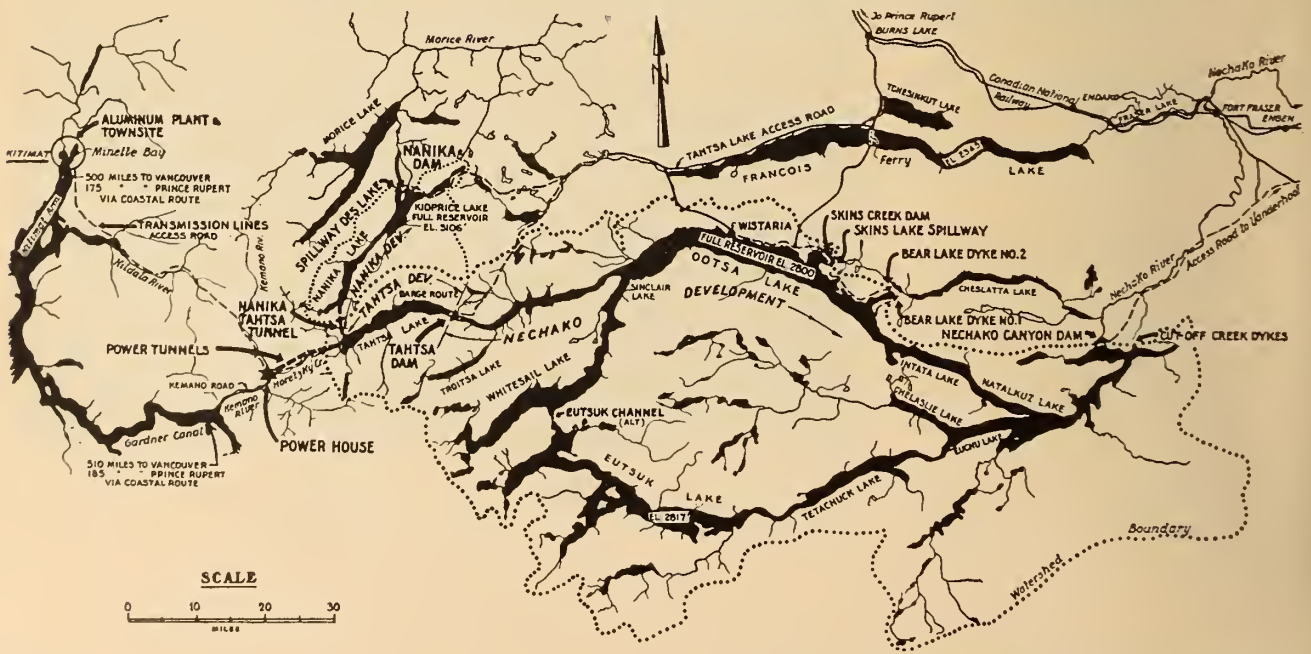
4. A port at Kitimat and a town, with all the necessary roads, bridges, services and facilities, etc.

Power System and Characteristics

The points of interest at Kemano are, sixteen 106,000-kva. generators, each connected through a circuit breaker to its own 13.2-kv. step-up transformer bank winding. The 301-kv. windings of the transformer banks are connected by means of paper insulated, oil filled cables to an outdoor switching station having a double bus, with a circuit breaker in each incoming or outgoing connection, as well as bus tie circuit breakers and disconnects.

There are four transmission cir-

Fig. 1. General plan showing Nechako-Kitimat hydro-electric power development and its relationship to Kitimat.



# of Alcan's B.C. Project

by

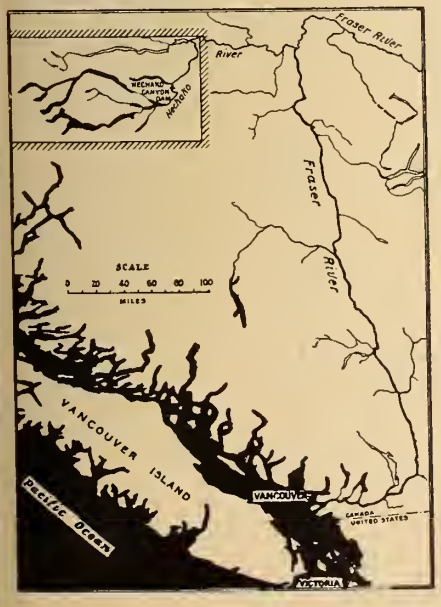
J. T. Madill, M.E.I.C.

Aluminum Company of Canada Ltd., Montreal, Que.

A paper presented on January 26, 1953, to a joint meeting of the Montreal Branches of the Engineering Institute of Canada and the American Institute of Electrical Engineers. It was also scheduled for presentation to the Edmonton, Winnipeg and Peterborough Branches of the E.I.C., on April 1, April 16, and May 26, respectively.

cuits planned for the first 10 miles up the Kemano Valley to the Kemano Pass Switching Station, two circuits over the higher part of the line covering the next 10 miles to the Kildala Switching Station, and four circuits again for the last 30 miles to Kitimat.

An explanation for only two circuits between the switching stations is that the valleys and pass through which the lines run are narrow, and there is space for two tower lines only. Also the terrain is rough, with rapid changes in elevation, with the result that there are few good tower sites. Hence long spans are necessary. Furthermore, part of this 10 miles is in an area not covered by timber, making it difficult to determine if heavy icing has occurred even in recent years.



If heavy icing does occur (and records from a test span on the pass over two winters show a maximum of only 3 lb. per ft. of ice), then the conductor strength requirements on long spans are such, and the tower loads become such, that double circuit lines as used for the rest of the distance become quite uneconomic. It was desired to build a line at least twice as strong as any to date; that is, one able to withstand icing corresponding to a conductor loading of 40 lb. per ft. This automatically means that an A.C.S.R. cable of economic proportions has a large conducting area. Hence the two single-circuit lines will have the same current carrying capacity as the four circuits covering the rest of the distance.

At Kitimat there is a double bus with bus tie circuit breakers and disconnects, and a circuit breaker in each incoming or outgoing connection. The loads are served by transformer banks rated 111,000 kva. One such bank supplies one group of rectifiers, which provide direct current at about 1,000 volts to one aluminum reduction line.

For the initial stage, involving only three generators, there are two step-up transformer banks, two transmission circuits and three receiving banks at Kitimat, to serve Potlines 1 and 2. It may be noted that in this stage no line circuit breakers are used at either end.

On a bulk power system, where the load is largely electro-chemical reduction lines, the requirements of service are special, and different from those of the ordinary utility. The load is absolutely continuous, 24 hours a day, 365 days a year. There is no light load period, the peak is the steady load. The blocks of load are large. Here the smallest single load which can be switched, that is either picked up or dropped, will be about 100 mw. or 130,000 hp., and this load must go off or come on instantly, not gradually. The power factor on the 13.2-kv. side of the receiving transformer will be at least 92 per cent.

An isolated power interruption of short duration, say 1 minute to 10 minutes, has little effect on the electro-chemical operations. On the other hand, if the power should be off long enough for the bath to freeze in the furnaces — a matter of several hours — the potline cannot be restarted for many days, and permanent damage is done to the furnaces, with a reduction in their useful life. Of course, this loss is in addition to the loss of production of metal during the de-energized period.

The rectifier load is not sensitive

to frequency variations, but is extremely sensitive to voltage variations. This is illustrated in Fig. 2, which is a plot of results from a test carried out on an actual potline in operation. The characteristics cited mean, among other things, that extra capacity must be installed throughout the system, so that the firm capacity, that is the capability

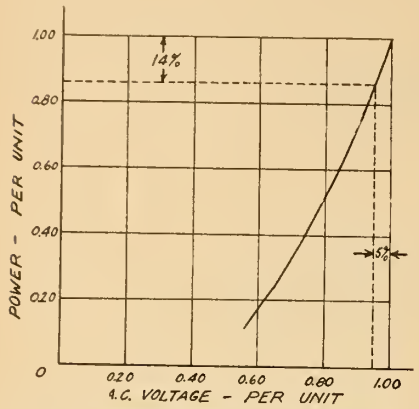


Fig. 2. Potline load vs. a-c. voltage.

Table I—Generator Data

Generator No. Manufacturer	1 Can. General Electric	2 Canadian Westinghouse	3 English Electric Ltd.
Output kva	106,000	106,000	106,000
Power Factor	0.8	0.8	0.8
Field Current, Amperes	1,080	710	1,060
Guaranteed Efficiency Full Load	97.3	97.3	97.45
Guaranteed Efficiency ¾ Load	96.8	96.8	96.95
Guaranteed Efficiency ½ Load All at 0.8 Power Factor	95.3	96.0	95.90
Short Circuit Ratio	1.0	1.0	1.0
Rotor Construction	Flutes dovetailed to shaft and laminated ring carrying poles	Discs shrunk on shaft carrying poles	Rolled plates shrunk on shaft carrying poles
Rotor total weight, lb.	640,000	658,000	830,000
Rotor Diameter, in.	174	206	194
Rotor Iron Length, in.	117	90	100
Generator Total Weight, lb.	1,140,000	1,154,000	1,420,000
Generator WR^2, lb.-ft.^{2}	16,400,000	23,800,000	23,700,000
Reactances in %:			
X_d	113.2	106.0	105.0
X_d'	28.6	25.0	30.0
X_d''	20.2	18.0	21.0
X_2	24.4	21.5	24.5
X_o	15.0	11.0	15.0
X_q''/X_d''	1.5	1.4	
No. of Parallels in Stator	6	2	2
No. of Turns in Stator Coil	3	1	1
Type of Stator Coil	Whole Coils	Half Coils	Half Coils
Total Vol. of Cooling Water, g.p.m.	1,560	1,117	900

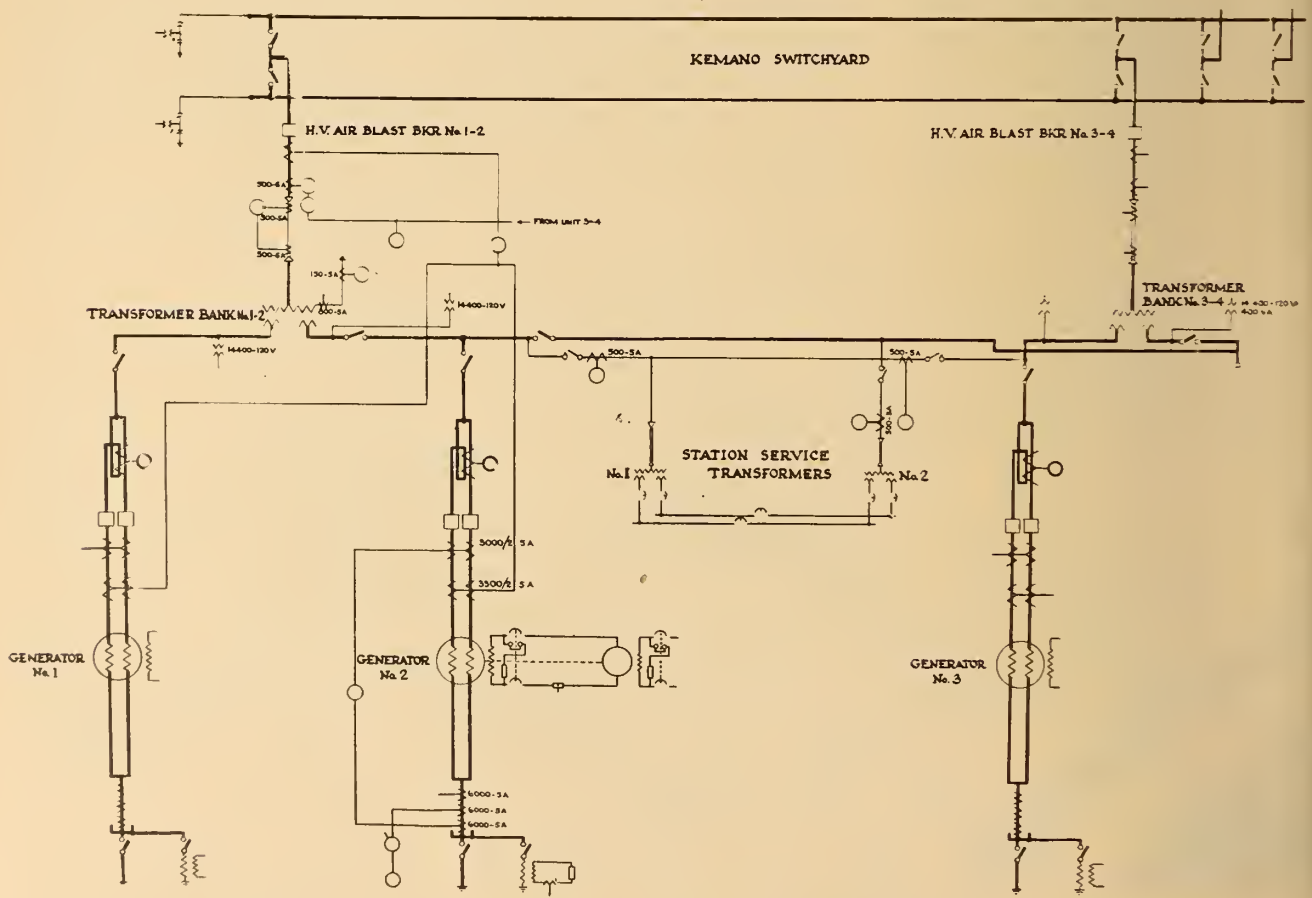


Fig. 3. Kemano initial single line diagram.

with any one link in the complete chain out of service, is equal to the rectifier load.

Kemano Power Station Equipment

Figure 3 shows the Kemano Power Station initial one-line diagram, which will serve as a base to which many of the interesting details of the power station can be referred.

Generators

The generators are rated 106,000 kva. with a 60°C. temperature rise or 122,000 kva. with a 80°C. temperature rise. They are 0.8 power factor, 13.8 kv., 22 pole, 60 cycle, 327 r.p.m. machines with an overspeed requirement of 610 r.p.m.

The rotor construction is unusual, because there is no spider in the ordinary sense of the word. A number of large forged steel discs are shrunk to the shaft and the poles fitted into dovetails machined into these discs. Figure 4 shows this rotor construction. The generators are being built by three different manufacturers and comparable data are listed in Table I.

The specifications required that six phase leads be brought out, that the winding be suitable for the application of split-phase protection, and also that the ratio of the field discharge resistance to the field resistance be at least 8. All are equipped with direct connected main and pilot exciters with the voltage regulators controlling motor operated rheostats in the main exciter field circuits. All have the thrust and upper guide bearing above the rotor and a lower guide bearing below. The usual temperature detecting elements are located in the stator windings, in the bearings and in the cooling air, and the usual flow alarms in the cooling water lines for the air coolers and for the bearings, and in the bearing oil lines.

The generators may be operated with their neutral point solidly grounded, or grounded through a loaded distribution transformer. The bus connecting the generator to the transformer is 7 in. double aluminum channel, generally of welded construction, and designed to carry 6,000 amp., as are the low voltage disconnects. The No. 2 generator can be connected to the non-loaded low voltage winding of the Bank 3-4 in the event of trouble on the No. 1-2 Bank or its high voltage cable. Thus two units are always available.

Turbines

This part of this paper would not be complete without similar information about the turbines. These will have a guaranteed output of 140,000 hp. and an expected output of 150,000 hp. at a net head of 2,500 ft., with a discharge of 600 c.f.s. They are four-nozzle vertical type impulse turbines, being built by three different manufacturers. Comparable data are listed in Table II. The governor fly-ball motors are operated by permanent magnet generators. The turbines have the usual protection against overspeed, loss of governor oil pressure, and bearing temperature, oil flow and water flow alarms.

From a number of considerations, including the hydraulics of the tunnels and penstocks, the planned minimum needle opening time is 30 seconds. This poses an operating problem when initially two blocks of load of 100 mw. must be picked up, one at a time, and carried by as few as two turbines and their generators. This has been solved by a needle pre-set opening solenoid, controlled from the control room.

When the load is ready, the control room operator presses a unit push-button. As the needles open and the frequency rises, the governor causes the deflectors to enter the jets, reducing the power and stop-

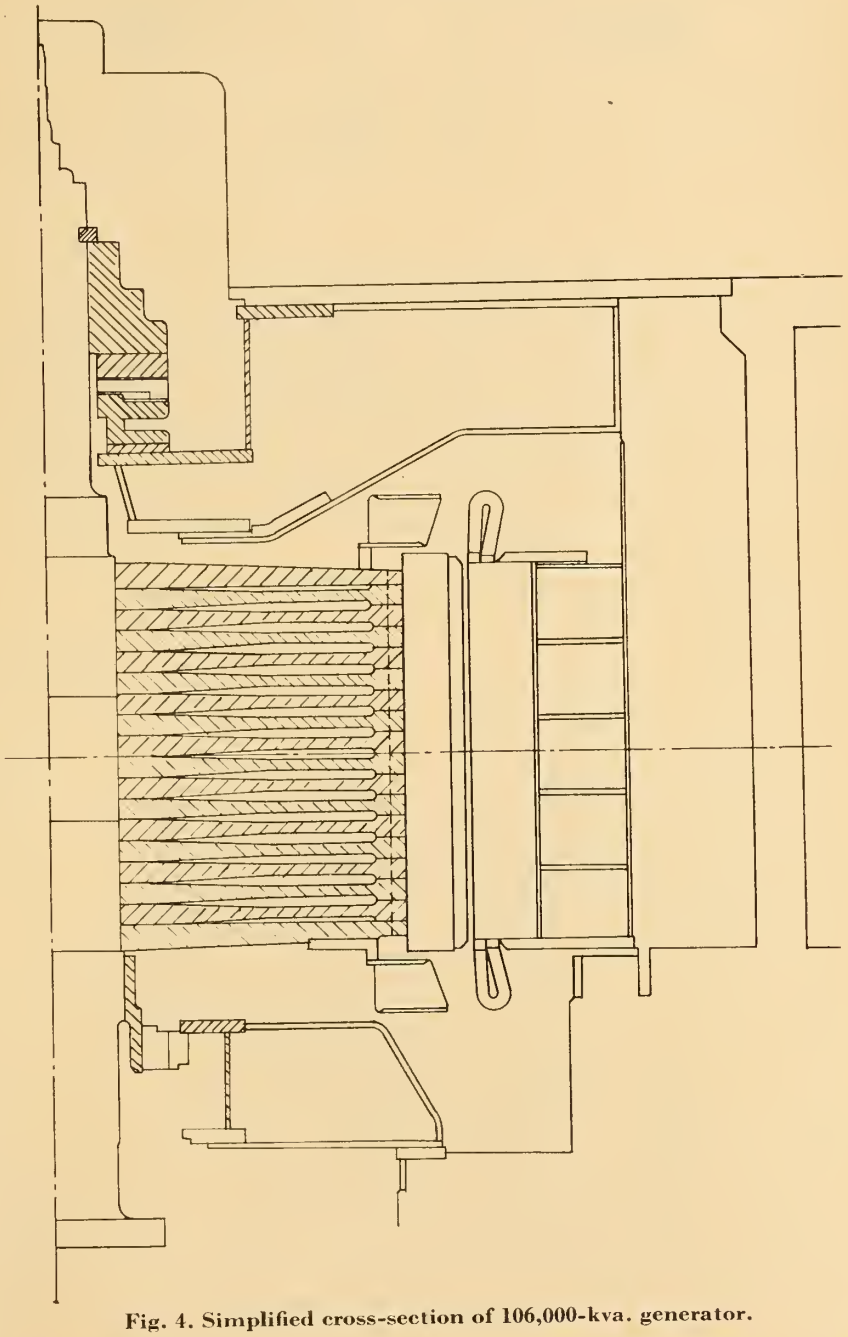


Fig. 4. Simplified cross-section of 106,000-kva. generator.

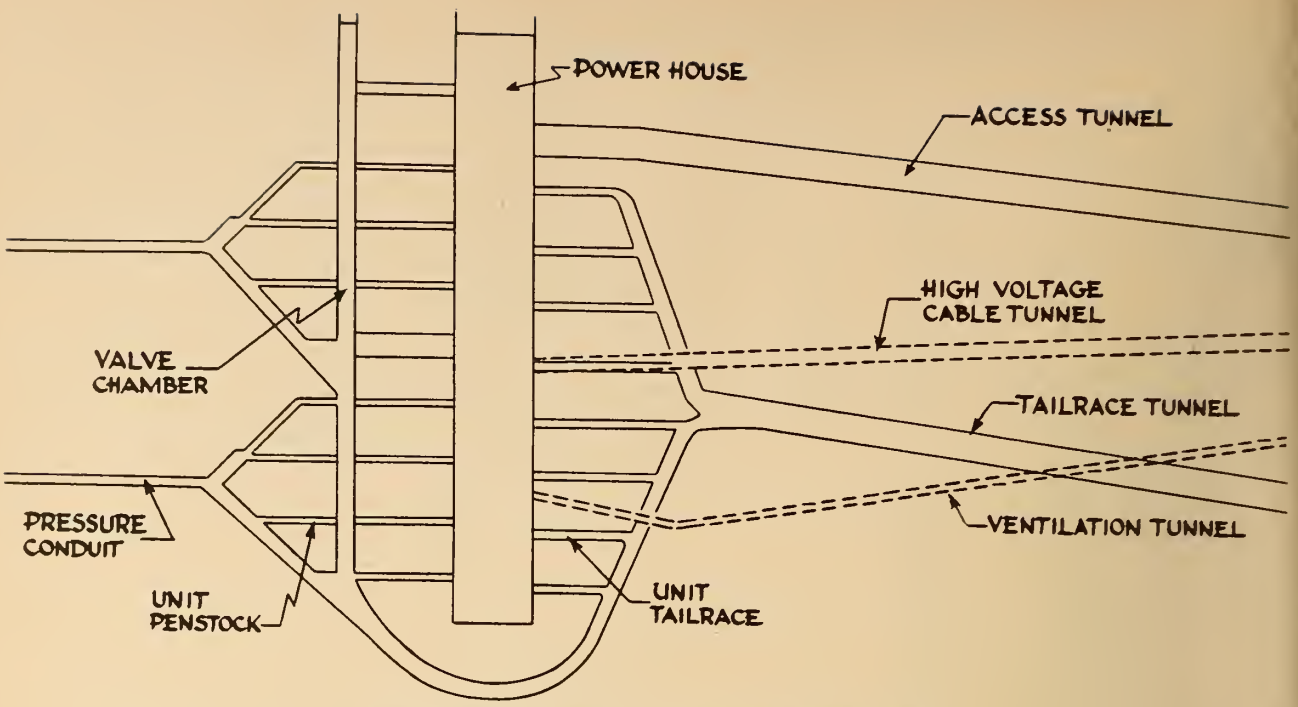


Fig. 5. Plan of excavation in the powerhouse area.

ping the frequency rise. When the needles have opened to the predetermined position, about 75 per cent of full load, this is indicated by a signal lamp near the push-button, and also by the needle limit indicator on the instrument board. At this point the operator at Kitimat is told to put on the potroom load. As soon as this is done, of course, the frequency drop causes the governor to withdraw the deflectors and the turbine supplies power to the generator.

Obviously, the movement of these deflectors has no effect on the hydraulic flow conditions and can be accomplished in a very short time interval, not longer than 3 seconds. Also because of this, load drop will not cause high over-frequency, as the accelerating power is removed from the turbine runner very rapidly by the governors operating the deflectors. The needles can close at a slow rate, about 1 minute, as set by penstock and tunnel requirements.

While on the problem of load pick-up, the other quantity concerned is, of course, voltage. It is planned to telemeter the Kitimat 275-kv. bus voltage to the Kemano control room. Thus, because of potline sensitivity to this quantity, it can be kept at any desired value by the power station control room operator directly, and before load pick-up can be raised by an amount equal to the expected drop upon load application. Obviously, in the later stages of the project, when many generators are operating, one potline will be a smaller per cent increment of load, and these expedients will no longer be required, except perhaps in the remote possibility of a total interruption.

L.V. Circuit Breakers

Returning to Fig. 3, the generator circuit breakers presented a problem, as a normal current carrying capacity of at least 5,500 amp. was required. Only three such breakers were needed, but to secure them would have involved development charges, high cost and possible

Table II—Turbine Data

Turbine No. / Manufacturer	1 Canadian Allis Chalmers	2 Vancouver Engineering Works	3 Dominion Engineering
Guaranteed Max. Output, hp.	140,000	140,000	140,000
Expected Max. Output, hp.	147,000	150,000	158,000
Expected Max. Discharge, c.f.s.	575	590	625
Guaranteed Max. Efficiency, %	89.5	90.0	89.5
Expected Max. Efficiency, %	92.5	92.0	91.5
Expected Efficiency at Full Load, %	90.2	89.5	88.8
Expected Efficiency at ¾ Load, %	92.5	92.0	91.5
Expected Efficiency at ½ Load, %	91.0	90.5	90.1
Shaft Weight, lb.	48,000	57,000	47,000
Runner Weight, lb.	72,000	89,900	48,000
Runner Diameter, in.	160	162	162
Total Turbine Weight, lb.	565,000	676,000	708,000
Buckets Formed By:	Forging	Casting	Casting
Bucket Material	Steel Plate	Mild Steel	13% Cr. Steel
Bucket Fastening	Welded to Disc	2 Fitted Bolts	Cast with Ring
Type of Runner	Integrally Welded	Bolted	Integrally Cast
Bearing	Self-Lubricated	Pressure-Lubricated	Self-Lubricated
Governor Manufacturer	Woodward	Pelton	Woodward

Table III—Kemano Transformer Data

	Manufacturers	
	English Electric Company of Canada	Ferranti Limited
1 Cooler operating:		
Kva	71,000	71,000
Temperature Rise, °C	55	55
Cooling Water, g.p.m.	170	220
2 Coolers Operating:		
Kva	95,000	93,000
Temperature Rise, °C	62	62
Cooling Water, g.p.m.	266	440
Reactance, LV to HV, %	10.5	10.7
Exciting Current, %	1.75	1.00
Shipping Dimensions: Length in.	204	214
Width in.	128	116
Height in.	186	170
No Load Loss, kw.	156	90
Full Load Loss, kw.	395	375
Guaranteed Efficiency, 1.0 P.F.:		
Full Load, 71,000 kva.	99.22	99.35
¾ Load	99.29	99.43
½ Load	99.28	99.47
Oil, Imperial gal.	7,220	6,380
Weight of Oil, lb.	62,000	55,000
Weight of Core and Coils, lb.	116,000	122,000
Weight of Tank and Fittings.	50,000	58,000
Total Weight, lb.	228,000	235,000

more than 150,000 lb., and this meant single-phase units.

It is interesting to note that it was essential to connect two generators to one step-up transformer bank, if the power station length was not to be dictated by the length of the row of transformers. Transformers were selected with two primary windings instead of one, because the only extra cost involved is for a small amount of extra bus and a 2 per cent increase in the transformer price. This is more than compensated for by the reduction in low voltage fault kva. from 2,000,000 to 900,000, with a consequent reduction in bus, insulator and disconnect strength requirements, circuit breaker strength and interrupting rating, and extent of damage when a fault does occur.

The transformers are to be supplied by two manufacturers, and are physically and electrically interchangeable. They are each equipped with two 100 per cent coolers, and this gives rise to an interesting

delays and difficulties. This problem was neatly solved using two standard 15-kv., 4,000 amp., 1,900,000-kva. interrupting capacity air blast circuit breakers operating as one electric and pneumatic unit, with one of each of the six poles in each of the six phase leads from the generator.

The phase parallels will be connected together on the transformer side of the circuit breaker. This gives an effective capacity of 8,000 amp. and provides a most economically attractive solution. Incidentally, since these circuit breakers are indoors, the limited space and the elimination of the oil fire hazard make the air blast circuit breaker almost essential.

Transformers

The main transformers are nominally 71,000 kva. single-phase units, type OFW, that is, forced oil water cooled by means of separate heat exchangers. There are no ratio adjusters on any windings, and the ratio is 13.2/13.2/301.4 kv. when three units are connected delta-delta-wye, with a total bank capacity of 213,000 kva. Either low voltage winding can carry its full rated load independent of the other. The impulse insulation level of the high voltage winding is 1,050 kv. This insulation is graded to 15 kv. at the neutral point which is solidly grounded. The specifications required a shipping weight of not

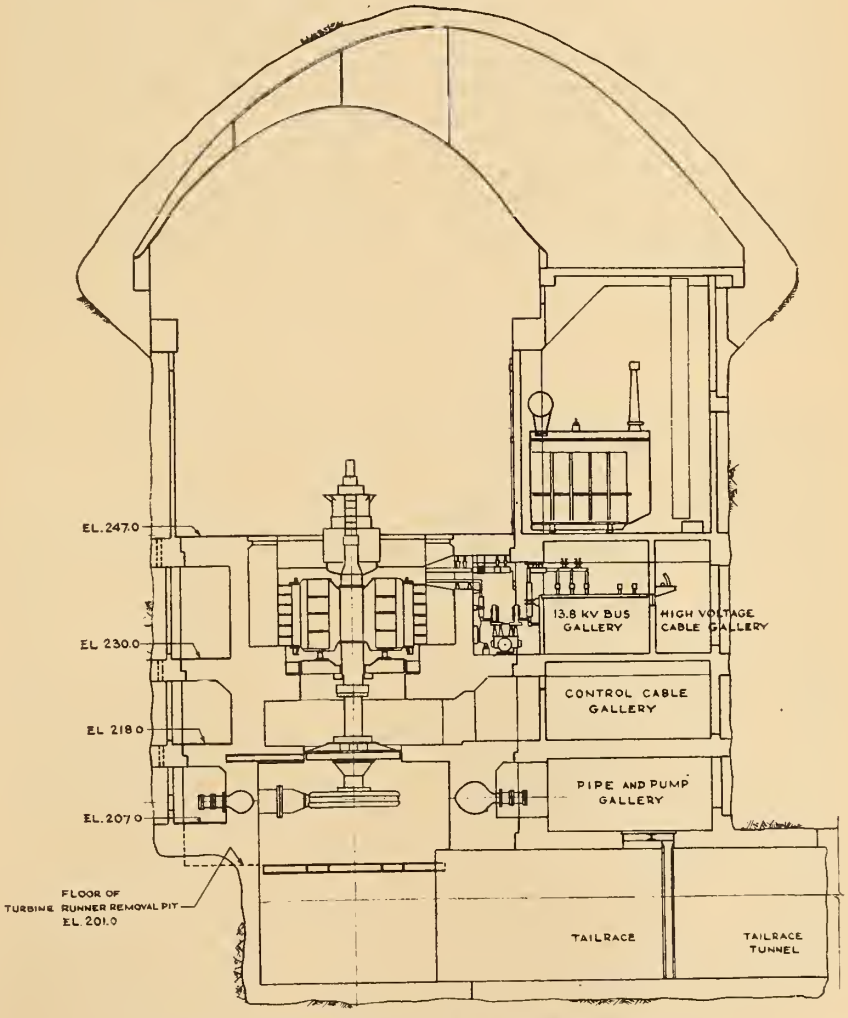


Fig. 6. Kemano Power Station. Cross-section.

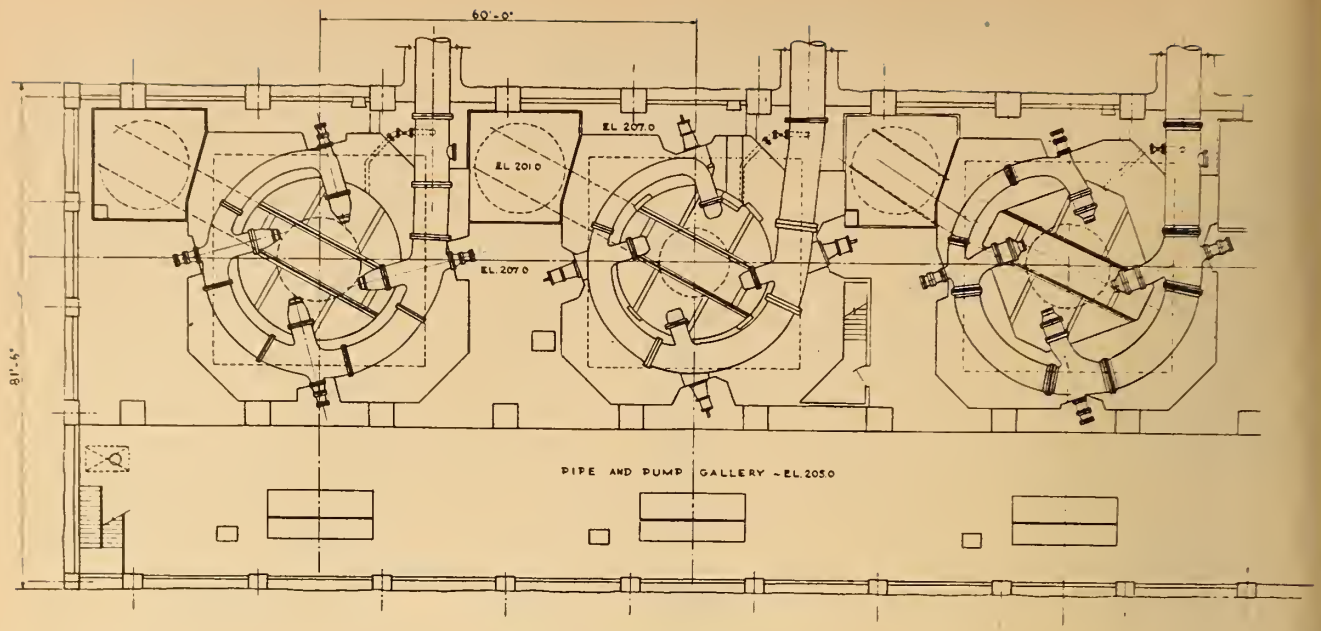


Fig. 7. Turbine needle floor.

increase in capacity if both coolers are operated. These data are shown in Table III.

Cables

The power is carried from the transformer cells in the power cavern to the outdoor 300-kv. switching station by means of three high voltage paper insulated oil filled cables per circuit. These cables have a current carrying capacity of at least 550 amp. They are of the Pirelli type, that is the oil in the central duct of the conductor is under only moderate pressure, perhaps 40 p.s.i., and its purpose is to serve as an insulating medium only. The cable distance from the transformers to the switching station averages 2,000 feet per phase, and the maximum difference in elevation is 75 feet.

These cables are to be installed in a special high voltage cable tunnel, divided into two sections by a vertical wall. There are only two circuits in each section, carried on insulated supports with 5 feet vertical distance between circuits, and one foot horizontal spacing between cables of the same circuit. The cable sheaths will be grounded at the mid-point only to eliminate sheath loss. The cables, their joints and terminations have to meet the same impulse specification as the transformers, that is 1,050 kv. with a 1½ by 40 microsecond wave. The two initial circuits are being supplied by two manufacturers and the relative data are shown in Table IV.

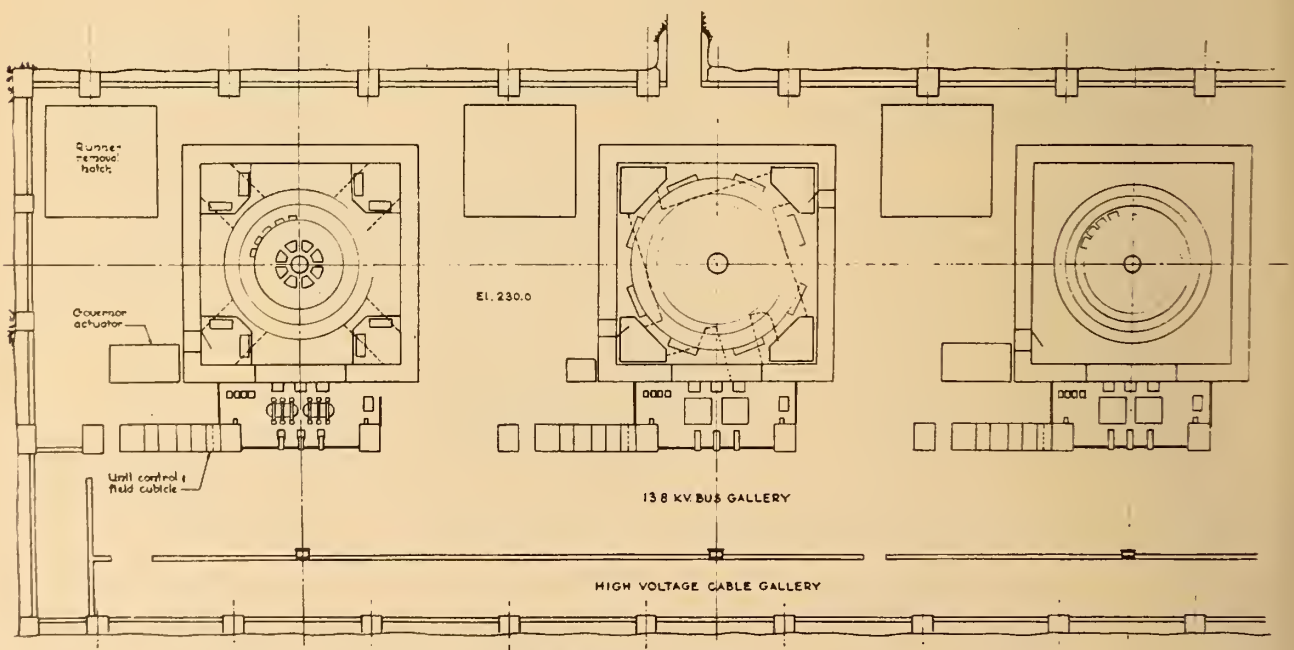


Fig. 8. Operating floor.

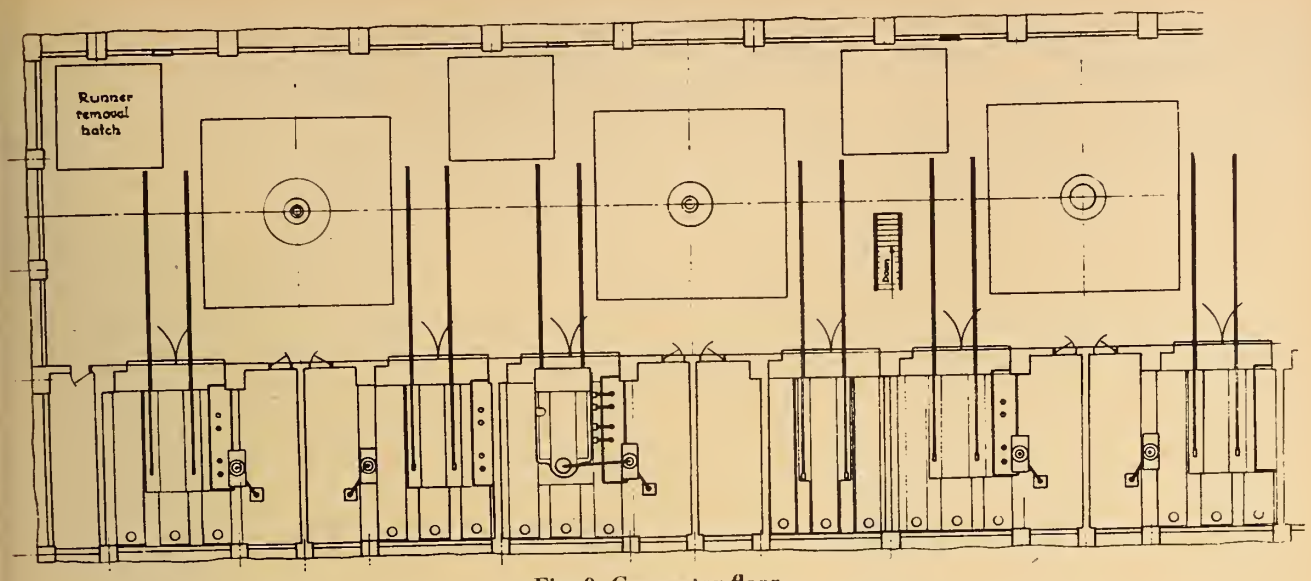


Fig. 9. Generator floor.

Kemano Power Station Arrangement

Figure 5 shows a plan of the excavation of the power house area. The pressure conduits, penstocks, valve chamber, power cavern, tail-race, access, high voltage cable and ventilation tunnels may be seen. Figure 6 shows a cross-section of the power house. This shows the turbine, the runner removal pit and staging, the generator, its circuit breaker, the low voltage bus gallery, the control cable, the pipe, and high voltage cable galleries, all below the transformer vault. Three plans are indicated, one through the turbine runner horizontal center line, one at elevation 230 and one at elevation 247.

Figure 7 shows the plan through the turbine. The chief point of interest here is that the turbine runner can be lowered to a car on tracks on the staging and moved back to the removal pit without in any way disturbing the shaft, the bearing, or the generator. It was the space requirements at this elevation, as may be seen, that determined the unit spacing of 60 feet.

Figure 8 shows the plan at elevation 230, the operating floor of the power house. Here it may be seen that the passage way under the bus gallery gives access to the only operating position at each unit. At this location are gathered together the governor cabinet, the generator brake controls, and the field cubicle structure containing the generator field circuit breaker, the exciter field circuit breaker, the motor operated rheostat and contactors, the pilot exciter field rheostat, the a-c and d-c distribution panels for the unit, the control station for the cooling water pump for each unit and the generator and turbine bearing temperature gauges, as well as the unit bay lighting panel.

Figure 9 shows the plan at elevation 247, the generator and transformer floor. Here the transformer vaults are seen, and it is obvious that space must be left opposite the generator. Therefore, only two transformers can be accommodated between each pair of units with 60 feet spacing, and this in turn means two generators per bank of three single-phase transformers.

Figure 10 shows the plan and elevation of one transformer vault. Great care has been taken to accomplish two things, first the limitation of damage in the event of serious transformer trouble. To this end, advantage has been taken of the floor beam depth to provide three large pits capable of containing the total volume of oil in one transformer, some 7,000 gallons. A 12-inch diameter drain leads from each pit directly down to the nearest tail-race. Fire doors will cover the front of all vaults, roof hatches with very light free resting metal covers will give relief to the plenum chamber above the vaults, and an extensive mulsifier spray system with four automatic temperature detecting devices will be installed.

The second objective was to design all facilities so that a transformer can be rapidly replaced. The desire has been to keep this period to not more than three hours. The heat exchangers move with the transformers, thus four special couplings are all that are involved in the way of pipe connections. Since this installation is indoors, all auxiliary leads for oil pump motors, indicators and alarms are made by plug and socket connections with flexible armored cable. The four low voltage connections require the most time, and at least three men can work simultaneously on these. The transformer will be rolled forward out of its cell, picked up by one crane and the spare unit put in its place, using the second crane if necessary.

In an underground power station, proper ventilation is a most essential consideration. Here, 76,000 c.f.m. of air will be drawn in through the main access tunnel for one-half of the development. Referring again to Fig. 6, the air is delivered to the control cable gallery and distributed from here to each unit at the level of the turbine bearing floor. By means of floor gratings it passes successively to the operating floor and to the main floor. Some is taken off at each unit on the operating floor, for the high voltage cable gallery and the total here discharged through the high voltage cable tunnel. From the main floor most of the air is drawn through the transformer vaults to the plenum chamber and the total discharged through the ventilation tunnel. Some air passes down behind the upstream wall to the turbine floor and

pipe gallery, and through floor gratings to be discharged through the tail-race tunnel.

H.V. Circuit Breakers

Some reference should be made to the high voltage circuit breakers. These are of the air-blast type, and are adequate for the ultimate installation, having an interrupting capacity of 6,000,000 kva. on a symmetrical basis at 301 kv., with a rate of rise of recovery voltage of 1,850 volts per microsecond. Calculations indicate that with the ultimate development, even with all transmission lines disconnected from the bus, which is the worst case, the rate of rise of recovery voltage will be about 1,200 volts per microsecond.

With this rate of rise the interrupting capacity is 7,000,000 kva. symmetrical at 301 kv. The calculated duty is 6,000,000 kva. for a line-to-ground fault between the circuit breaker and the cable termination. The circuit breakers have a current carrying capacity of 800 amp. and an impulse level of 1,050 kv. They have an opening time of 5 cycles and a closing time of 6 cycles. The opening or closing direct current from the battery is only 3 amp. or less.

The high voltage disconnects on the units are quite standard, but the line disconnects are unusual. They have a current rating of 1,600 amp. and will be equipped with interrupters in parallel with the main blade, which are capable of interrupting 90 amp. line charging current at 300 kv., or a load current of 800 amp. with 60 kv. across the disconnect, several times before contact erosion becomes serious. Thus, it will be possible to switch the transmission lines without circuit breakers. Of course, if this is successful, and if the isoceraunic level is as low, and hence faults are as few as expected, line circuit breakers will never be installed.

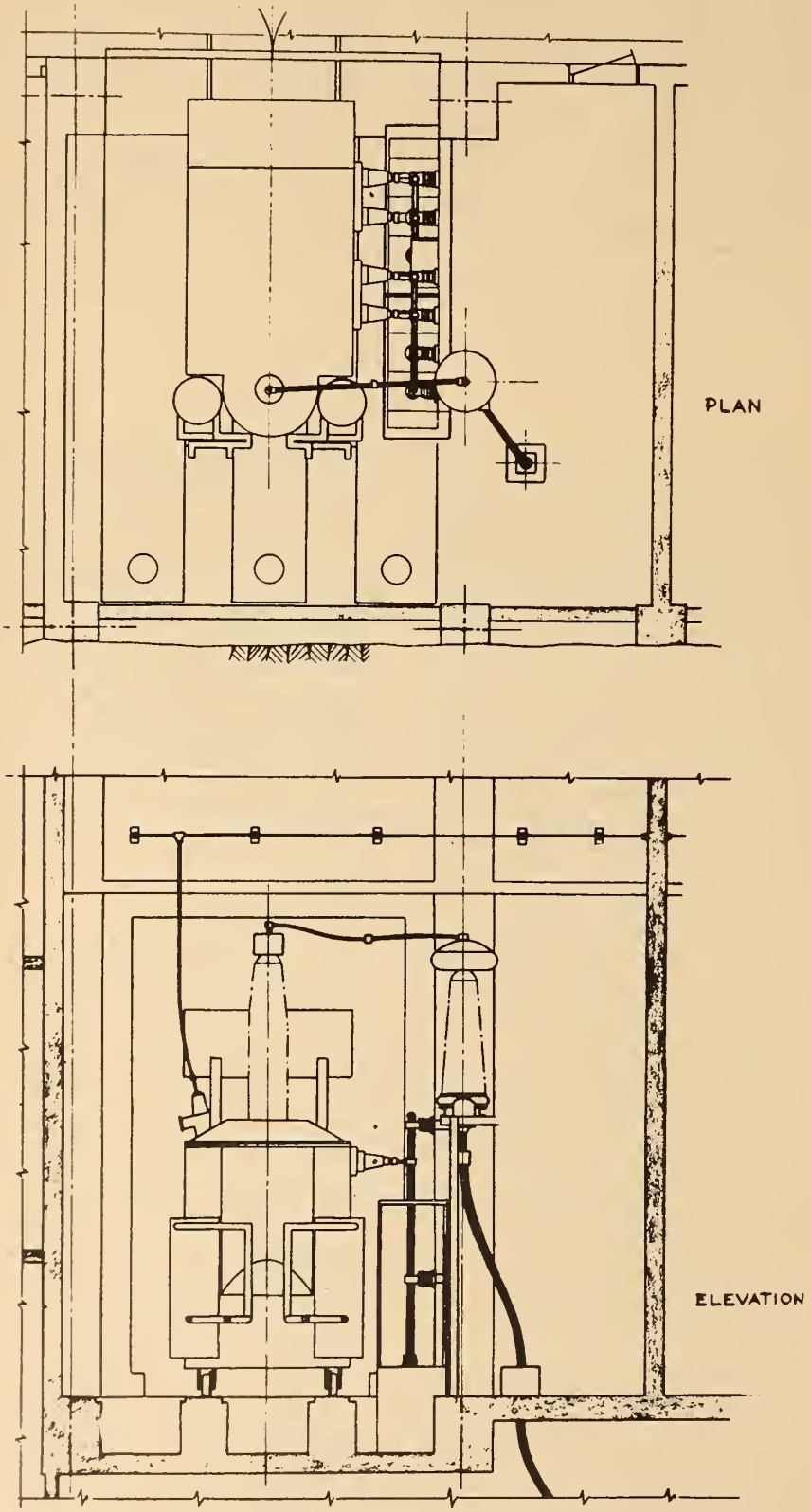


Fig. 10. Transformer vault.

Auxiliary Power

Most hydro-electric stations can stand a loss of auxiliary power for an interval of from 15 minutes to 2 hours, but here all cooling water is supplied by pumping from the tail-races. Therefore, pump motor power can only be interrupted for a very few minutes. Because of this great care has been taken to provide secure and reliable 550 volt auxiliary power. Two three-phase, 2,500-kva., water-cooled transformers, either of which can carry the load, are to be used.

The No. 1 transformer can be supplied from generators 2 or 3 directly, and from generator 1 through the transformer bank. The No. 2 transformer can be supplied from generator 2 directly and from generator 1 or 3 through the transformer banks. The motor operated disconnects for these various sources are interlocked so that generators or main banks cannot be paralleled through them. These auxiliary transformers have two separate 550-volt windings and as high a reactance as possible, to reduce fault currents

to a maximum of 25,000 amp. This is to permit the safe use of moulded case breakers on the 550-volt system, and to prevent the necessity of cascading 550-volt circuit breakers.

One winding in each transformer supplies one-half of one station service switchboard, and the other winding in each supplies the other board. All essential load centres, including the field cubicles where the cooling water pump motors are connected, can be supplied from either board. They are automatically switched from one source to the other in the event of failure of the source in use.

Similarly, great care has been taken with the auxiliaries of any piece of equipment such as the transformers or the high voltage circuit breakers which serve two generators. In the case of a transformer, each of the two coolers receives its water from a separate header, and the two oil pumps receive their power from different field cubicles.

Relaying

The generator stator windings are protected by a differential scheme, using percentage type instantaneous balanced beam relays with restraining and operating windings energized from 6,000 to 5 amp. current transformers on the neutral leads and two 3,000 to 2.5 ones on the two phase leads. They are also protected by split-phase protection, having a double primary current transformer with a ratio of 500 to 500 to 5 amp. This is located between the generator circuit breaker and its disconnect, so that both windings will be always at the same potential, and so that it overlaps the transformer differential zone.

A primary unbalance of 50 amp. or 1 per cent should operate the relays, which are high speed induction type with a time delay of about 3 cycles. An instantaneous balanced beam overcurrent relay in the neutral of the standby CT's, or supplied from a CT in the secondary of the grounding transformer, provides fast sensitive protection against faults to ground on the bus. It also protects the low voltage winding of the main transformer or the high voltage winding of the station service transformer. The stand-by protection is provided by voltage restrained overcurrent relays.

All of this protection operates one of two trip relays, which both trip the generator circuit breaker, field breaker, exciter field breaker and the governor shutdown solenoid. At 15 per cent speed the brakes are automatically applied. A field failure relay, activated by millivolts from the field shunt, and set for 85 per cent of field current for normal voltage no-load, trips only the generator breaker. The field ground detector annunciates only, and is an overcurrent relay in a source applying 110 volts at 60 cycles between the field circuit and

Table IV—High Voltage Insulated Cable Data

Manufacturer	Canada Wire & Cable Company	Pirelli General
Conductor Material	Aluminum	Copper
Conductor Shape	Segments	Circular Strands
Conductor No. of Strands	12	66
Conductor Area, cm	1,113,000	515,000
Conductor Outside Diameter, in.	1.09	1.17
Paper insulation thickness, in.	1.08	0.95
Sheath Material	Aluminum	Lead
Sheath Thickness, in.	0.170	0.115
External Reinforcing	Not Used	Helical Bronze Strip
Weight per ft. Completed Cable, lb.	8.75	13

Table V—Arrangement of Protective Relays

Generator		Transformer	
Trip Relay A	Trip Relay B	Trip Relay A	Trip Relay B
Split-Phase	Generator Differential	Cable Differential	Transformer Differential
L.V. Neutral	Standby Protection	H.V. Neutral	Line H.V. Ground
Overspeed	Thrust Bear. Temperature	Gas Detector	Station Service Overcurrent
	Governor Low Oil Pressure	Line Overcurrent	Remote Trip
		Station Service Gas Detector	
		Master Ground	

Table VI—Kitimat Transformer Data

Manufacturer	Can. General Electric	Canadian Westinghouse	Ferranti Limited
1 Cooler Operating:			
Kva	37,000	37,000	37,000
Temperature Rise, °C	62	55	55
Cooling Water, g.p.m.	145	85	150
2 Coolers Operating:			
Kva	47,000	45,500	49,000
Temperature Rise, °C	62	62	62
Cooling Water, g.p.m.	185	170	300
Reactance %	10.5	10.0	11.0
Exciting Current %	1.5	1.7	1.7
Shipping Weight, lb.	85,000	92,000	118,800
Shipping Dimensions: Length, in.	152	211	151
Width, in.	114	104	142
Height, in.	154	128	148
No Load Loss, kw.	90	90	73
Load Loss, kw.	226	226	220
Guaranteed Efficiency, 1.0 P.F.:			
Full Load, 37,000 kva.	99.15	99.15	99.21
¾ Load	99.22	99.22	99.29
½ Load	99.21	99.21	99.29
Oil, Imperial gal.	4,750	4,180	5,710
Weight of Oil, lb.	41,000	36,000	49,000
Weight of Core and Coils, lb.	67,000	70,000	91,200
Weight of Tank and Fittings, lb.	27,000	30,000	41,000
Total Weight, lb.	135,000	136,000	181,200

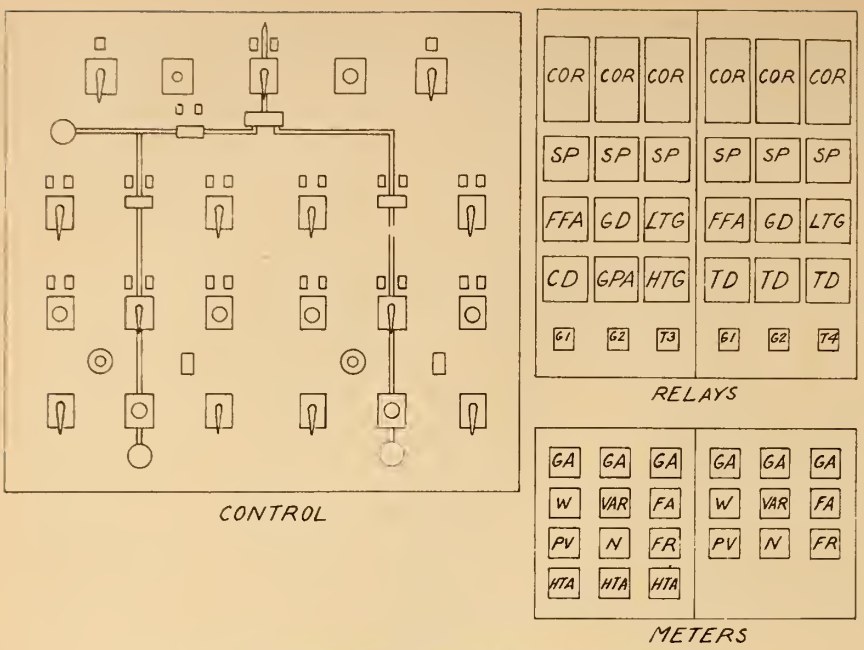


Fig. 11. Arrangement of meters, relays and control.

ground. Thus the whole generator d-c and main exciter armature circuits are covered.

The thrust bearing has two temperature relays, one to annunciate and the other, at a higher temperature, to operate the trip relay and at 50 per cent speed to apply the brakes continuously. This is required because of the high speed and large inertia involved; 25 million lb.-ft. squared. In the event of a thrust bearing failure, everything must be done to bring the generator to rest as soon as possible, if major damage is to be avoided.

Reduction of governor oil pressure also first annunciates, and then operates a trip relay, before the pressure falls too low to operate the needles. A-c. and d-c. overvoltage protection is provided. The former operates a contractor to insert resistance into the main exciter field, and at the same time to run the motor operated rheostat in the "lower voltage" direction. This overrides the regulator, so that the loss of potential on the latter cannot cause over-excitation. The d-c. overvoltage inserts resistance into the pilot exciter field.

The transformer bank is protected by a differential scheme, in which the current transformers on the low voltage side have a ratio matching the turns ratio of the main bank. Both H.V. and L.V. CT's have a saturation characteristic such that the knee of the curve is at 230 volts, with a magnetizing current of 0.1 amp. The relays are differentially connected low energy induction type overcurrent, with instantaneous trip attachments. A ground relay is connected to a current transformer in the bank high voltage neutral point connection.

A differential circuit also covers the oil filled cable by means of through type current transformers around the cable immediately below each termination. The relays are high speed induction type. This zone is primarily to simplify the operator's inspection task, and for his guidance if the transformer zone operates. The time required to inspect all transformers, indoor and outdoor cable terminations and the cable run itself is considerable. With the two zones the operator has a much better guide to fault location, and to his course of action.

Obviously, if both zones operate, indicating a cable fault, the circuit will be out for some time, and generator No. 2, if bank 1-2 is involved, must be immediately switched to bank 3-4. If only the transformer differential operates, a faulty transformer can be charged in 3 hours. Of course, all transformers are equipped with Canadian built gas detector relays having a gas accumulation alarm, and a pressure trip element. All of the transformer protection operates one of two trip relays which open the high voltage circuit breaker, the two generator circuit breakers, and the exciter field breakers.

The various relays and their distribution between trip relays is shown in Table V. The objective is to have some fundamental protection for each piece of equipment on each trip relay. The transmission line relaying initially is just phase and ground induction type overcurrent relays, with a total ground current relay. Provision has been made for the addition of phase comparison type relaying if desirable.

Table VII—Transmission Line Data

	Double Circuit	Single Circuit
Total Length, miles	1 at 39	2 at 10
Conductor Name	Falcon	Emu
Conductor Ultimate Strength, lb.	55,000	136,000
Conductor Area, cm.	1,590,000	3,360,000
Conductor Steel Strands	19	37
Conductor Aluminum Strands	54	108
Conductor Overall Diameter, in.	1.55	2.30
Conductor Weight, lb. per ft.	2.03	4.76
No. of Armor Rods	12	16
Armor Rod Max. Diameter, in.	0.508	0.522
Diam. over Armor Rods at Clamp, in.	2.6	3.3
Suspension Clamp Design Strength, lb.	25,000	75,000
Suspension Clamp Test Strength, lb.	37,000+	110,000+
Suspension Clamp Test Slip Load, lb.	10,000	30,000
Suspension Clamp Design Slip Load, lb.	3,000	10,000
No. of Suspension Units per String	16	18
No. of Dead End Units per String	18	20
Insulator Ultimate Strength, lb.	25,000	25,000
No. of Strings: Suspension, Normal	1	3
Dead End	3	6
Reactance, ohms per mile at 60 c.p.s.	0.734	0.771
Resistance ohms per mile at 60 c.p.s.	0.0684	0.0326
Susceptance, micromhos per mile at 60 c.p.s.	5.78	5.49

Metering

The metering is standard, and the meter and relay arrangement is shown in Fig. 11. For each generator the three phase currents, power, reactive, needle opening and needle limit, field current, pilot exciter voltage and frequency are indicated. The current in the high voltage winding of each transformer is indicated to show the total load on the bank and the cable. The generator power is totalized, indicated and recorded. The temperature from two thermocouples in each stator winding is recorded on high-speed multipoint instruments. The winding temperature from each transformer is recorded on similar instruments. Figure 11 also shows the control desk arrangement for two generators and one transformer.

The control room occupies space in the service area similar to that occupied by the transformers in the main sections of the plant. Therefore, the width was set by the transformer vault length, and the length by the service bay length. The problem was to arrange relays, instruments and control panels for 16 units in the fixed area so that the operator could see and reach where necessary. Also the layout had to be fairly reasonable for 4, 6 or 8 units as well as 16, as it may operate for years at any one stage. The maximum distance to any instrument is 21 ft.

Communication

Communication between Kemano and Kitimat will be by power line carrier. Three duplex telephone channels will be installed initially, and with some additions the same equipment can accommodate five duplex channels. It also will provide the initial voltage telemetering channel, and several other such channels if required, as well as a remote tripping scheme from Kitimat, and phase comparison relaying if used.

One problem was the multiplicity of traps for ten frequencies. Broad band coupling and trapping solve this. Reliability was the other problem. Icing of the power lines may cause the carrier attenuation to increase from say *2* to *60* db., or by a factor of 100,000. This has been overcome by a set which will operate through 63 db. or 80 in the absence of noise, and which is equipped with AVC. Also, all components common to all channels are duplicated, and the coupling is phase to phase, that is, to one conductor on each of the two transmission line circuits. Thus, the loss of one circuit still permits operation phase to ground.

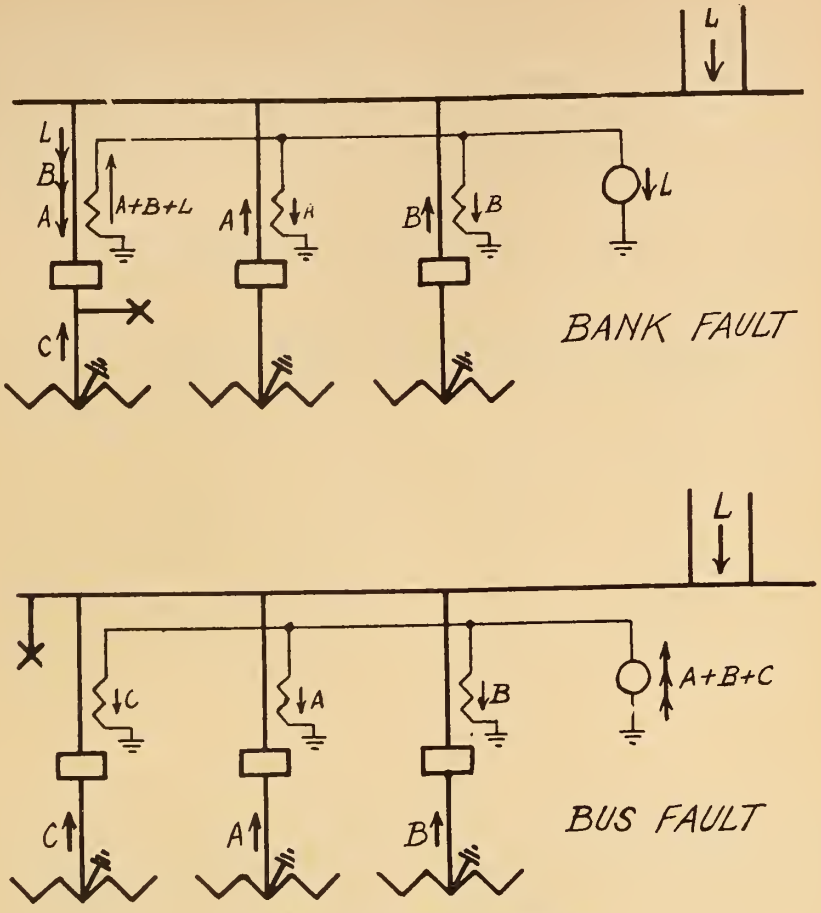


Fig. 12. Kitimat ground relaying.

Transmission Lines

Table VII gives all the essential data on the characteristics of the transmission lines. The conductor, fittings, clamps and hardware were all subjected to design-proof tests, so that all components will develop the maximum strength of the insulator strings, regardless of whether these are 1, 2, 3, 4 or 6.

Electrically the transmission lines present some interesting aspects. Figure 13(a) shows the normal reactance of the transmission system while (b) to (f) show various possible conditions with different sections out of service. It may be seen that the intermediate switching stations reduce the reactance from 200 to 150 per cent of normal, comparing (f) with (b). Since ability to transmit power is roughly inversely proportional to reactance, the switching stations give a 33 per cent increase in power limit under emergency conditions.

The reactance of the (b) condition can be offset by means of a source of kvar. installed at the load. Figure 14 shows the required kvar. for conditions (b) and (f). It may be seen that to transmit 1,200 mw. under (b) requires 350,000 kvar. while under (f) only 130,000 kvar. This is a saving of 220,000 kvar. The loading of the transmission circuits when transmitting a total firm load of 1,600,000 hp. or 800,000 hp. per double and single circuit, uses only half its capacity. With abnormal conditions F, the power limit is roughly 1,600 mw., so that 1,600 hp. or a 1,200 mw. loading leaves a margin of 400 mw. or 25 per cent. With the severe criteria of condition F, this should be ample.

Kitimat Electrical Equipment

The high voltage disconnects and circuit breakers for the initial stage of Kitimat are similar to those at Kemano. The transformers are single-phase OFW units, rated at 37,000 kva., with a ratio of 275 to 13.2 kv. with four 2½ taps. Each bank of three is supplied by a different manufacturer and comparable data are shown in Table VI. The low voltage disconnects are of the outdoor type, rated 6,000 amp. in the main connections and 1,200 amp. in the rectifier connections.

The rectifier equipment for each

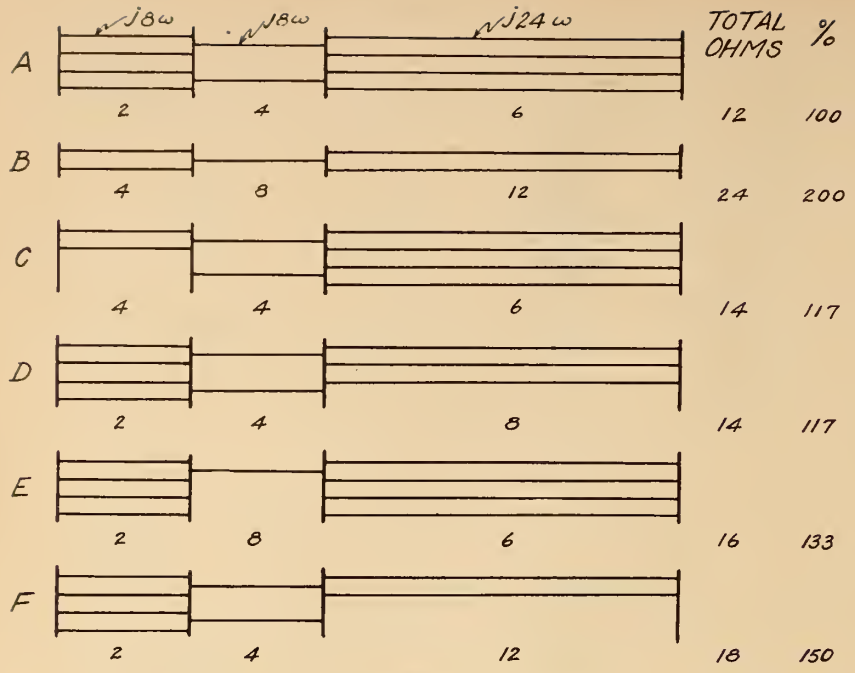


Fig. 13. Transmission line reactance.

potline consists of 8 units, each rated 12,500 kw., and consisting of a single tank 1,200 amp., 1,000,000 kva. interrupting capacity outdoor oil circuit breaker, a self-cooled phase shifting transformer rated 13,200 kva., 2 units with 15° phase shift, 4 with 7½°, and 2 with 0° to give 48 phase operation, a self-cooled rectifier transformer rated 13,200 kva., with a three-phase primary and two six-circuit wye connected secondary windings.

These 12 windings supply the 24 anodes of two rectifier frames, each consisting of 12 ignitron type pumped, water-cooled tanks with auxiliaries. The cathodes of the 16 frames connect through high speed air circuit breakers to the positive main bus. The neutral points of all secondary windings connect to the negative main bus, through interphase transformers. The overall efficiency of this rectifying equipment, from 13,200 volts a-c to 1,000 volts d-c will be better than 96 per cent.

The main banks are protected by high voltage and low voltage induction type phase and neutral overcurrent relays, and by gas detector relays. As well there are alarms in the oil and water flow systems, and on the winding temperature device. The rectifier transformers have phase and neutral relays on the primary side, gas detector relays, high temperature and low oil level alarms. The rectifier tanks are protected against loss of vacuum, reverse current and over temperature.

A total or master ground relay is installed and Fig. 12 shows how it discriminates between any fault on the bank side of the high voltage switch, for which it does not operate, and one on the bus side, for which it does. Upon operating, by means of two tone generators in series, and two in parallel on different carrier channels, it remotely trips the high voltage breakers at Kemano, thus rapidly clearing a bus fault or line fault near Kitimat.

One problem is that of measuring large direct currents. This is done by a transductor, which is an iron cored transformer around the d-c. bus, operating with constant applied voltage and a saturated core. Any change in the direct current changes the inductance and hence the exciting current, a 5-amp. portion of which then gives a measure of the direct current.

The Kemano design is being done by the British Columbia International Engineering Company, under the direction of W. G. Huber, general manager, and Mr. G. E. Crippen, chief design engineer. The Kitimat electrical design is being carried out under the direction of H. J. Kirkpatrick, assistant chief engineer of Alcan's General Engineering Department. The author would like to acknowledge the assistance and co-operation of these gentlemen and their staffs.

In conclusion then, great interest will be centered on the actual test efficiencies of the Kemano turbines and generators and the Kemano and Kitimat transformers. Equally the performance with regard to pitting of the turbines, and the temperature rise of the generators and transformers will be watched carefully, as these data will help to point the way for the future.

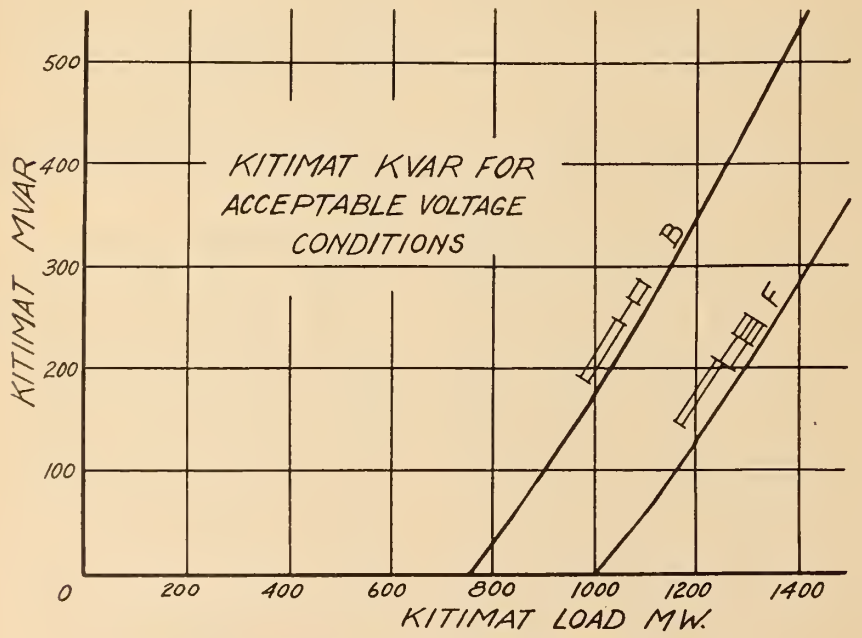


Fig. 14. Kitimat kvar. for acceptable voltage conditions

THE PROPANE UNIT of the ROYALITE OIL COMPANY

by

A. G. A. Piercey, M.E.I.C.

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Madison Natural Gas Company Limited
Turner Valley, Alta.

Liquified propane was first recovered in Turner Valley in 1948, when the plant of Western Propane, Limited, started operations. This plant was purchased by the Royalite Oil Company in July, 1952, and on August 11 operations on the old site ceased and the moving of the equipment started. Since that time the equipment has all been overhauled, and installed in its new location, adjoining the Royalite Oil Company gasoline plant. Operation started here on October 20, 1952.

Re-location of the plant has several obvious advantages. It reduces the personnel required, since steam and lean monoethanolamine solution will be supplied from the Madison Natural Gas Company's boiler house and scrubbing plant, respectively. It also should increase the capacity of the plant as the inlet vapours will be available at a somewhat higher pressure. Apart from loading and trucking operations, it is expected that, eventually, an addition of only one man per shift will be required to the present gasoline plant personnel.

The place of the propane unit in the preparation of Turner Valley gas for market can best be seen by a quick review of the various steps.

In the field, separator tail gas from low pressure crude wells is collected at suction pressures of from 10 to 60 p.s.i. and compressed. This gas, along with separator tail gas from high pressure crude wells, and varying amounts of gas cap gas, flows through the gas gathering system of the Madison Natural Gas Company to the main compressor station at Turner Valley, where the pressure is raised to 330 p.s.i.

Most of us not in the business know that propane, the "bottled gas" that has done so much to add to the amenities of rural life and has even supplanted coal gas in some communities, comes somehow or other as a result of natural gas treatment, but few of us have any idea of the somewhat complicated processes involved.

Mr. Piercey's paper, which was read before the Calgary Branch on October 23, 1952, gives a step by step description of the production of propane as exemplified in one of the most modern plants in the industry.

The gas from the compressors flows to the gas coolers on the inlet side of the absorber building of Royalite's gasoline plant, where it is cooled from approximately 200° F. to 60° or 70° F. Any liquid condensate entrainment is caught in inlet separators. The wet gas enters the bottom of the absorbers and flows upwards counter-current to the flow of lean oil.

The lean oil enters above the top tray, flows down over 21 bubble cap trays, and collects as rich oil at the bottom of the absorbers. This rich oil contains the propane and isobutane plus products which are subsequently recovered in the propane unit and gasoline plant unit respectively. The flow of rich oil to the gasoline plant is regulated by liquid level controllers. The residue gas from which the gasoline and part of the propane have been removed leaves near the top of the absorbers, passes through outlet traps and demistifiers to remove any entrainment of lean oil, and then flows to the Madison scrubbing plant, where the acid gases are removed. The rich oil from the absorbers flows to the gasoline plant where the propane and the gasoline are stripped from the oil.

There are two parallel distillation units in the gasoline plant proper. In the case of Unit No. 1, the rich oil from Absorbers 1 and 2 flows through a heat exchanger into a vent tank, where the pressure is reduced to 140 p.s.i. The vent tank vapours, which contain approximately 10 per cent propane, flow to the bottom of the reabsorber. The rich oil then flows through a series of three heat exchangers, where it is heated by the hot lean oil leaving the still.

Final heating of the rich oil is done in two steam preheaters using 150 p.s.i. steam. The hot rich oil enters the still, which operates at a pressure of 90 p.s.i. Live steam at 150 p.s.i. is fed in at the bottom of the still at a rate of one-half pound of steam per gallon of rich oil. This steam serves to agitate the oil and helps to carry the propane and gasoline vapours to the top of the

still. The stripped oil, now called "lean oil," flows back through the heat exchangers and a cooler to the lean oil surge tank. From the surge tank the oil is pumped through two additional coolers to the absorbers at a rate of 320,000 Imperial g.p.d. by means of a triplex pump driven by a 75 hp. electric motor. The vapours from the still are condensed in two horizontal and two vertical still condensers and collect in the still accumulator. Vapours from the still accumulator, which contain approximately 25 per cent propane, go to the bottom of the reabsorber.

Unit No. 2 operates in parallel with Unit No. 1, and differs only in having the four heat exchangers after the vent tank, and in having the oil circulated by steam turbine driven centrifugal pumps instead of by triplex pumps.

The reabsorber has 25 bubble cap trays. It is 66 in. inside diameter, 53 ft. in height, and is similar to the absorbers, except that it operates at a pressure of 73 p.s.i. and has an oil circulation of 237,000 Imperial g.p.d. Vapours from the reabsorber contain approximately 20 per cent of propane by volume, and form the lean gas stream to the propane unit proper.

The raw gasoline in the still accumulators contains approximately 20 per cent of propane. This propane is removed from the gasoline in a 30-tray bubble cap refractionator, 54 in. in inside diameter, 46 ft. 6 in. in height, operating at a pressure of 160 p.s.i. The isobutane plus product goes to twelve 580-barrel storage tanks. The vapours from the refractionator, which contain between 75 and 80 per cent of propane, form the rich gas stream to the propane unit.

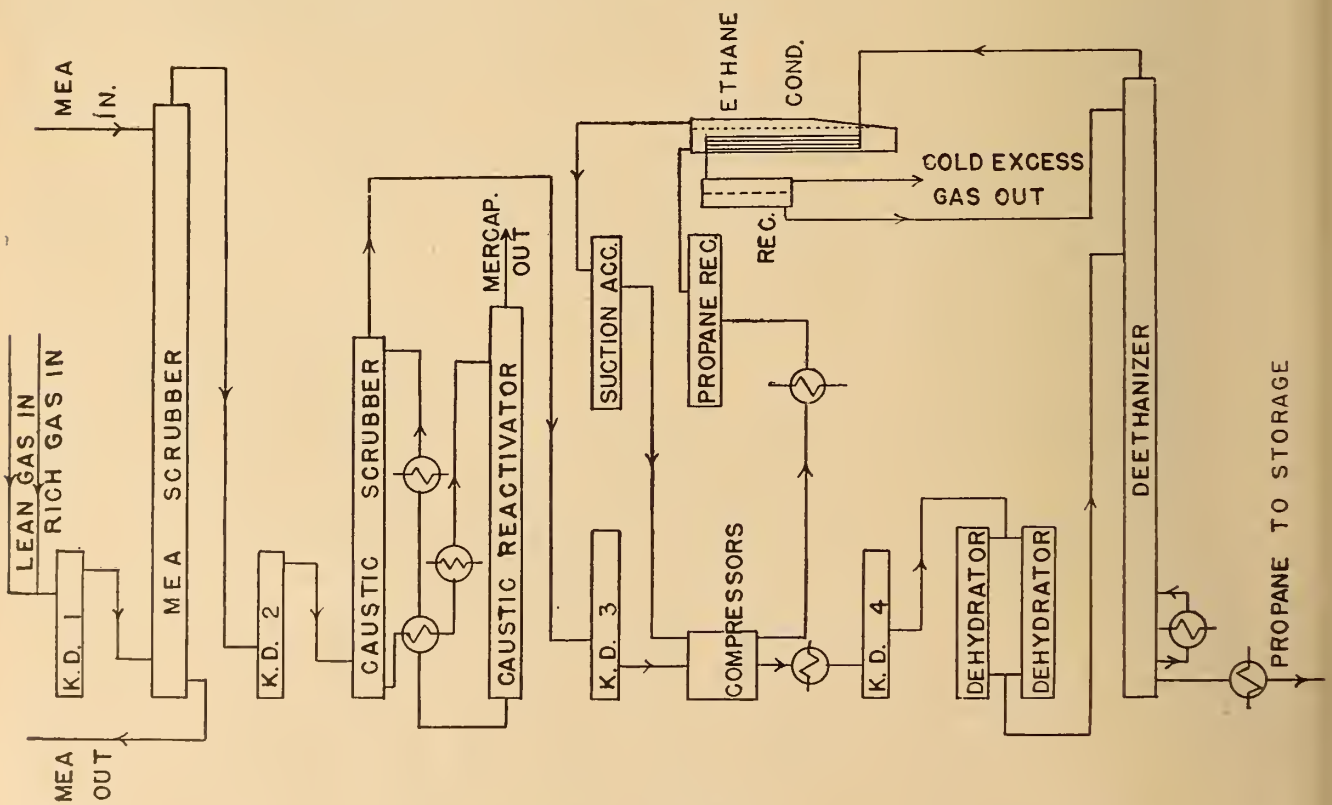
Feed to Propane Unit

	Lean Gas	Rich Gas	Combined Stream
	%	%	%
Methane	44.2	4.0	38.0
Ethane	23.5	13.2	21.9
Propane	19.2	78.8	28.4
Isobutane plus	0.7	0.2	0.6
Carbon dioxide	1.2	0.3	1.1
Hydrogen sulphide	11.2	3.5	10.0
Totals	100.0	100.0	100.0
Volume Mcf/day	2,475	450	2,925

The sequence of operations in the propane unit is best followed by means of a schematic diagram (Fig. 2).

The combined feed gas to the propane unit at a pressure of approximately 70 p.s.i. first passes through a knockout drum (KD-1), where any entrained lean oil or other liquid is trapped. The hydrogen sulphide, carbon dioxide and part of the mercaptan content of the gas is then removed, in a monethanolamine (MEA) bubble cap scrubber, 3 ft. in diameter and 58 ft. in height. The lean MEA solution is supplied from the Madison Natural Gas Company's scrubbing plant, and the rich MEA solution is returned to the scrubbing plant for reactivation. Solution rate is 6 gal./min. - 1,000 gr. H_2S/100 c.f./MMcf. The MEA scrubber is equipped with a flow recorder controller (FRC-1) and a liquid level controller (LLC-1).

The scrubbed gas from the top of the MEA scrubber flows through a knockout drum to remove any entrained solution, and then through a caustic scrubber 2½ ft. in diameter and 35 ft. in height. The lean 5 per cent caustic solution flows down through bubble trays and reacts with the remaining mercaptan content of the gas flowing upward in the tower. The rich caustic flows from the bottom of the scrubber



Flow sheet of propane unit.

through a heat exchanger, where it is heated by the returning hot lean caustic from the caustic reactivator, and then through a steam preheater and into the caustic reactivator. The caustic reactivator is a tower 3 ft. in diameter and 38 ft. in height, equipped with bubble cap trays. The liquid level at the bottom of the caustic scrubber is controlled by means of a liquid level controller (LLC-3) and the caustic solution flow is controlled by a flow recorder controller (FRC-7) operating on the steam to the caustic circulating pump. Steam to the caustic regenerator is controlled by a flow recorder (FRC-5). In the caustic reactivator, the mercaptans are removed at the top and the regenerated caustic solution is recirculated through the heat exchanger and a cooler to the top of the caustic scrubber.

The clean gas from the top of the caustic scrubber flows through another knockout drum (KD-3) to the suction headers of the compressors. There are two compressors at present. The larger has two cylinders compressing gas to the deethanizer tower, and one cylinder compressing propane refrigerant gas. The smaller has one cylinder operating on gas to the deethanizer tower, and the other on propane refrigerant gas. The compressors boost the pressure of the gas to the deethanizers from 60 p.s.i. to 350 p.s.i. The hot compressed gases then pass through a gas after-cooler and a knockout drum (KD-4) to one of the dehydrators, where their water dewpoint is lowered to at least −20 °F. These dehydrators, 3 ft. by 16 ft. by 4½ in. are of the solid desiccant type, containing an aluminum oxide desiccant.

The deethanizer is 2½ ft. in diameter, 60 ft. in height, and operates at about 350 p.s.i. The feed gas enters at the side of the tower at one of the four entry trays. Reflux enters near the top of the tower. Heat is supplied at the bottom by the usual steam heated reboiler.

The level of the liquid in the bottom of the deethanizer tower is controlled by a liquid level controller (LLC-4). A temperature recorder controller (TRC-1), which can be used on one of three trays, (3, 5, 7) of the deethanizer, is used in conjunction with a flow recorder controller (FRC-4) on the steam to the reboiler to maintain the desired temperature at the bottom of the deethanizer.

The overhead stream consists of methane, ethane, and some propane. This stream flows to the ethane condenser, which is 26 in. by 42½ in. by 20 ft. in length, and has a cooling surface of 1,120 sq. ft.

Cooling is accomplished by the elevation of liquid propane. The evaporated propane flows to a refrigerant suction accumulator, and then to the refrigerant suction headers of the two compressors. The compressed refrigerant propane then flows through a propane condenser 32 in. by 19 ft. (1,810 sq. ft.) to the liquid propane receiver (3 ft. by 6 ft.) from which it is recirculated to the ethane condenser. Any liquid propane required for make-up is added to the liquid propane receiver.

The condensed ethane and pro-

(*Continued on page 383*)

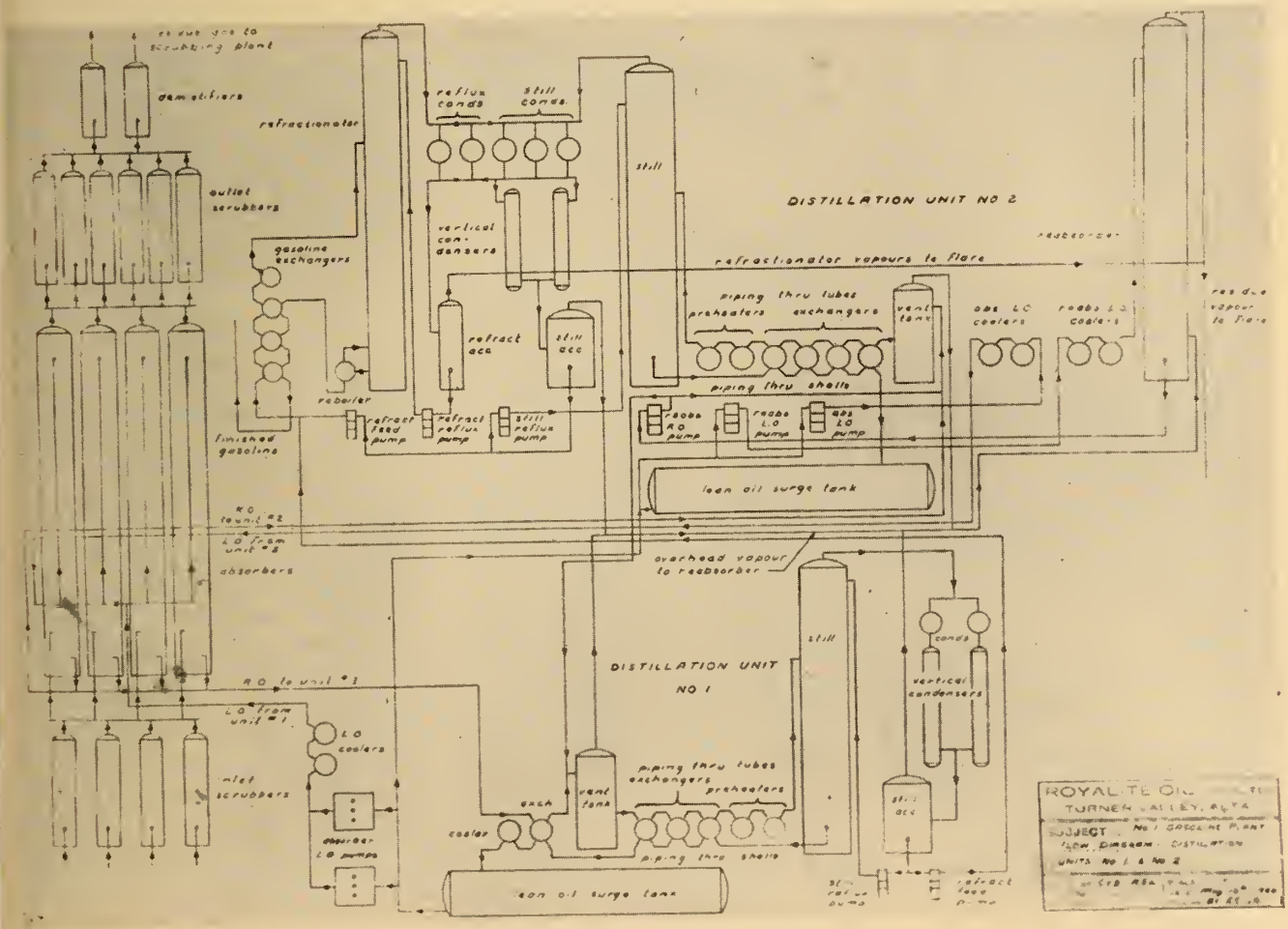


Fig. 2. Flow sheet of gasoline plant.

Construction and Operation of Royalite's Sulphur Recovery Plant

by

D. D. Dunbar

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A paper presented before the Calgary Branch of The Engineering Institute of Canada, October 23, 1952, at Calgary, Alberta.

This paper deals with many of the problems associated with the construction and bringing into operation of a plant designed to recover elemental sulphur from acid gas. The Royalite Oil Company Limited plant at Turner Valley was designed by the Foster Wheeler Corporation, and was constructed by the Royalite Oil Company Limited. Construction began in October 1951, and elemental sulphur was first pumped into the storage area on July 17, 1952.

Many of the chemical and physical aspects, which are unique to sulphur production, are noted. Also, the more important of the operational and safety features are referred to. Briefly indicated are the processes through which the gases are passed, how they are separated and finally marketed.

The Royalite Oil Company has recently put into operation a sulphur recovery plant at Turner Valley, Alberta, for extracting sulphur from natural gas. Before choosing the location for the plant the following conditions were considered:

1. Location in the main plant yard but situated where an open flame would not create a hazard.
2. Soil conditions (soil bearing value, elevation of water table, etc.).
3. Drainage characteristics.
4. Accessibility to existing plant installations, notably the Girbotol scrubber building and the boilerhouse (for acid gas feed line and water and steam connections).
5. Adequate space to carry out excavation and erection work, without interfering with other plant operations.
6. Sulphur storage and loading area.

On this basis, the site was located in the area immediately to the north of and on the same level as the boilerhouse and generator building, above the edge of the embankment. This area appeared to best satisfy the general requirements.

Gasoline, Girbotol Plants

The natural gas, which originally was produced from the "pay" formation, holds in solution a number of compounds. The most important of these are H_2S gas, CO_2, gasoline-type hydrocarbons and water vapour.

The gas is stripped of most of the hydrocarbons heavier than methane (including propane) in the gasoline plant absorber towers. Most of the water vapour is removed in the scrubbing plant towers with diethylene glycol. The CO_2 and H_2S gases are removed in the lower trays of the towers by the absorbing agent monoethanol amine. The natural gas has thus been stripped almost completely of gasoline and acid gas, and in this form is piped into the consumer market of Calgary and environs.

The acid gas ($H_2S + CO_2$) which has been separated in the Girbotol scrubbing process from the main gas product is, in turn, liberated from the MEA absorbing agent by heating of the MEA to dissociation. The MEA, upon dissociation, releases the acid gas in the upper section of the Girbotol reactivators. Downstream from these reactivators, the gas may be piped to the reactor furnace of the sulphur plant, or may be expelled to the atmosphere during shut-down periods.

Sulphur Plant Start-Up

Prior to actual starting-up of the sulphur plant, the refractory-lined furnace is brought up to a temperature of approximately 1,400° F. by means of burning a combination of air and natural gas, through a separate port in the furnace wall. The H_2S gas, mixed with a selected quantity of air, is forced into the furnace mixing chamber under a pressure of 0.4 to 0.6 p.s.i.g. The mixture of H_2S and air, present under a small pressure, has an ignition temperature much lower than that temperature to which the refractory lining has been heated. Hence, the gases immediately ignite

upon impinging on the target wall of the vessel.

The initial reaction which is:

$$2\,H_2S + 3\,O_2 \longrightarrow 2\,SO_2 + 2\,H_2O + \text{heat}$$

is highly exothermic, and produces a great amount of heat energy. This heat gradually elevates the temperature of the refractory lining to 1,800°F. This temperature, which was the original design temperature has, during recent operations, been reduced to approximately 1,590°F./1,600°F. in the outlet duct. When the walls of the furnace outlet duct reach this elevated temperature, the plant is ready to be placed on production. The ratio of oxygen to H_2S gas is altered in such a manner that a maximum of gaseous sulphur is produced from the reaction.

Chemical Aspects

The theoretical equation is: — $2\,H_2S + O_2 \longrightarrow 2\,S + 2\,H_2O +$ heat. In actual plant performance, however, a number of factors influence the selection of the most efficient ratio. These are:

(1) the improbability of perfect mixing resulting in incomplete combustion of H_2S.

(2) the smaller proportion of O_2 present increases the reaction producing sulphur. On the other hand, this reduction also entails the undesirable result of permitting a larger quantity of H_2S to pass through the vessel unreacted. Likewise, an increase in ratio of O_2 to H_2S reduces the amount of H_2S passing through unreacted. However, more SO_2 and less sulphur will be produced by changing the ratio in this manner.

(3) The presence in the feed gas of light hydrocarbons, mainly CH_4, which have been carried over to a small extent by the Girbotol scrubbing process already referred to. These hydrocarbons have a tendency to rob the mixture of its oxygen, thus decreasing the proportion of O_2 to H_2S.

(4) The production of carbonyl-sulphide (COS) in a complicated secondary reaction occurring simultaneously with the sulphur, sulphur dioxide reactions. This product is eventually partially recovered as sulphur during its flow through the catalyst bed.

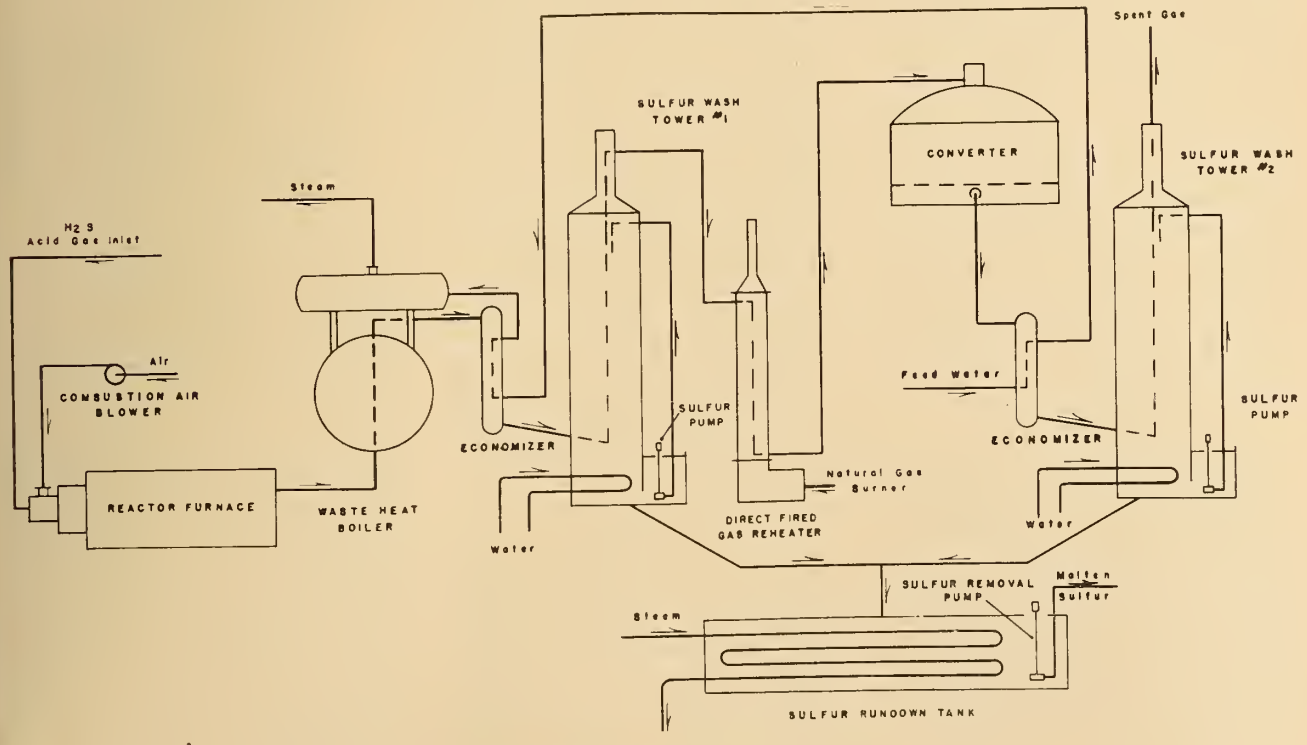
Physical Aspects

In order to recover sulphur in the molten or crystalline form, the reactor furnace temperature must be reduced to the condensation temperature, and eventually to the freezing temperature of sulphur.

Referring to the flow diagram, it will be noted that boiler feedwater is pumped countercurrent to the main process flow. This water, which recovers heat from the sulphurous gases in the two economizers, recovers sufficient additional heat energy from the gases in the waste heat boiler to be generated into 225 p.s.i.g. saturated steam. This in return reduces the acid gas temperature to 550°F. to 580°F.

The acid gases, which consist of sulphur in the gaseous form, SO_2, H_2S and COS, are cooled further in No. 1 economizer which is, in effect, a shell to tube heat exchanger. The temperature has, at this stage, been lowered to 385°F./400°F., as compared to 831°F., the condensation temperature of sulphur. Much of the sulphur is, therefore, condensed in this vessel, and the liquid is permitted to drain into the No. 1 wash-tower sump section.

In order to effect a greater recovery of molten sulphur in the wash towers, sulphur, maintained by water cooling coils at 265°F./270°F. in the sump sections, is used as a reflux in these vessels. Much of the sulphur which otherwise would escape as a gas, is brought down in the liquid state. At this stage of recovery, approximately 60 per cent of the sulphur, originally present as a component part of the H_2S feed gas, has been recovered from the process. The



Flow diagram of sulphur recovery unit.

remaining portion is in the forms of unreacted H_2S, SO_2 and COS gases.

Bauxite Catalyst

The second phase of the plant is designed to recover much of this otherwise lost product. The primary feature is the converter containing a two-foot bed of activated bauxite catalyst in pellet form. In the presence of this catalyst at temperatures of 420°F. to 440°F., the H_2S and SO_2 gases take part in an exothermic reaction producing elemental sulphur according to the equations:

$$2\ H_2S + SO_2 \rightarrow$$
$$3\ S + 2\ H_2O + \text{heat}$$

The COS is reduced to CO_2 and sulphur. The efficiency of this catalyst, or the extent to which the above reactions occur, is dependent on (1) the bed thickness; (2) space velocity of the process flow; and (3) extent to which the bauxite has been carbonized.

Since the temperature of the gases was reduced to 260°F. 265°F. by the reflux sulphur in the wash tower, it is apparent that the temperature of the gases must be raised approximately 170°F. in order that the desired reactions in the converter are realized. A temperature increase is brought about by routing the escaping gases from the top of No. 1 wash tower through the shell of a direct fired gas reheater. The reheater fuel is scrubbed (H_2S free) natural gas. The products of its combustion are passed through the tubes of the reheater heat exchange section. These gases, having elevated the acid gas temperature to the desired range, are vented to the atmosphere.

The heat-producing reaction of H_2S and SO_2 forming gaseous sulphur has elevated the temperature of the acid gases above that temperature at which sulphur may readily be condensed, — approximately 570°F. It is evident, therefore, that a cooling agent or agents must be employed to encourage further condensation.

Condensation of Sulphur

Temperature reduction to 395°F. 405° F. is effected in No. 2 economizer. Boiler feedwater at 300 p.s.i.g. and 220°F. is passed through the tubes, and the process gases pass through the shell of the vessel at temperatures ranging from 550°F. 560°F. and at a few ounces above atmospheric pressure. Hence, the conditions present in No. 1 economizer and No. 1 wash tower are duplicated in No. 2 economizer and No. 2 wash tower. Liquid sulphur is pumped to the top of No. 2 wash tower and brings down much of the remaining gaseous sulphur in the liquid state.

The gases leaving No. 2 wash tower stack, consisting of H_2S, SO_2, CO_2, CO, N_2, COS, H_2O vapour and uncondensed sulphur, are collectively termed the tail gases and these gases are vented to the atmosphere. The quantitative difference between the sulphur entering the plant in the form H_2S gas and the sulphur contained in the tail gases, divided by the former quantity, represents the efficiency of the plant. This efficiency under normal operating conditions varies between 88 and 92 per cent.

Production of Molten Sulphur

The liquid sulphur which accumulates in the lower sump sections of the wash towers is drained off after the liquid level has reached the drain nozzle. It is this sulphur, also, which is employed as a refluxing agent in the towers. It is being continuously pumped by immersed centrifugal sulphur pumps, driven by 8½ hp. steam turbines. The drain nozzles on the walls of the sump sections are sufficiently high to insure an adequate head above the impeller blades of the pumps, and thus maintain them in a permanently primed condition.

The surplus sulphur, that is, the sulphur currently being produced, is drained off in graded, insulated, steam jacketed lines to a brick-lined reinforced concrete rundown tank. This tank, which is partially buried, is maintained at a temperature of approximately 275°F. by means of 50 p.s.i.g. steam contained in a system of 2 in. diameter steam coils. Two hundred and seventy-five degrees F. is the temperature at which liquid sulphur is least viscuous and is, therefore, most readily handled by pumps. All sulphur lines are insulated and steam jacketed to insure against freezing, and are graded from the 11 hp. steam turbine-driven sulphur pump located on the roof of the rundown tank, to the storage area.

Sulphur Storage

Sulphur is temporarily stored in the Royalite plant at Turner Valley in solid blocks 40 ft. wide by 100 ft. long and 6 to 8 ft. in height. Twenty-four hour production is pumped on to the block surface in a 30 to 35 min. period each morning. Production is represented by a 2 to 3 in. new layer daily. The factor governing block dimensions is the insulating properties of solid sulphur.

If the block dimensions were so small that daily production exceeded 6 in. of depth, the newly poured mass would develop a thin crust, which in turn would act as an insulator to the still molton interior and prevent its rapid solidification. Breaking up and removal of a sulphur block frozen on the outer surfaces with a molten inner core, either by blasting or by other mechanical means, would constitute an unnecessarily hazardous operation. It is, therefore, considered a safety precaution to pour the molten sulphur into as large an area, and into as thin layers, as space will permit.

Process Flow

Again referring to the schematic flow chart, it is noted that the process or acid gas and product flow has been charted. The process flow is comprised of the following:

(1) The acid gas line from the Girbotol scrubbing plant to the sulphur plant.

(2) The combustion air line from the atmosphere through the 82-hp. steam turbine-driven air blower.

(3) Air and gas lines to the reactor furnace.

(4) Ducts connecting the vessels and the shells of the vessels.

(5) The liquid sulphur lines from the wash towers to the sulphur rundown tank.

(6) The sulphur reflux lines from the wash tower sump sections to the splash angles in the upper sections of these vessels.

(7) The liquid sulphur line from the rundown tank pump to the storage area.

Chemical Analyses

Analyses are carried out each shift by the operators. The method followed is a titration with N 10 iodine and a titration of N 10 NaOH. The iodine titration is carried out on 50 c.c. of N 10 iodine and 50 c.c. of N 10 sodium thiosulphate solutions to a permanent blue colour. One litre of gas was previously aspirated through these solutions. The permanent blue colour resulting from the iodine titration is changed to red by adding one drop of thiosulphate and methyl orange. Titration of N 10 NaOH is then carried out until the red colour disappears. The volume of iodine and NaOH are recorded along with the atmospheric temperature.

The operators carry out a Tutweiler test for H_2S volume per cent in the feed gas. In addition, complete Orsat and Tutweiler tests are made weekly, to determine volume percentages present of H_2S, CO_2 and inert gases (largely CH_4).

Instrumentation

Pressure Control

It is reiterated here that in these piping systems, pressures play little part, other than inducing flow and overcoming frictional resistance in the lines, vessels, ducts and catalyst bed. The main feature regarding pressure is that the combustion air is maintained at a slightly higher pressure, by a pressure indicator controller instrument, than the acid gas entering the reactor furnace. This instrument actuates a control valve on the high pressure steam line to the air blower turbine.

Also, upon closing the main valves (either the start-stop push-button valve or the gear and chain operated positive closing valve) in the acid gas line at the sulphur plant, the back pressure will build up to that pressure set on a pressure regulator control valve at the main plant stacks. The acid gas will then be vented to the atmosphere at that pressure (6.5 p.s.i.g.). The vented acid gas is dissipated by a supply of air, blown by electrical and steam-driven fans prior to release to atmosphere, to minimize air pollution at that point. The tail gases from the sulphur plant contain small quantities of H_2S and SO_2 (about 1.5% by volume).

Temperature Control

Temperatures throughout the flow process are vitally important, and are recorded and controlled by thermo-couples and temperature recorded controller instruments at all important points. The temperature of the gases leaving the reactor furnace is determined by the ratio of air to gas selected. This ratio selection is, in turn, determined by the results of chemical analyses of both the feed gases and the tail gases.

The temperatures of the gases leaving the waste heat boiler and the two economizers are controlled by instruments and mechanisms which regulate the flow through the system of boiler feedwater and the amount of steam being generated in the waste heat boiler steam drum.

Boiler Feedwater and H.P. Steam Control

Liquid level is controlled by a rod installed on and connected to the water side and the steam side of the steam drum. This device employs the thermal expansion principle. As the water level drops, more steam will enter the rod, and the resulting increase in temperature causes the rod to expand. This linear expansion is multiplied by a system of levers and linkages, which are connected in such a manner to the diaphragm of a control valve that it is caused to be opened. This allows a greater quantity of boiler feedwater to pass into the boiler system. Similarly, the valve would be closed off as the water level rose in the steam drum.

Pressure control is of importance in the boiler feedwater and H.P. steam systems. A pressure regulator set at 300 p.s.i.g. maintains the feedwater at that pressure upstream of the liquid level control valve. This regulator, in turn, actuates a control valve on the H. P. steam line to the feedwater reciprocating pumps. There is, therefore both liquid level control and pressure control on the feedwater system.

A pressure regulator set at 225 p.s.i.g. controls the pressure of the steam leaving the steam drum. This is the pressure of the steam system in the Turner Valley plant.

Reflux Temperature Control

The temperatures of the refluxing sulphur in the wash towers are controlled by temperature recorder controller instruments, which in turn control diaphragm valves on the cooling water lines leading from the wash towers.

The temperatures of the gases leaving the two wash towers are controlled by the amount of sulphur being refluxed by the pumps. This is determined by the speed at which the sulphur pump turbines are set. An excessively high temperature in the No. 2 wash tower stack, for example, might indicate that the speed of the turbine should be set at a higher r.p.m. figure. The resulting increase in liquid sulphur being splashed through the hot gases would have a tendency to reduce the tower temperature.

Fuel Gas Combustion Control

The temperature of the gas leaving the direct fired gas reheater and entering the catalyst bed is controlled by two temperature recorder controller instruments (one on the main control panel, the other outside the furnace building). These duplicate instruments control the flow of natural gas through a diaphragm valve upstream of the gas fired reheater. Temperatures at different points in the catalyst bed are recorded by a temperature recorder potentiometer, connected to thermocouples inserted in the bed.

Liquid Sulphur Temperature Control

The control on the temperatures of the sulphur lines and the sulphur in the rundown tank is effected by a 225/50 p.s.i.g. reducing valve on the high pressure steam main header. Since the temperature of 50 p.s.i.g. steam is 298°F., all sulphur lines jacketed with steam at this pressure or slightly less, will be maintained at a temperature of approximately 275°F. All jacketing lines and the rundown tank coils are supplied with steam through a line downstream from the reducing pressure regulator.

Acid Gas — Air Flow Control

The instruments controlling the feed gases and combustion air to the furnace are of vital importance to the operation of the plant. The quantity of air being blown into the system, per cubic foot of acid gas entering from the scrubbing plant, is determined by the ratio selected on the ratio flow controller recorder instrument. The acid gas flow is measured by a Pitot tube, and atmospheric conditions are corrected by pressure and temperature instruments which record the number of standard cu. ft. of gas passing.

The ratio flow recorder controller actuates a flow recorder control valve on the combustion air line. A pressure indicator controller upstream of this valve on the air line actuates a control valve on the high pressure steam to the air blower engine. Hence, as the acid gas flow increases, a proportionately increasing quantity of air is introduced to the furnace, and the ratio of gas to air is maintained at the selected figure. This ratio is determined by furnace outlet temperature tail and feed gas chemical analyses and atmospheric conditions to a minor extent.

Feedwater Chemical Requirements

Feedwater entering the boiler and economizer tubes must be checked for oxygen content, pH value, organic material, oil or grease, total soluble solids, suspended solids and alkalinity. Usual practice requires that the oxygen content be kept below 0.03 c.c. per litre to prevent corrosion. The pH value of the feed water should be controlled within the range of 7.0 to 8.0 and should never be below 7.0. The total quantity of oil or grease should not exceed 7 p.p.m., and the total

soluble solids should not be greater than 150 p.p.m. The total solids (soluble plus suspended) should not exceed the total soluble solids by more than 5 per cent. The total alkalinity of the concentrated boiler water should not be greater than 20 per cent of the total soluble solids.

Because of these strict requirements, feedwater for the sulphur plant is obtained from the Girbotol plant reactivator reboilers condensate lines. A typical analysis of the feedwater is shown:

Alkalinity — 11 p.p.m. (Bicarbonate as $CaCO_3$)
Total hardness — 2 p.p.m. (Calcium)
Sulphate (as Na_2SO_4) — 7 p.p.m.
Chloride (as NaCl) — 7 p.p.m.
Salinity — 32 p.p.m. (Ca — 1, Na — 9, SO_4 — 5, Chloride — 4, Bicarbonate — 13).
pH at 80°F. = 7.8, Oxygen content — nil, oil content — 3.0 p.p.m. Sulphate-carbonate ratio — 0.94.

Since the Girbotol reactivator reboiler steam requirements are proportional to the gas flow through the Girbotol plant, the supply of feedwater condensate will increase in direct proportion to increasing loads in the sulphur plant. Hence, the feedwater becomes more readily available as the need for cooling the acid gas stream increases. Cooling water is also procured from the Girbotol plant MEA-water coolers, and the same supply-demand condition prevails as in the case of condensate return.

Utilities, Steam Generation and Requirements

Fuel gas is obtained from a scrubbed gas line in the vicinity of the sulphur plant. The gas reheater uses approximately 40 Mcf. per day of fuel gas. The feedwater system requires approximately 800 g.p.h. of condensate, and 145 g.p.m. of cooling water is pumped through the wash tower cooling coils. In addition, the plant uses 15 electric hp.

The various turbine drives, steam for sulphur line jacketing and rundown tank steam coils require only about 50 per cent of the total amount generated. Hence, the balance of about 4,300 lb. per hr. is piped back into the main boiler plant steam system, and serves as an additional source of steam energy for the plant as a whole.

Installed Units

Following are descriptions of the units, listed in the order in which they are situated in the process flow:

Reactor Furnace

This is of circular steel design having flat heads at each end. The shell is equipped with one burner having an 8 in. gas and 10 in. combustion air connection, in addition to an auxiliary burner for preheating. The furnace is internally refractory lined and insulated.

Waste Heat Boiler

This is made up of cast iron extended surface U-bend heating elements installed in a circular casing. The elements are connected by means of riser, return bend, and downcomer tubes to a steam and water drum providing natural circulation. The heating surface is arranged for one pass for gas flow vertically. Elements are arranged six wide with effective lengths of 5 ft. - 0 in. The total heating surface is 992 sq. ft.

The steam and water drum is 36 in. in diameter, of fusion welded construction. Flanged openings are provided for a steam outlet, feed inlet, safety valves and a continuous blowdown. Connections are also provided for a water column, chemical feed, gauge, and feedwater regulator. The drum has an internal distributing pipe for proper release of feedwater from the economizer, steam outlet dry pipe, riser steam and water separating baffles, wier plates for circulation control to the downcomer pipe, continuous blowdown collecting pipe and a chemical feed distributing pipe.

The boiler casing is of steel, 10 ft.-0 in. in diameter. The casing includes a thick steel tube sheet arranged for support of the elements at the drum and a thick steel tube sheet welded at the opposite end for support of the elements at the U-bend end. The casing is internally refractory lined and insulated.

Economizers

Each economizer is made up of cast iron extended surface U-bend elements, installed within a rectangular casing. The elements are connected by means of manifold headers and return bends. Each economizer is arranged 5 rows wide. Economizer No. 1 contains 1,200 sq. ft. of heating surface; economizer No. 2 contains 600 sq. ft. of heating surface. The casings are externally insulated.

Gas Reheater

This is of the vertical shell and tube type supported over a steel casing refractory lined surface arranged for natural gas firing. The reheater consists of carbon steel tubes installed in a steel shell. A stack is located on top of the shell. The total heating surface is 874 sq. ft. The flue gases pass through the tubes and acid gases pass through the shell countercurrent. The shell is externally insulated.

Converter

This is a steel plate shell. Provision is made for a 24 in. thick catalyst bed, supported on cast iron removable grid plates and stainless steel perforated plate. Thermocouple connections are provided for the measurement of the catalyst temperature. An opening is provided in the shell for a preheating burner. The converter is internally refractory lined and externally insulated.

Wash Towers

Each wash tower provides for the collection of all sulphur condensed in the respective portion of the system before transporting to the rundown tank. The towers are constructed of steel plate materials, consisting of casing, distributing plates arranged for introduction of the gas at the bottom and providing for separation of the liquid sulphur in the bottom section. This section is directly connected to a sump section on the top of which is installed an 8-hp. steam turbine drive for an immersed centrifugal sulphur pump.

Sulphur Rundown Tank

The reinforced concrete tank is capable of holding approximately 4 days' production of liquid sulphur. The bottom and sides of the tank are lined with common brick. The top is equipped with access openings, steam heating tubes, gauging rod and sulphur removal pump. Steam heating tubes of U-bend type are provided, complete with manifold headers.

Other Units

Other units include a 16 x 36 centrifugal blower driven by a 9 x 9 vertical steam engine. The blower and engine are directly connected through a flexible coupling. The gas preheating burners have a capacity of 1,000,000 B.t.u. per hour. Combustion air is provided at 16 ounces pressure through another centrifugal blower driven by a 5 hp., 440 volt, 3 phase, 60 cycle totally enclosed motor. A safety valve for the fuel gas line serves to shut off the burners in the event of power failure. Each burner includes

a gas pressure regulator and hand gas cocks.

The gas reheater is equipped with a 4 in. burner with a capacity of 2,200 cu. ft. per hr. of natural gas at 8 p.s.i.g. The burner includes a gas pilot, flame protection unit, pressure gauge, and a 1 in. gas cock. A gas pressure regulator and a safety valve are also provided.

The sulphur pumps are vertical centrifugal type, of cast iron, with spirally cut units for lubrication. Each pump is directly connected to a vertical steam turbine through a gear speed reducer. Pump capacity is 185 g.p.m. of liquid sulphur at 250°F. against a head differential of 40 ft. Pump speed is 1,720 r.p.m. and 8.5 hp.

Materials and Constructional Aspects

Refractory materials include No. 1 firebrick 4½ in. thick, insulating brick 9 in. thick and 1 in. of plastic insulation. The reactor furnace combustion chamber is lined with 2½ in. of castable refractory.

Insulation consists of 2 in. rockwool blanket, 1 in. thick plastic, ⅜ in. surface coating and the riser tubes are insulated with 85 per cent magnesia blocks 2 in. thick covered with ⅜ in. thick surface coating. The process equipment and process vessel insulation is covered with a ¼ in. of protective weatherproof material.

All steam and feedwater piping and the steam jacketed sulphur lines are insulated with 85 per cent magnesia of standard pipe covering. All piping is painted with distinguishing colours according to the "Standard Colour Code for Piping". Approximately 52 tons of structural steel was used in the boiler and furnaces building and the foundations for the building and units required more than 250 cu. yd. of concrete. Over five miles of reinforcing and temperature steel was positioned in these foundations and in the rundown tank. A special high temperature-resisting clay-high alumina cement concrete was poured onto the top of the converter base.

Conclusions

It has been found that there is a reasonable correspondence between the design data and actual operation. One notable difference has been experienced in the quantities of sulphur being condensed in the two wash towers. No. 1 Wash Tower was expected to produce the bulk of the sulphur (approximately 66 per cent). However, No. 2 Wash Tower has actually been producing the greater amount.

Design drawings and engineering specifications were at all times closely followed. A number of items which arose during the construction phase were discussed prior to the installation of any features which had not been covered by drawings or specifications.

The plant has incorporated into its construction a number of safety features. These include the start-stop push button switch actuating a rapid-closing valve on the acid gas line. An alarm system had been installed in both the boilerhouse and the generator building. In the event the sulphur plant operator is met with a major hazard, he has an opportunity of obtaining assistance from operators in nearby buildings. First aid equipment, air respirators and fire-fighting equipment have all been made available for emergencies.

It is considered that the plant is a relatively easy one to operate, despite what appears to be at first a complicated piping and instrumentation layout. Lines and valves painted distinctive colours, the gauge from the waste heat boiler steam drum to floor level, and other features, are both functional and attractive in appearance. During normal operations, the efficiency of the plant and production of elemental sulphur have exceeded expectations. ✓

THE PROPANE UNIT OF ROYALITE OIL COMPANY

(Continued from page 377)

pane, and uncondensed methane and ethane from the ethane condenser flow into the ethane reflux receiver, which is 3 ft. in diameter and 5½ ft. in length. The liquid ethane is recirculated as reflux to the top of the deethanizer tower.

The flow of reflux to the deethanizer is controlled by a flow recorder controller (FRC-3) which controls the steam to the reflux pumps. The pressure on the reflux accumulator is controlled by a pressure recorder controller (PRC-2) on the cold excess gas line.

The temperature of the reflux to the reflux accumulator is controlled by a temperature recorder controller (TRC-2) which operates by controlling the pressure of the propane refrigerant in the ethane condenser. The correct level of liquid propane is maintained by a liquid level controller (LLC-5) which operates on the inlet propane line.

The uncondensed gas, at a temperature of about 0° F., is used to cool the liquid propane product from the bottom of the deethanizer tower by counter-current flow in a fin tube heat exchanger. This gas is then used for fuel in the Madison boiler house.

A six-point temperature recorder is used to record the temperatures at the following points:

1. Inlet gas to the deethanizer	TC-1
2. Top tray of deethanizer tower	TC-2
3. Reflux at inlet	TC-3
4. Reboiler out	TC-4
5. Product to storage before cooling	TC-5
6. Product to storage after cooling	TC-6

Flows of fuel gas, regenerator gas, propane to storage, refrigerant to condenser, steam, etc., are all metered by conventional flow recorders. Suitable sampling points, temperature wells, pressure wells and orifice flanges have been installed to permit testing the efficiency of any individual unit as desired.

The liquid propane is run to storage in propane storage tanks approximately 9 ft. in diameter and 62 ft. long. Propane is shipped from these tanks in conventional liquid propane trucks, either to the terminal in Calgary, or directly to the purchaser's storage tanks.

Production at present is about 18,000 Imperial g.p.d. The product contains better than 95 per cent of propane by volume, is dry, and contains no hydrogen sulphide. ✓

Engineering Features of the

This paper is more than a mere description of one of Canada's most modern paper mills. It is noteworthy because it discusses at some length the engineering reasoning which underlay the general layout and the choice of equipment, very important factors in any project, which are less often mentioned than they should be in papers like this. Mr. Cooley presented this paper before the Vancouver Branch on January 21, 1953.

Some time ago the Canadian Western Lumber Company and the Pacific Mills amalgamated forces to form the Elk Falls Company, manufacturers of newsprint, to build a mill near Campbell River, B.C. The Campbell River area was chosen because it provides six requisites for paper making, namely, wood for pulp, plenty of good water, a large source of electric power, a sheltered area for storing logs, a place for the disposal of waste and facilities for shipping. The combination of Pacific Mills and Canadian Western is a logical one. The former provides experience in manufacture, purchasing, and sales connections; the latter provides logs suitable for pulp and the experience in logging to keep costs within economic limits.

To build a paper mill requires thorough investigation of the sources of wood supply for the future. The Elk Falls forest management license covers only logged off areas and no young trees may be taken from these lands until 1974. Thereafter the lands will produce 15 million cubic feet of timber annually from 380,000 acres on a perpetual sustained yield basis. Until 1974, when timber from the license becomes available, the plant will operate on logging and sawmill waste from the Canadian Western Lumber Company and its affiliates

Woodmill exterior. Hog at right receives refuse from woodmill. Log haul may be seen behind hog building.

Site

Having determined the best possible site, the land was purchased for the mill itself and negotiations made for areas suitable for the water supply system. This got complicated at times, as land had to be bought from private individuals and traded for other more suitable land owned by the provincial Park Commission; the Park Commission cannot sell real estate, but it can trade.

The area was cleared of brush and trees and test holes and test piles were driven. Dr. Karl Terzaghi was retained to advise H. A. Simons, the general consulting engineer, as to the best areas for heavy buildings.

Building Plan

Locations of buildings are decided partly by soil conditions, but continuous streamlined flow of material also plays an important role. The mill must take logs from the water, remove their bark, reduce them into suitable lengths and diameters, grind them into wood pulp, screen this pulp, blend sulphite stock into the groundwood stock and make 100,000 tons of paper annually from the combination. In addition, it was to incorporate the latest of equipment and design to eliminate manual labour as far as possible. Economically, it seemed most feasible to buy sulphite stock, rather than make it in the new mill, so facilities had to be provided to receive the sulphite. A source of

Elk Falls Paper Mill

by

E. C. Cooley

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steam was required and also facilities for construction and maintenance of the plant.

Timing dictated that paper and pulp making facilities get attention first, because they require the most engineering and construction; the woodmill could be left till later. To get on with the pulp and paper end, docks and handling facilities were needed, and, prior to building docks, dredging the harbor would be required. Two considerations resulted in building tracks and a terminal for railroad cars. First and most important was the money saving from shipping construction materials directly into the site rather than transferring them from cars into coastwise craft at Vancouver; time required to reload could be important, too. Second was the fact that the railway spur would provide an inlet for materials and an outlet for paper in case of tie-ups in shipping after the plant was operating.

After much study, the building plan ended with the wood blocks from the wood mill entering the groundwood mill at the south end and proceeding northward where they are ground into pulp. If more production is required, the grinding department can be extended southward from the wood entry. The pulp continues northward to be screened. After screening, the pulp slurry is thickened, bleached, washed and stored in tanks and chests. The heavy chests are in the basement and the thickners, washers, and bleaching require two floors, consequently three floors result. If expansion is required, the building can be extended eastward.

Next the pulp continues northward to a paper machine whose total length is approximately 400 feet. Room for expansion here is also left on the east side. The paper after being wrapped travels northward and is stored in a warehouse large enough to hold a ship load and some to spare to cover unpredictables, such as weather. From there the product is trucked westward to the main shipping dock. If more warehouse space becomes necessary the building can be lengthened toward the east and widened toward the north.

The building width is sufficient to accommodate the paper machine, the drive and operating spaces both back and front. The front operating space is wide so that the components of the machine may be easily removed and replaced, and this space is common to a future machine placed parallel to the present one.

The total machine room width suits the pulp screening layout, so the outside building walls of these two rooms are continuous. More width was needed for the grinder room to provide room for the maintenance of the grinders and their 5,500 hp. motors, so one wall was jogged out. In the wrapping department the same thinking applied; here also the building was widened to accommodate the wrappers and the nearby sulfite repulping equipment. Some thought was given to putting the sulfite equipment near the other pulp equipment, but sulfite is received in bales or rolls and transported by truck. It is less expensive to move material through a pipe than to transport it mechanically.

Within reasonable limits the ground floor elevations of the buildings are as close as possible to dock level to minimize handling problems. The basement floors of the main buildings are 12 ft. 6 in. above extreme high tide. This meant some excavation of overburden. No bed rock is present and the best ground will support two tons per sq. ft. safely. The buildings are located to take advantage of the best foundation conditions, even though this means placing them 75 ft. further from the water than desired. The terrain permits most buildings to be oriented truly north and south.

The boiler house serves the paper machine mainly, hence it is located adjacent to the west side of the machine room with a passageway and space for expansion between.

Engineering Considerations in Building Details

In planning a building, what materials shall be used? Concrete gives long service, but is rather more expensive than some other materials, is difficult to alter and is heavy. Timber framing is less expensive but not suitable for heavy machinery. Steel framing gives permanence and allows for changes,

but does not decrease the first cost; it is also less rigid than concrete. However, is relatively light. In these days of long deliveries concrete has one real advantage: its components are generally quickly available.

Concrete was chosen for the pulp processing and paper making buildings. The boiler house has a steel frame, first, because the boiler supports must be steel, second, additions and changes here are certain, third, the boiler supports can be incorporated into the building and last, concrete here would be subjected to undesirable temperature changes. The boiler house roof is light weight precast concrete slabs. It is light and fireproof and reasonable in cost. This construction permitted the omission of $30,000 worth of sprinklers.

The woodmill building has steel framing, plywood siding, concrete floors and tongue-and-groove wood roof decking, a combination that gives stability, but is light enough to be reasonably supported on piling. The steel framing ties in well with the steel conveyors, decks, and log handling equipment.

For a choice of the materials for the paper warehouse, three things had to be borne in mind; first, economy; second, speed, because the warehouse would be needed for storage while building the rest of the mill, and, third, a space under roof unencumbered by columns and posts. This building is 87 ft. wide and 480 ft. long, of timber columns and trusses using lumber roof decking and plywood siding The floor is gravel covered with 3 in. of asphaltic concrete. There is one slight weakness in the floor; oil and grease tend to dissolve the asphalt, but, it is easily patched and a concrete floor would be subject to expansion cracks and joints.

Some observations about the buildings in general are in order. Concrete floor slopes where there may be considerable water are made $\frac{3}{8}$ in. to the foot, down to $\frac{1}{8}$ in. to the foot where little water is expected. This means rather extensive trenches to avoid variations in floor elevations above 10 in., but there are no puddles of standing water.

All floor trenches are sloped to 6 in. per 100 ft. with their covers uniformly 12 ft. 6 in. above high tide. Trenches are double-size for the predicted flows and room is left for tile lining in case chemicals should attack the concrete.

Expansion joints are built into the concrete buildings at approximately 220 ft. intervals, with ribbons of stainless steel to make the joints leakproof.

Light weight concrete in thin sections is used in certain places where concrete is needed, but forming is difficult and heavy loading objectionable. For instance, the office and the testing station in the boiler house are floored with light weight concrete. Its cost in place was slightly less than concrete, as the slabs were precast and quickly assembled in the field.

Cemented asbestos board is used on the walls of the boiler house, making a permanent, light and fireproof siding, quickly assembled in the field.

Where extensions and additions to concrete buildings are anticipated the walls are of readily removable material such as plywood or concrete blocks, and the footings in these regions are designed to support future loads.

No footings are placed on fill, and none are on solid ground sloping more than 1 to 3. If one footing had to be lowered, then adjacent footings were also lowered to maintain this 1 to 3 slope and thus avoid danger of settlement. In some locations a three-sack concrete mix was used to build up the solid ground to a reasonable footing level.

Floors are 18 ft. apart, providing room for beams and pipes overhead. This storey height is increased where height is needed for barometric legs, overhead conveyors, etc.

Concrete chests and tanks are lined with tile having a smooth glazed surface. Groundwood stock is subject to slime growth and the action of micro-organisms. Small pockets, cracks and crannies inherent in concrete surfaces promote such troubles. Tile surfaces inhibit slime growth and make light work of cleaning.

Engineering Features in Process Equipment

What types of equipment should be selected and where should it be obtained ? The answer involves a number of factors. For instance, what is the experience at other mills ? How do prices compare ? Who will give the best service ? Most important, who can make prompt delivery ?

Other things being equal, it is good policy to buy from the local supplier. It is much easier to expedite his services than someone's 2,500 miles away, when help in a hurry is needed. Experience shows that faulty design and workmanship in equipment is likely to be the biggest single problem in getting operations started.

Proper placement of equipment in a new plant comes from a study of the equipment components, from advice from the supplier and from the use of plenty of good common sense. Recently a large automatic steam valve could not be disassembled because a nearby 8-in. pipe was in the way; it was presumed the gate would be removed from the top, instead it had to be taken out the bottom.

Plenty of room is the watchword in locating machinery — space to

Paper machine. Bird screens on extreme left.

walk around, clean around, work around it, plus additional room to disassemble it. Don't take the certified foundation plan and assume that it shows everything; a couple of pipes or a guard may be found sticking out where they are least wanted. Layout after layout was made of the Elk Falls plant and revised most frequently to provide more space around equipment. What is plenty of room now could be barely sufficient when a few pumps, pipes, etc., are added as time goes on.

Much to the consternation of the piping draftsmen, Elk Falls insisted on 10 ft. clearance above the floor under pipes. Now fork trucks can barge around the buildings almost anywhere without getting a 2,000 gpm. shower bath.

Considerations in Designing Material Handling Equipment

The design of material handling equipment is largely in the hands of the user as contrasted to that of process equipment obtained from a supplier. Likewise, the success or failure of conveyors, piping, etc., depends on the ingenuity of the user's designing engineers. Skill here is often the distinction between a good plant and a bad one.

The biggest handling problem at Elk Falls is that of taking wood blocks or short logs (4 ft. maximum length) from the woodmill to the groundwood department, a distance of some 1,100 ft. In the east, cable and button conveyors are commonly used; flumes have been used in the west. In this size either is expensive. The conveyor would involve a large amount of maintenance; a flume was a problem because water must run down hill and the Elk Falls plant site required an uphill run.

A flume was adopted. The trough is elevated above the roads, and four feet of fall is provided from end to end, with a sump for collecting, screening and recirculating the water. The trough is fabricated of ¼-in. steel plate, 9 ft. wide at the top, 2 ft. 8 in. wide across the flat bottom and 3 ft. 2 in. deep. The trapezoidal shape tends to maintain velocity at low flows. Supports for the trough consist of timber bents at 40-ft. centers connected by 40-ft. queen-post trusses, giving an economical construction with considerable eye appeal.

The flume requires about 120 hp. and provides a readily tapped reservoir of wood, as it will store up to 50 cords of wood and thus allow the woodmill to shut down for four to five hours twice daily. There seems to be practically no limit to its conveying capacity.

A good deal of thought went into designing a means of holding the wood back at the lower end of the flume, but allowing the water to pass. The solution involves six spike rolls spaced a short distance apart, with variable speed control. The water passes between the rolls to the sump and the wood remains on the spikes until it is released by rotating the rolls.

The wood blocks pass out the end of the flume and drop onto a chain conveyor. The conveyor wearing surface was lined with rubber. This has not been satisfactory, principally because the rubber strips do not stay in place. Had they been vulcanized or cemented down, they would no doubt have given better service. The advantages of rubber lining are less chain wear, less noisy operation and power saving.

Leaving this conveyor the wood blocks or short logs pass over a set of 15 straightening rolls set in the bottom of a tapering trough. Each roll is covered with short spikes. The rolls are progressively driven faster and faster so that when the log leaves the straightening section, it is thrown endwise against a bumper. Dropping straight down it is moved laterally by a bed of cross chains onto another series of roller chains that pass slowly above and between the wood grinder hoppers. The whole purpose of this combination of conveyors is to reduce the hard work of hand feeding the grinders. The roller chains permit the wood to be easily drawn off at the feeder chutes. Two men handle about 60 cords of wood each 8-hour shift into six grinders. One man operates the flume and the conveyors leading up to the roller top section.

There are four individual sections of roller top conveyors placed end to end between the grinders to allow more flexibility and less hazard in the operation. The sections overlap each other to prevent dead spots where one stops and the other starts. Here, as well as throughout other parts of the plant, idler sheaves are without teeth, thus allowing parallel chains to wear unequally, as they will, without setting up internal strains in the conveyor unit.

Hogged fuel is carried on 36-in. belt conveyors, with hitch sheaves at points where the dribble of carryover will fall into a chute or bin and not become a nuisance to be shovelled up. Tight floors under the conveyors catch the carryover and do not allow it to scatter.

A word about pumps: practically every supplier of pumps has a good product, and all have accumulated considerable experience in pumping paper pulp. One will underbid the others. One may go over plantwide pumping problems in a conscientious effort to give the best possible layout. The buyer cannot afford to pass up any possibility that will raise his plant out of the indifferent class in such an important matter as pumps. For instance, at Elk Falls there are 50 pumps on pulp and on water, having a combined capacity

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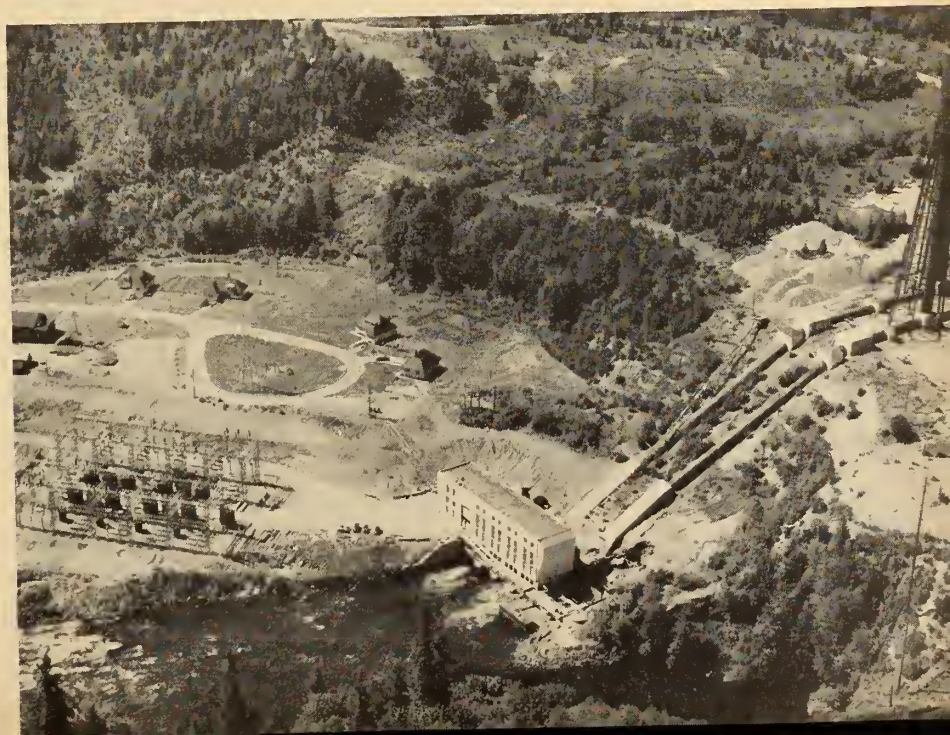
British Columbia Power Commission's John Hart plant on Campbell River.



Water supply pump station, pipe line and surge tank in distance.

of 100,000 gpm. It follows then that the company that promises most satisfactory service is the one selling the pumps.

In the matter of vacuum pumps a different situation arose. One supplier offered positive displacement pumps using less power and selling for less than competitive water ring pumps. These are harder to maintain, but even that quality is hard to measure. Balancing power and first cost against the maintenance factor, the positive displacement type was chosen.

A word about piping, including fittings and valves. Plain wood, stainless steel, transite, iron and treated wood pipe are all common in paper mills. Here again the cost factor arises, also questions of resistance to corrosion, resistance to shock and availability. Treated wood pipe was chosen at Elk Falls because it is resistant to paper mill chemicals, resistant to decay (groundwood induces swift decay in wood pipe), resistant to shock, priced reasonably and readily available. The type used was assembled in the field from creosoted wood staves and individual bands. The staves are spliced end to end, making possible long straight runs of pipe without resorting to fittings. Fittings on pulp and water service are stainless steel (Type 304) and valves on stock lines are also stainless steel; resistance to corrosion is the main consideration. This quality was sacrificed on water lines in favour of cast iron valves at a substantial cost saving.

Routing of pipe lines is a considerable study in itself, especially when five or six 12-in. lines have to be squeezed between the overhead beams and the walls and still kept 10 ft. off the floor. However, 18-ft. ceiling heights nearly always give enough room. Vacuum pumps are connected to a common header, blanked off at proper points. Removing the blanks allows the transfer of load from one pump to another.

The fresh water supply comprises a pumping station on Campbell River, housing three vertical turbine-type pumps discharging through 2½ miles of 36 in. wood stave pipe, untreated, to storage tanks on a hill above the mill site. A surge tank is located at the high point in this pipe line to absorb the hydraulic shocks of starting and stopping flow. Wood staves will last a good many years here, where they are constantly wet and in contact with no corrosive elements, even though they are untreated.

Steam Balance

It is well to point out that separate sources of power are desirable for a paper machine. Then in case of the failure of the main source, the machine will continue to run and thus clear itself of pulp and paper. Otherwise, the whole unit stops at once with resulting damage from the stock flooding everything.

To accomplish this and also effect a saving in power costs, steam drives the paper machine. Steam at 600 p.s.i. drives a 2,000 hp. turbine which exhausts 35-p.s.i., steam which is used in the paper dryers. Instead of the usual 12,000 B.t.u./hp. hr., the turbine heat consumption is about 3,500 B.t.u./hp. hr., so that it is cheaper than hydro electric costs. Turbines driving fans and pumps also exhaust to the paper dryers in sufficient quantity to supply their demand, effecting both reliability and savings.

Engineering in the Electrical Supply

The John Hart hydro electric plant of the B.C. Power Commission is situated on Campbell River about 2½ miles away. Electric energy at 138 kv. is supplied to a substation adjacent to the Elk Falls mill site. There it is transformed to 13.8 kv. and fed into the mill through underground cables, the most hazard-free and reliable method. Duplicate feeders are provided, either capable of supplying the full mill requirements. Three 5,500 hp. synchronous motors drive six grinders at 257 m.p.h. These motors tend to correct the low power factor brought about by the many small squirrel cage motors. Automatic load control is installed on the three motors to maintain constant load during the reloading of grinder pockets; i.e., three pockets absorb greater power while the fourth is loading.

Other underground cables distribute 13.8 kv. current to strategically located transformers, where the voltage is reduced to 2,300 and to 550. The larger motors, in the 300 hp. category, utilize the former voltage, while the latter is employed in motors of 5 hp. and up. The entire power supply and distribution system was designed to permit easy expansion without sacrificing existing facilities.

Woodmill Engineering Features

The mill is designed to handle small logs, such as are recovered from sawmill logging operations, and also handle some large logs.

The log haul draws logs out of salt water and delivers them to the second story of the woodmill. It has manganese steel chain, wear strips, and chairs; even the driven sprocket teeth are manganese. Most of the sprocket is mild steel, but it is built up so that the main wear is taken on the manganese steel rims. Since grinder production is dependent on properly filled pockets, the wood blocks should fill the pockets end to end, so on the log haul the logs are cut to lengths that are multiples of the proper wood block size. A swing saw does the cutting. To take a random length log and cut it in even multiples may sound complicated, but the operator need only consult marks on the side of the chain trough, make a rapid mental decision, then spot the log.

Logs are debarked using water pressure. To the mill man a successful barker is one that removes the bark and runs faithfully night and day. He is not interested in any other refinements. The barker at Elk Falls has further refinements, but it admirably fulfils the operator's wants. It utilizes rotating nozzles above and below the log at 1,500 p.s.i. The barker pump in the boiler house is steam driven by a variable speed turbine, which exhausts to the paper dryers. Remote control stops the turbine in an emergency.

The barked logs are cut to 49-in. lengths on a slasher employing submerged circular saws. Dogs on log lugger chains move the logs laterally through the saws. Submerged saws permit much better operator vision and a simpler, more sturdy framework. Ahead of the slasher and to one side is a log indexing mechanism built of a vertical deck of chains that travel at an angle to the normal log movement. This "aligner" pushes the logs endwise so that they are sawed at the proper places.

Trash from the woodmill is caught in four chain conveyors and discharged to a fifth which takes it to the hogger. All of these except the two under the barker are "upside down conveyors", that is, the material is carried on the lower strand, while the chain returns above the loaded section. Advantages are a totally clean conveyor with no dribbles off the ends, more headroom in the basement, and that sprockets and drives are readily accessible from the operating floor above.

The wood hog had to be set outside the woodmill building so that proper drops might be incorporated where one conveyor discharges into another. This is important where long sticks must be handled, because if the transfer points are not properly made the trash will surely hang up.

Here again the final design came only after a struggle; some 56 separate layouts were made of equipment placement in the woodmill, and the end came partly because it was getting too late to change. The result is an operation that will convert rough logs into clean, bright grinder blocks at the rate of 6,000 or 7,000 ft./hr., using only two men who rarely do more than push buttons.

The foremost thought in planning the mill was to produce newsprint at a profit using the fewest people doing the least hard work. In reaching that objective, the designers seem to have been fairly successful. ✓

Government Co-operation in Shipbuilding

Over the years, Canada has built up a huge and valuable plant for the building and repairing of ships. A modern shipyard, equipped to build and repair a variety of high quality vessels, includes dry docks or marine railways, building berths, fitting-out wharves and powerful cranes for handling equipment and materials. Integrated with these are foundries and shops with their miscellany of machinery, tools and other equipment.

This complexity of facilities, multiplied many times on the Atlantic and Pacific Coasts, the St. Lawrence and the Great Lakes, is valuable beyond the terms of the many millions invested in it by industry and Government. And like the workers' skills, the yards' facilities should not be allowed to deteriorate through idleness after the present defence program has tapered off. Only by continuity of employment can they be kept at the level of efficiency that Canada needs.

The shipbuilding industry realizes it must stand on its own feet in the competitive commercial field. But it is aware too, that Government co-operation is essential, and has been vital up to now in keeping the post-war industry healthy.

The formation of the Canadian Maritime Commission has been a means of helping the industry, by keeping its problems before the Government and recommending development policies. The Ship Replacement Plan, under which post-war purchasers of Government-built vessels may sell them abroad, has resulted in making funds available for the replacement or modernization of Canadian shipping in Canadian yards. The 1949 Vessel Construction Assistance Act has further encouraged building in Canada through tax concessions on depreciation.

Still another help has been the 1950 amendment to the Canada Shipping Act restricting the importation of over-age and obsolescent vessels. In addition, the Government has set up an inter-departmental committee of officials to look into the question of reserving our coastal shipping trade to Canadian-built and Canadian-registered vessels. Reservations of this trade would be a prime means of extending to Canadian shipbuilding protection which is afforded to other industries.

From "Newsletters" of Canadian Shipbuilding and Ship Repairing Association.

Air Trooping Is Expanding

One of the most significant features of the cold war as far as British aviation is concerned has been the very great expansion of air trooping. As the newer types of aircraft become available, particularly the jet and turboprop transports, the Services plan to carry even more troops and their equipment by air.

The following statistics point up the growth so far: In 1950-51, trooping flights covered some 40,000 passenger miles. A year later, trooping traffic had increased tenfold, to 4 million miles. In 1951-52, 22½ per cent of all troops sent abroad went by air. In 1952-53, exclusive of N.W. Europe, this had gone up to 50 per cent. About 85 per cent of all trooping to the Middle East is now done by air. Since air trooping started in 1951, a total of over 6½ million miles has been flown.

For the future, Government and Air Ministry planners believe that the new Vickers *1000* jet transport coming along will revolutionize air trooping because it can carry 120 men and their equipment over very long ranges at something like 10 miles a minute. They have also calculated that twelve Bristol *Britannia* turboprop troopers, with operating reserves, could cover all trooping movements to the Middle East and Far East. The same number could also cover all the trooping between the Far East and the Middle East.

Air trooping is being extended along as many routes as possible for two main reasons—first because it greatly increases air mobility and reduces the number of troops blocked unproductively at sea in the pipeline.

Air trooping is already cheaper in direct cost on many routes, and it will eventually become cheaper on all practicable routes.

R.A.F. Transport Command, the two Airline Corporations and the British Independent Charter Operators all have their part to play, but Civil Aviation carries the main load and plans have been made for taking it over as a transport arm in an emergency.

Transport Command's future work will centre round the two new types of aircraft now coming along. One, the Vickers jet, is for fast long-range strategic work, carrying men and supplies quickly and economically to trouble-spots.

For tactical work, where it is necessary to drop men and supplies from the air, or land them on rough, unprepared strips near the battle, the Command will use the big *Beverley* freighter. This can carry some 20 tons of men and supplies over about 1,100 miles.

Capacity, Products, Future of the Canadian Steel Industry

by

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A paper presented to the Toronto Branch of The Engineering Institute of Canada on October 2, 1952.

"As steel goes so goes the nation" is an old saying that is becoming truer every day. The consumption of steel per capita is now one of the best yardsticks of a nation's standard of living and industrial strength. Its steel production is certainly the yardstick of its international strength. Citizens of the United States for example, now use more steel (1,360 pounds per year) than any other commodity except water. Although consumption of steel per capita in Canada is considerably less than this (approximately half), it is nevertheless one of the highest in the world, and is increasing more rapidly than in any other nation in the world.

Before we can properly discuss any national industry we must first have a look at the country in which it operates, for it is the country which largely determines the size and character of its industry. This is particularly true of the steel industry which, because of the low unit price of its product (about 4 cents per pound), and the tremendous quantity of raw materials required, must operate close to both its market and its raw materials in order to survive.

Contrary to popular belief, iron ore is the least important. A steel industry can afford to be further from its source of iron ore than it can from its metallurgical coal, limestone, steel scrap and potential market. This is only relative, however, and unless the iron ore can be shipped *economically*, or the sum total of all these transportation costs add up to the right figure, a stable, competitive steel industry cannot exist. There are other factors, of course, most important of which is the size and product mix of the market.

How does Canada "stack up" for the establishment and continued success of a sufficiently large and integrated steel industry?

The Fathers of Confederation were quick to realize the dangers involved in the unnatural economy that would prevail in a country such as ours. Trade routes were more naturally north and south, and the growing power south of the border, spurred on by the success of the Civil War, could exploit this weakness and ultimately annex at least those territories west of Ontario. Confederation was the result of their fears, and one of the main inducements to bring these territories into Confederation was the promise of an east-west railroad. So, to this unnatural, certainly uneconomic decision, necessary though it was for national survival, the steel industry in Canada owes its real beginning.

Listing the obstacles facing the growth of Canada's steel industry, the author presents statistics to show its remarkable growth of 235 per cent by the end of 1953 as compared to prewar. No other country is expanding its steel mills so much or so fast.

Outlining the products our mills can supply, he states his belief that present expansion, when completed, will catch up with our needs, and that future additions should be tied to population increase. In conclusion, he tells why we cannot process all our iron ore, and shows there is room for only a modest capacity increase in British Columbia at present.

Ore Not Well Distributed

Canada presents serious problems relative to raw materials. When you consider that well over four tons of basic raw materials are required to produce a ton of finished steel, you realize just how important it is for a steel industry to have these raw materials close at hand.

Limestone presents no particular problem, since it can be found in suitable quantities right across Canada. Iron ore, although existing in sufficient quantity to supply Canada's need for any degree of expansion likely to occur, as well as allow considerable quantity for export, is not so well distributed.

In the east we have the Wabana deposits in Newfoundland and the new Labrador fields. For economic reasons these can only be expected to serve eastern Canada, the eastern seaboard of the U.S.A. and overseas markets. The completion of the proposed St. Lawrence Seaway would

eventually result in Labrador ore becoming an economic source of supply for the steel industry surrounding the Great Lakes. Wabana ore, although economic for Dosco, must depend on overseas markets if mine costs are to be kept in line. The high silicon and phosphorus content of this ore makes it unattractive to U.S. mills. Steep Rock, Algoma and the Grenville area will naturally serve the Great Lakes' pool, along with the American deposits in Northern Michigan, Wisconsin and Minnesota.

There are no known deposits of iron ore in the Prairie Provinces. In British Columbia, however, there are some relatively small magnetite deposits along the coast, sufficient to support a small steel industry and leave a little for export. Other sources in Canada include the large iron sulphide tailings of Consolidated Mining and Smelting Company, International Nickel and Noranda, which, properly treated, could produce large quantities of iron suitable for steel making. The Allard Lake deposits of ilmenite, which supply Quebec Iron and Titanium Company, is another large potential source of iron. With an estimated ore reserve of almost 6 billion long tons, with promise of still more to come, Canada has obviously little to worry about.

Coal and Scrap Limitations

In regard to metallurgical coal, Canada's position is not so fortunate, and no steel industry operating blast furnaces can afford to be far from this important raw material. There appears to be an adequate supply in Nova Scotia to serve the needs of Dosco for many years to come. Unfortunately the only other known deposits are located on the eastern flank of the Rocky Mountains, and a very limited supply on the Pacific Coast. These deposits certainly cannot compete with metallurgical coal from the Appalachian area now supplying the central Canadian steel industry with practically all their coal.

There is little likelihood that the steel industry will ever be able to economically use either eastern or western metallurgical coking coals. From the standpoint of quantity alone, however, our coal reserves are enormous, though not too well distributed. Refinements in steel making practices, such as low shaft blast furnace, electric smelter, etc., would put a lot more of these coal reserves under the classification of a metallurgical coal, or else reduce the

Table I—Production of Iron Ore by Countries*

(Net Tons)

	Country	1939	1951	Increase %
1	United States	57,939,538	130,401,600	125
2	Russia	30,870,000	49,000,000	59
3	France	36,362,672	38,810,880	7
4	Sweden	15,197,633	17,759,155	17
5	United Kingdom	16,223,872	16,404,640	1
6	Germany	13,279,048	14,241,920†	7
7	Luxemburg	6,455,069	6,239,018	−3
8	Canada	1,696,078‡	4,736,190	179
9	Chile	1,792,880	3,386,880	89
10	India	3,545,920	3,306,900	−7

* Annual Statistic Report A.I.S.I. 1951.
† American, British and French Zones.
‡ Newfoundland included.

Table II—Production of Pig Iron and Ferroalloys by Countries*

(Net Tons)

	Country	1939	1951	Increase %
1	United States	35,677,097	72,448,534	103
2	Russia	16,800,000	23,000,000	37
3	Germany	17,192,000	11,791,303†	−31
4	United Kingdom	8,937,376	10,829,056	21
5	France	8,134,974	9,638,511	18
6	Belgium	3,373,038	5,346,155	58
7	Japan	3,650,818	3,514,132	−4
8	Luxemburg	2,023,823	3,479,961	72
9	Canada	930,122	2,753,973	196
10	Saar	2,089,961	2,611,349	25

* Annual Statistic Report A.I.S.I. 1951.
† American, British and French Zones.

Table III—Production of Steel by Countries*

(Net Tons)

	Country	1939	1951	Increase %
1	United States	52,798,714	105,199,848	99
2	Russia	20,719,000	31,300,000	51
3	United Kingdom	14,807,856	17,515,120	18
4	Germany	24,807,261	14,887,664†	−40
5	France	8,756,671	10,837,814	24
6	Japan	7,381,000	7,012,833	−5
7	Belgium	3,333,355	5,611,809	68
8	Czechoslovakia	2,668,668	3,650,818	37
9	Canada	1,509,480	3,508,155	132
10	Luxemburg	1,944,457	3,391,777	74

* Annual Statistic Report A.I.S.I. 1951.
† American, British and French Zones.

Table IV—Estimated Capacity for 1953 by Provinces

(Net Tons x 1,000)

Province	Iron Ore*	Pig Iron	Steel
Newfoundland	2,500	—	—
Nova Scotia	—	530	823.0
Quebec	—	—	270.7
Ontario	2,800	2,978	3,850.0
Manitoba	—	—	66.7
Alberta	—	—	2.5
British Columbia	200	—	65.0
Total	5,500	3,508	5,077.9

* W. M. Goodwin — C.I.M.M. Bul. May 1952, p. 267.

dependence of the steel industry upon this raw material.

Steel scrap is required in large quantities to feed the hungry open hearth or electric furnaces. Even the blast furnaces and cupolas use their share of this scarce commodity. It is more often than not the shortage of steel scrap that both limits the capacity of a national steel industry, and speeds national disaster when engaged in international conflict. As someone said, the steel industry depends on a pile of junk. In 1951 Canada's steel and iron industry used 2.7 million tons of scrap. In 1954, close to 4 million tons of scrap will be required if Canada's recent $160 million steel expansion program is to result in more steel for your use. Let us hope that this scrap is found and sent on its way to the steel mills.

So it is seen that the steel industry in Canada faces many problems. Not the least of these is the ever present threat of the gargantuan steel industry to the south, with which it must at all times be competitive. Our rolling mills, because of a considerably smaller market and great product mix, have had to roll many different sizes and shapes on one mill and still be able to compete with mills producing only a narrow range of sizes or shapes, at a consequent higher production rate and lower cost.

Our Steel Production Record

How has the steel industry in Canada made out? The tables described below indicate Canada's relative position in regard to the production of iron ore, pig iron and steel, when compared to the ten largest producing countries of these commodities in the world. Figures for 1939 and 1951 are shown, as well as the percentage increase between these two periods.

Table I shows that Canada, at the end of 1951, was the eighth largest producing country of iron ore, showing an increase over 1939 of 179 per cent, considerably greater than that of any other country. We haven't produced a ton of ore from Labrador yet, and Steep Rock is really just beginning to produce. By 1960 Canada should be close to fourth place, with much of this production going into export.

Table II shows the production of pig iron and ferroalloys. In 1951 Canada was in ninth place with production almost three times that of 1939. When the new blast furnaces presently being built by Algoma and Stelco are "blown in" along with the addition of an electric smelter on the west coast, Canada should be close to seventh place in the production of pig iron and ferroalloys.

Table V—Canada's Production of Hot Rolled Iron and Steel Products*

(Net Tons)

Products	1951
Rails	257,244
Structural Shapes — Heavy	134,743
Structural Shapes — Light	93,349
Plates, Sheets and Strip	1,058,751
Bars — Merchant	522,058
Bars — Concrete	154,024
Wire Rods	318,266
All others	316,390
Total	2,854,825

* Annual Statistic Report A.I.S.I. 1951.

Table III, giving the production of steel by countries, shows Canada in ninth place again with a production of 3.5 million tons in 1951, representing an increase over 1939 of 132 per cent. Again this per cent increase is considerably greater than any other country, a fact not generally realized by Canadians.

By the time the additional million tons of steel soon to come from the two 300-ton open hearth furnaces being built at Algoma and the four 275-ton furnaces almost completed at Stelco, are added to the list, Canada will certainly be in eighth place. Add to this the two new open hearth furnaces presently being planned by Dosco, as well as proposed increases in steel capacity in Manitoba, Alberta and British Columbia, and Canada will be the sixth largest producer.

Table IV shows the estimated capacity for 1953 by provinces, for iron ore, pig iron and steel. The estimated 5 million tons of steel for 1953 is an increase of 1½ million tons over 1951, which was equivalent to Canada's total production in 1939. This represents a total percentage increase over 1939 of almost 235 per cent. No other country is expanding as fast or as much.

The products of this industry are so numerous and diversified that it would be impossible to list them here. Table V is an attempt to summarize these for you, while Table VI shows the major imports. It will be noted that the largest item of import is plates, sheet and strip, representing 45 per cent of our imports for 1951. Canada now has the last word in plate, and hot and cold strip mills, considerably more modern in fact than most of the mills from which these imports came.

Smaller Imports

With the increased ingot capacity soon to become available, and since these strip mills have an almost insatiable appetite, this item of import is due for a decrease. In brief, the Canadian steel industry can supply practically any steel product that one might wish. Off standard sizes and shapes, however, should be ordered in sufficient quantity for economic rolling.

In the case of blooms, billets and bars there is practically no limitation in the capability of Canadian mills to produce. All but the largest structural sections can be rolled. Plates, sheets and strip are, generally speaking, only limited in their width — 98 in. maximum for plate, 48 in. maximum for sheets and strip. There is no limitation in wire products or such related products as nuts, bolts, welding wire, etc. The only major limitation on pipe is the diameter, 16 in. being the present maximum. From the standpoint of grades produced, as well as both section and steel quality, the Canadian steel industry can equal any other steel industry in the world, and in many cases surpass it.

There is another group of products coming from the steel industry that all but the chemical industry is inclined to gloss over. I refer, of course, to those important chemicals produced in our by-product coke ovens. Considerable expansion in coke ovens has taken place in plants of all the major steel producers. The primary purpose of this is to produce metallurgical coke for our blast furnaces. It has also, however, due to the important by-products produced, resulted in expanded facilities in Canada for the production of chemicals.

Benzol, for example, is one of the most important industrial chemicals, and is used in a countless number of organic syntheses. Coal tar dyes, synthetic rubber, poly-

trene, aviation gasoline, dichlorobenzene, phenol, and plastics such as nylon and alkyd resins are only some of the products derived from pure benzol.

Toluol, another product, is used for the production of TNT and as a solvent in the lacquer industry. Naphthalene, one of the most versatile and important industrial organic chemicals, has innumerable uses besides moth balls. Pyridene is a basic material for many industrial and medicinal compounds. Ammoniumsulphate, creosote, xylol, tar, to say nothing of fuel gas, add to the list of the amazing number of products coming from our by-product coke ovens. The more iron and steel we produce, the more these chemicals will become available for the expanding chemical industry in Canada.

No More Expansion Needed for Present

What about the future of the steel industry in Canada? You don't need to be told that Canada is going places, mostly under her own steam. The United States has $7.5 billion invested in Canada and, although this has an influence greater than the amount would indicate, what many Canadians do not realize is that over 80 per cent of the cost of our industrial expansion since the war has been supplied by Canadians. The total amount of this investment which has helped us to almost double our gross national output, is over $20 billion.

This industrial expansion, however, will result in Canada being more dependent than ever on her exports, one-third of her income presently coming from this source. Even though we are now the world's third largest trader, we shouldn't lose sight of the fact that due to our small population and almost complete dependence on these world markets, the expansion of the steel industry will only be economically sound if based on home consumption. With the United States gigantic steel production beginning to overhaul demand, and with the ever growing tendency for small countries with no steelmaking traditions behind them, to establish their own steel industries, no other approach can be taken.

To have "a steel industry of our own" has become as much a symptom of national pride as of economic feasibility. This means that the export market for steel is being considerably reduced. The steel industry in Canada must prepare itself to meet any strong competition from those countries that are traditionally large exporters of steel products. By installing new and modern mills, modernizing present equipment and technological advances in the science of making and rolling steel, the Canadian steel industry is fully capable of meeting this competition.

What about future expansion? There is no question in my mind that present expansion, now completed or in progress, is adequate. Any future expansion should be tied closely to the population rise. If, as some people predict, our population should double in the next twenty-five years, steel production in Canada will probably triple.

Canada Can't Refine All Her Ore

Before concluding, two subjects should be mentioned which have provided much talk and publicity of late, and about which there is some misconception. One is the development and processing of all iron ore in Canada by Canadians to pig iron or steel, and the other is the establishment of a self sufficient steel industry on the west coast.

First, the development of the Labrador ore fields, for example, will have cost over $200 million before a ton of ore is shipped. This ore will not be economical in the Great Lakes area until the St. Lawrence Seaway is completed. Due to the 350-mile rail haul, as well as to other factors, it will even then probably be some time before it becomes competitive with present sources in this area. When this time arrives, however, it, along with other ore bodies mentioned previously, will supply both the Canadian and American steel industry for many years to come.

The fact that these ore bodies are being developed by American capital is no cause for concern, but rather of relief. It would be many years before the Canadian steel industry could undertake and support such projects as these. To do so would probably require artificial stimulation, resulting in higher tariffs, higher costs, higher prices, and a general lowering of our standard of living. American interests, however, by developing these ore bodies,

Table VI—Imports of Primary Forms of Iron and Steel, 1951*

(Tons of 2,000 lb.)

Commodity	Tonnage
Pig Iron	14,554
Ingots, Blooms, etc.	95,681
Bars	216,110
Structural	297,117
Plates, Sheets and Strip	756,363
Pipes and Tubes	177,625
Wire and Rods	49,716
Castings	36,269
Forgings	45,540
Total	1,688,975
% of Total from U.S.A.	64%

* Primary Iron and Steel, D.B.S. Dec. 1951.

Table VII—Iron and Steel Consumption by Industries, 1951*

Industry	% Consumption
Automotive	8.0
Agricultural and Farm Machinery	4.7
Building Construction	12.3
Containers	9.7
Machinery and Tools	5.3
Merchant Trade Products	13.2
Mining, Lumbering, etc.	4.2
National Defense	1.7
Pressing, Forming and Stamping	5.7
Public Works and Utilities	0.9
Railway Operating	13.4
Railway Cars and Locomotives	6.1
Shipbuilding	1.3
Miscellaneous	0.6
Wholesalers and Warehouses	10.5
Direct Export (a) British Empire	0.3
(b) Other countries	2.0

* Primary Iron and Steel, D.B.S. Dec. 1951.

for us, will make ore available for our industry at much lower costs and much sooner than we could ourselves. Iron ore cannot be mined economically in small quantities, and only in the United States is the demand sufficient to make a project such as Labrador economical.

While steel is usually confined to national barriers, iron ore has been international in a political and economic sense. Besides the obvious fact that it is expedient to sell something when you have a surplus, the U.S. has supplied us with most of our ore in the past and will continue to do so for some time to come. In 1951 we obtained 3½ million tons from them, which is just a little more than our export figure. Should we not reciprocate?

Another factor making international exchange of iron ore advisable is that often home ores, because of either their higher or lower quality, must be mixed with other quality ores in order to obtain most economical operation. This applies to some of the operations in Canada.

In order to refine all the iron ore produced in Canada to either pig iron or steel, as some have suggested, we would require a lot of things presently unavailable to us, and some of which probably never will be available. We just haven't the home or export market, population or resources to support such a project. The American steel industry would not be the least bit interested in buying cold pig iron from us with steel costs predicated on the use of molten pig iron in the open hearth. A little matter of 75 cents per ton duty on pig iron, and up to 20 per cent ad valorem on steel going into the United States, would discourage them still further.

In any event Canada just doesn't have the metallurgical coke to refine all this iron ore. Thus, the only thing to do is to export and be glad that somebody wants to buy it. Sweden, with a much longer tradition of iron and steel making, has tremendous reserves of iron ore higher in quality than even Labrador, yet they export over 75 per cent of their production. They haven't enough coking coal either. The most that can happen in the foreseeable future, relative to the establishment of a new and large steel industry to handle our new found ores, is the building of one or two electric smelters with a capacity of 100 tons per day each.

Electric Smelter for B.C.

Due to the high freight rates and the growing industrialization of the west coast, to say nothing of the booming oil industry in Alberta, a lot of interest has been directed toward the establishment of a self-sufficient steel industry in that area. Although this may be possible some day, it certainly is not at present. Some expansion, however, of present facilities for steel making on the west coast now appears to be justified.

Western Canada Steel Limited, in Vancouver, have at present an annual capacity of about 32,000 tons of steel, which cannot be exceeded due to the shortage of scrap. Any future expansion therefore, must come from the smelting of iron ore. Since the market is not large enough to support a large modern blast furnace with a capacity of from 800 to 1,400 tons a day, the only alternative is to build an electric smelter. Since it is reasonable to expect that a market can be found for at least 35,000 tons of pig iron per year, an electric smelter capable of producing 100 tons per day, will be the most economical solution.

There is sufficient electric power available which would replace a large part of the metallurgical coke normally required for a blast furnace. Also, since the electric smelter is only about one-third the height of a blast furnace, a cheaper, lower strength coke may be used. The iron ore on the west coast is particularly well suited to electric smelting. Pig iron so produced, because of its lower sulphur and carbon, is more easily refined. With the recent announcement that Western Canada Steel Limited plan to go ahead with the construction of an electric smelter, we can expect steel production on the west coast to practically double.

British Columbia currently consumes each year approximately 250,000 tons of steel products. Over 60,000 tons of this is in the form of small bars, rods and shapes. The balance is made up of about 35,000 tons of tin plate and steel strip, 20,000 tons of plate and a tremendous variety of other miscellaneous products.

This 60,000 tons of small bars, rods and shapes, is definitely attractive to the west coast steel industry, and will probably take up most of the increased capacity. Rolling equipment will no doubt be further modernized, and the addition of a rod mill may eventually follow. Alberta will certainly augment their market, particularly with removal of the mountain freight differential. Mills for the rolling of sheet, strip, plate and heavy structural, however, will not be economical for many years to come. It may not be too long before the rolling and fabrication of the smaller sizes of skelp becomes economical.

With less than one hundred years behind it, the steel age is only just beginning. Fundamental research that is presently taking place on continuous casting, direct reduction of iron ore, oxygen enriched low shaft furnaces, hot extrusion of steel, etc. may eventually make some of our present methods obsolete. You may be assured that the steel industry of Canada is keeping up with the times, will continue to make the most rational use of our available raw materials, and to supply you with quality steel, having an eye to the present as well as to the future.

For the program of the

E.I.C. ANNUAL MEETING

HALIFAX, MAY 20, 21, 22

see pages 409-412
of this issue

Fluid-Borne Solid Particles

with particular reference to

Solid Fuel for Internal Combustion Engines

by

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This paper deals with the transport of solid particles of coal suspended in air, with a view to further practical work in internal combustion engine design and in the use of pulverized coal as fuel. The relation between the velocity of a coal particle in still air and the resulting frictional resistance force has been found experimentally for several different coal particle sizes. Test results indicate some of the factors to be considered in engine design and operation. A comparison is made between values of drag coefficient for coal particles moving in air, and those for spheres, at the same values of Reynolds number.

Introduction

The possibility of an economical internal combustion engine for pulverized solid fuel led to the work reported in this paper. Rudolph Diesel thought that it would be possible to use coal dust directly in an internal combustion engine more than 50 years ago (1), but was unsuccessful in his attempts to do so. Successful solid fuel engine operation was first realized by Rudolph Pawlikowski in Germany in 1916 (1). His first engine was a single cylinder of 80 hp. and was still in use in 1939; a reasonably low degree of wear was attained. At the Conference on Coal as Fuel for Internal Combustion Engines in 1939 (1) some early engine designs and tests were described.

Powdered fuel engine operation is similar to that of the diesel engine. Finely divided fuel particles are drawn into a precombustion chamber with primary air during the suction stroke of the piston, and remain in the precombustion chamber during the compression stroke. Ignition due to engine compression occurs in the precombustion chamber and the sudden rise of pressure there causes the mixture of air and fuel to be forced into the main cylinder chamber where combustion is completed. One of the chief difficulties has been engine wear. Lubricating oil consumption is higher in the coal dust engine than in the oil-fuel diesel engine; however, in engine tests (1) oil consumption has been reduced to a figure only about double that for an oil engine.

The advantage of burning coal in an internal combustion engine is the cheapness of the fuel. Fuel cost per unit of energy output for a coal dust engine (assuming 30 per cent efficiency) would be roughly one-fifth that for a gasoline engine (at 20 per cent efficiency), two-fifths that for a diesel engine (at 30 per cent efficiency), or one-fifth that for a steam engine using coal (at 6 per cent efficiency), at the present time.

Design Considerations

The injection of the solid particles into the engine, the formation of a combustible mixture by thorough

Table I—Coal Dust Particle Settling Tests

(g = Centrifuge Acceleration; $1 \times g = 32.2$ ft./sec.^{2})
(V = Settling velocity of coal dust in air, ft./sec.)

Particle size 0.084 mm.		Particle size 0.065 mm.		Particle size 0.052 mm.		Particle size 0.046 mm.	
g	V	g	V	g	V	g	V
18.0	1.95	1*	0.842	11.8	0.98	2.6*	0.363
17.8	2.06	1*	0.870	11.8	0.97	3.9*	0.452
9.6	1.47	6.5*	1.08	21.8	1.28	6.0*	0.538
8.9	1.64	7.0*	1.01	5.4*	0.763	9.1*	0.482
9.0	1.54	14.7	1.12	69.0	1.96	16.7	0.837
29.3	2.01	14.1	1.09	57.5	1.79	23.1	1.14
33.3	2.12	22.9	1.56	92.5	2.08	52.2	1.35
22.8	2.04	22.5	1.41	89.7	2.09	47.5	1.27
22.5	2.15	30.8	1.79	49.0	1.61	107.0	1.87
35.4	2.39	30.8	1.73	10.8	0.938	97.7	1.86
6.7	1.34	35.4	1.53	14.8	0.936	1*	0.400
6.7	1.26	11.2	0.966	23.1	0.997	—	—
6.7	1.23	11.0	1.03	122.0	2.21	—	—
1*	1.09	—	—	191.0	2.75	—	—
1*	1.09	—	—	1*	0.682	—	—
—	—	—	—	1*	0.747	—	—
—	—	—	—	1*	0.652	—	—

* These values are the vector sums of centrifugal plus gravitational acceleration.

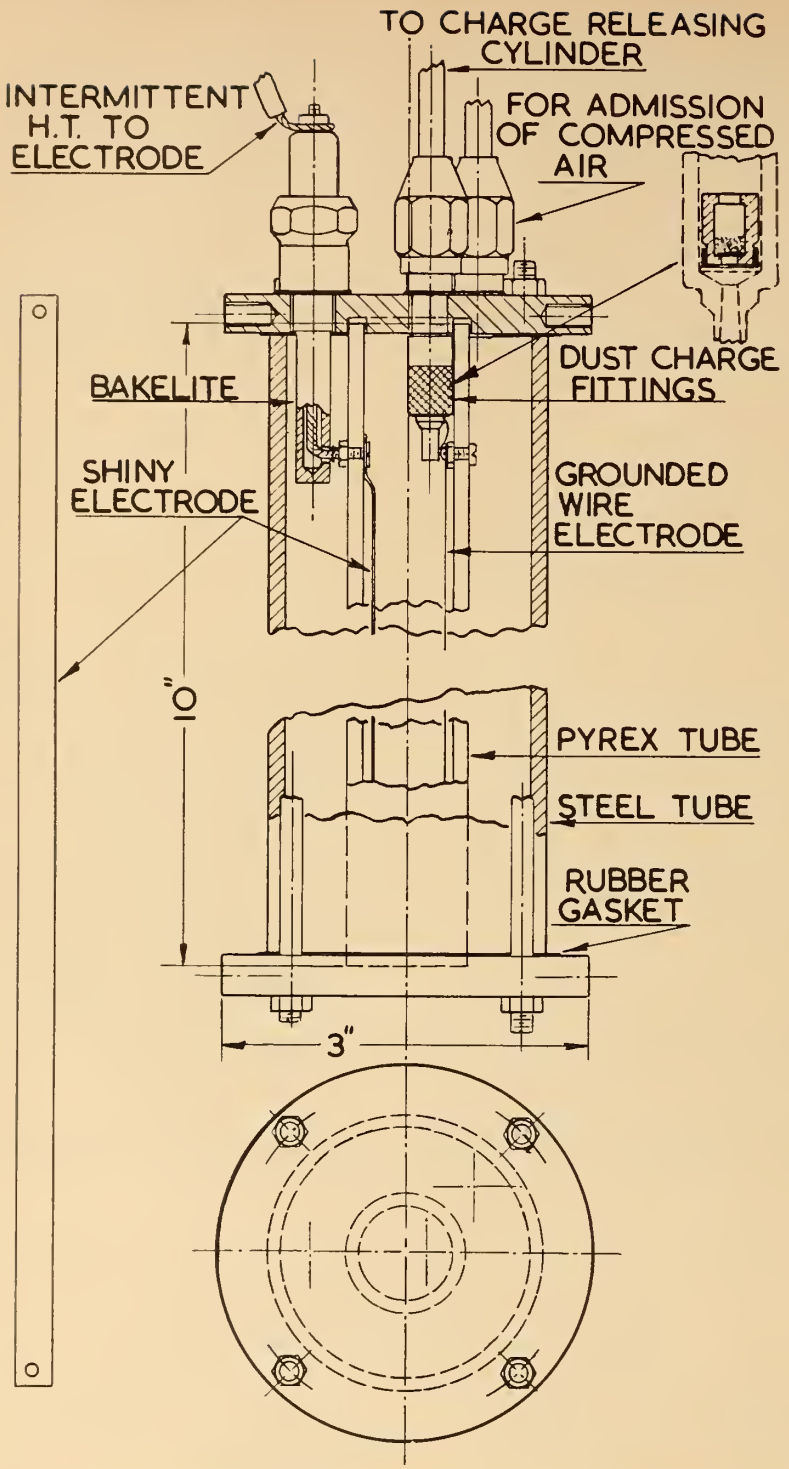

Fig. 1. Apparatus for measuring the settling velocity of coal dust particles in air at various pressures.

mixing with the correct quantity of air and the expulsion of the combustible residue all require that the dust be fluid-borne in the air, the air acting as a carrier. The more practical problems of wear and of lubricating oil consumption depend largely on the extent to which the solid is prevented from making contact with the working surfaces by remaining fluid-borne. However, when dust is carried along in a gas stream relative motion between the solid particles and the fluid in which they are carried is inevitable, and varies with the size of the particle. The maximum allowable fuel particle size in any particular engine for satisfactory operation depends on the extent of this relative movement which can be allowed, and this in turn depends on the engine design and on operating conditions also.

Experimental Work

In the laboratory, measurements of the relative velocity between coal particles and air were made when the mixture was subjected to various values of acceleration and pressure. Coal dust samples of definite size limits were prepared for this purpose by passing the finely ground coal through sieves and by elutriation for finer grading. A kinetic elutriator was used (2), elutriation being accomplished by subjecting a sample of finely divided coal particles to a number of different velocities of upward flowing water and by collecting the solid particles carried in the overflow at each respective velocity.

For the measurement of the rate of settling of coal dust in air, a simple form of electro-static precipitator was employed. A small cloud of dust of uniformly sized particles passing between the electrodes of the precipitator was partially precipitated as a visible deposit at each pulse of voltage when an intermittent voltage feed was used. The settling velocity was found by taking the product of the distance between the deposits and the frequency of the voltage pulses. The final design of the apparatus used is shown in Fig. 1. The electrodes were placed close together to give as high a value of potential gradient as was practicably possible without spark jumping. The shiny aluminium electrode used provided a surface that was suitable for observing faint dust deposits. The intermittent high voltage from one of the spark leads of a magneto was used as a voltage supply.

For measuring the settling velocity of dust particles at accelerations greater than that of gravity, a centrifuge was used (Fig. 2). The angle of the dust precipitator tube was adjustable so that its axis could be set in line with the mean direction of travel of the dust particles, the actual particle path not being a straight line relative to the centrifuge table in either the horizontal or the vertical plane. Calculations of centrifugal acceleration were made for approximately the mid-point of the precipitator tube, i.e., using a centrifugal radius of 2.5 feet.

Test Method

The dust to be tested was kept at a temperature of about 70° C. to ensure dryness. The shiny aluminium strip electrode was prepared for the test by detaching it from the precipitator tube, wiping it clean,

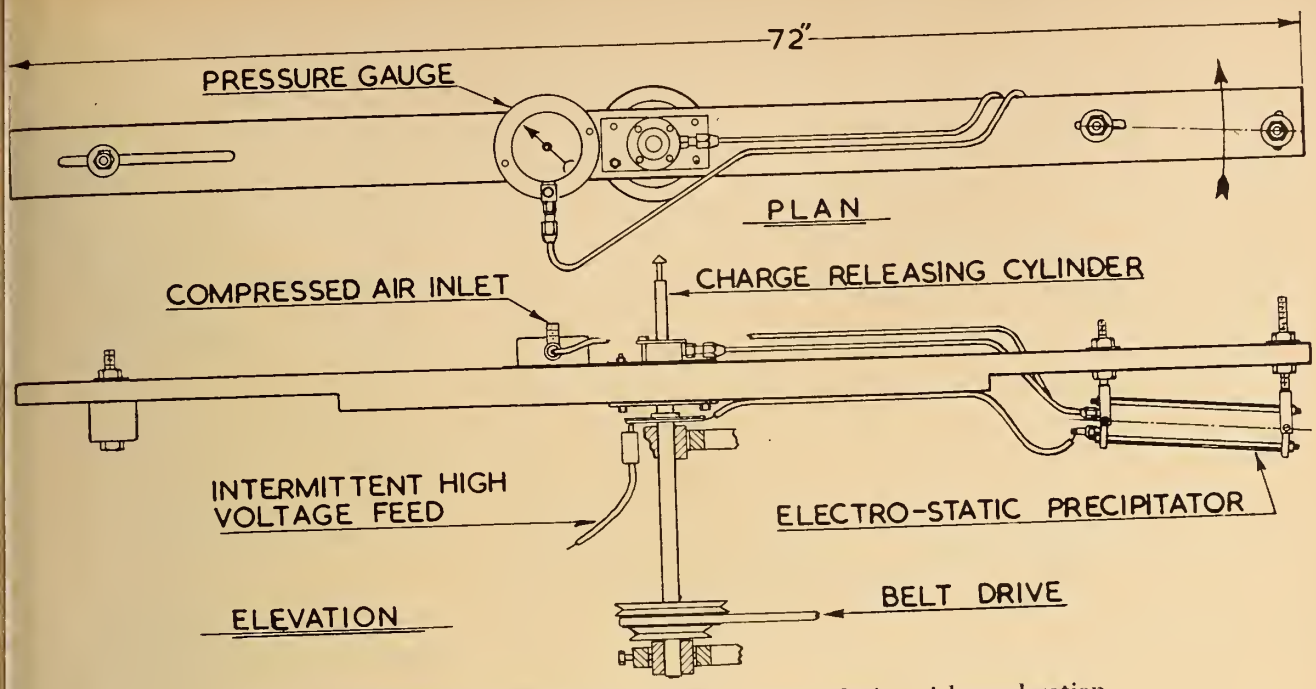

Fig. 2. Centrifuge for measuring coal dust settling velocity with acceleration greater than that of gravity.

applying uniformly a thin coat of grease (a heavy gland packing grease was used), and replacing it in the tube. The small dust charge capsule (see Fig. 1) was then charged one-third full (0.015 cc. approximately) of the dust to be tested, placed in the capsule nut, and the latter screwed into position (see Fig. 1). The precipitator tube was then set in place, the centrifuge was started, and the magneto for intermittent voltage supply turned on. The centrifuge and magneto speeds were recorded and the charge of dust was released from its receptacle in the upper end of the precipitator tube by injecting a small blast of air from the charge releasing cylinder (see Fig. 2). Release of the dust charge took place when one side of the thin rubber flapper valve in the dust charge capsule was forced through the opening in the tiny end plate to which it was cemented at one point (Fig. 1). For tests at higher than atmospheric pressure compressed air was admitted to the dust precipitator tube. After stopping the centrifuge the shiny electrode was removed from the dust precipitator. The dust could be observed deposited in waves along the electrode. Some experience was required in learning how to measure the distance between the deposits before results could be repeated. Apparently, the dust cloud consisted of several small clusters, giving deposits in separate series of waves for each cluster.

Tests

Bituminous coal was used for the tests. A mean diameter of a representative particle from each graded sample of dust, measured under the microscope, was taken as the particle size of the sample. Results for four different particle sizes (0.084 mm. to 0.046 mm.) are given in Table I, and are plotted in Fig. 3, 4, 5 and 6. The maximum value of acceleration used in the tests was 191 times that of gravity. This was for one particle size only, maximum acceleration values for other sizes being considerably lower than this. Results of tests at higher pressures than atmospheric were not extensive

Table II—Drag Coefficient C_D and Reynolds Number R For Coal Dust Particle Settling Tests

Particle diameter mm.	V	g	C_D	R
0.084	0.5	0.4	20.4	0.859
	1.0	1.2	15.3	1.72
	1.5	8.3	47.0	2.57
	2.0	22.0	70.3	3.44
	2.5	40.5	82.7	4.30
0.065	0.5	0.6	23.8	0.66
	0.75	1.2	21.2	0.99
	1.0	5.7	56.4	1.32
	1.25	14.2	93.2	1.66
	1.5	25.5	112.0	1.98
	1.7	36.8	125.5	2.25
0.052	0.5	1.0	31.5	0.53
	1.0	12.5	98.7	1.06
	1.5	37.5	132.0	1.59
	2.0	83.0	164.0	2.12
	2.5	157.5	198.5	2.65
	2.75	202.0	210.0	2.91
0.046	0.25	0.8	89.6	0.234
	0.50	4.8	134	0.469
	0.75	11.5	143	0.703
	1.0	21.6	151	0.940
	1.5	58.0	181	1.41
	1.7	82.0	198	1.60
	1.9	110.0	213	1.78

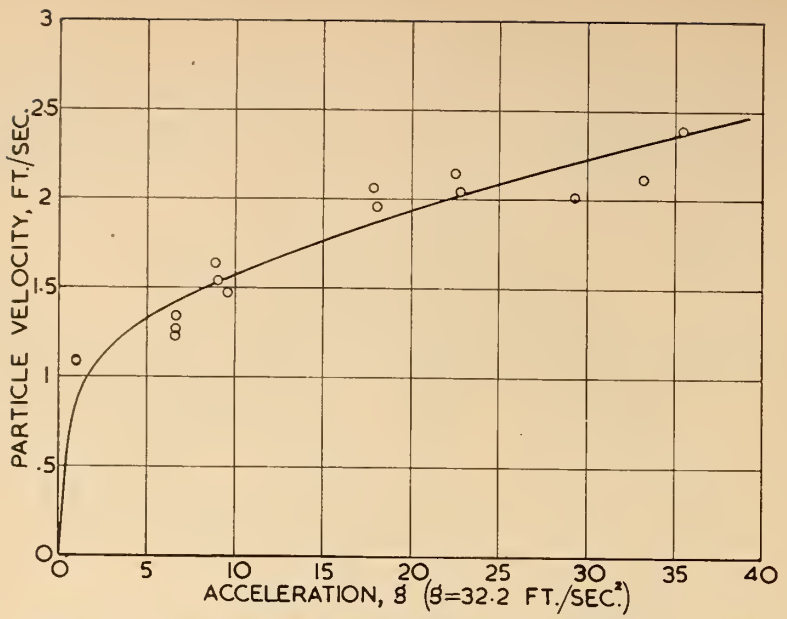

Fig. 3. Results of coal dust particle settling tests: particle size = 0.084 mm.

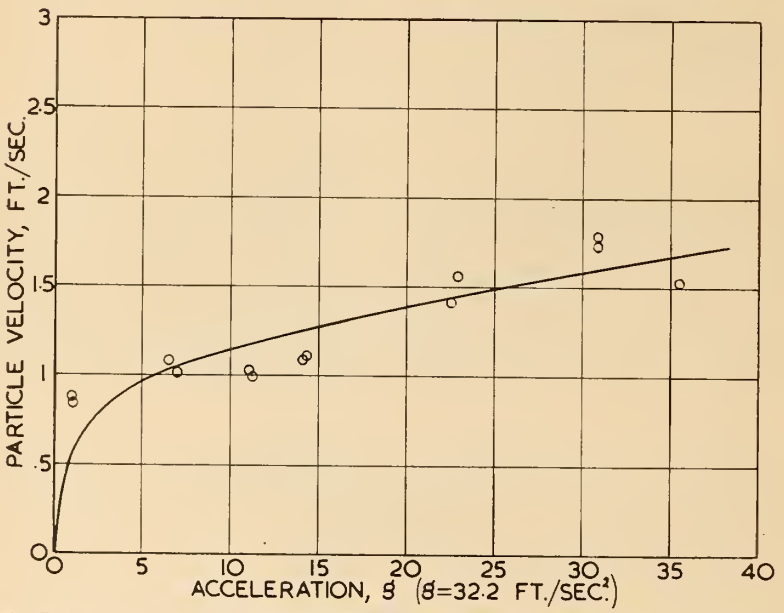

Fig. 4. Results of coal dust particle settling tests: particle size = 0.065 mm.

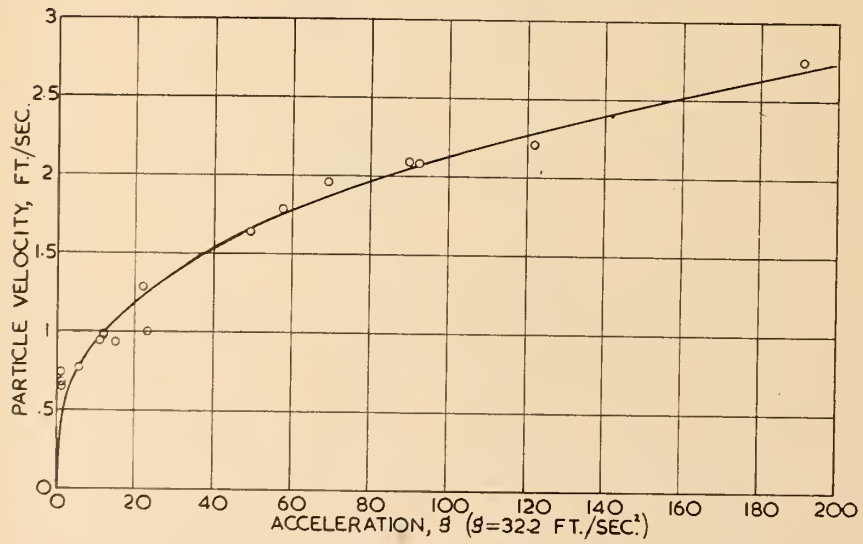

Fig. 5. Results of coal dust particle settling tests: particle size = 0.052 mm.

and are not included in the present paper.

Discussion of Results

In the velocity-acceleration curves, the force acting on a particle is equal to the product of particle mass and acceleration. It is also equal to the force of frictional resistance between the particle and the carrier fluid. Assuming that this force varies as some power of velocity, the equation may be written:

$$F = Mg = k\,V^a$$
$$\text{or } g = K\,V^a$$

where

F = force
M = mass of particle
g = acceleration
V = velocity
K, k and a = constants

The equation $g = 12.0V^{2.78}$, g = gravitational acceleration, V = velocity in ft. per sec., found for the coal particle size 0.052 mm. is plotted along with the experimental curve in Fig. 7 where velocity is taken as the independent variable. The two curves are close but do not coincide exactly.

It may be noted that all the experimental curves have a sharp turn at low values of g, near $g = 1$. It has been shown (3), that for an obstacle immersed in a flowing stream, the drag coefficient, C_D, is a function of Reynolds number, R, only. Note that drag force $F = C_D\,\rho\,D^2\frac{V^2}{2}\frac{\pi}{4}$, where ρ = density of fluid, and D = diameter in the case of spheres. A graph of C_D as a function of R, (3), given for flow of a stream past a sphere shows that

$C_D = 250$	when $R = 0.1$
30	1
4.5	10

These values of R are of the order of those encountered in the tests. Thus the comparatively sharp turn in the experimental curves is because of the great change in C_D, i.e., in K (not accounted for in the curve of $F = KV^a$ shown in Fig. 7) over the range of values of R encountered.

Values of C_D and R for the coal dust settling tests have been calculated (see Table II) and plotted in the same graph with the $C_D : R$ curve for spheres (Fig. 8). C_D increases as R increases, instead of decreasing as it does for spheres. It is interesting to note in comparing the $C_D : R$ curve for rough pipes with that for smooth pipes (4) and the $C_D : R$ curve for discs with that for spheres (3) that the change in slope is in the same direction in going from rough flow conditions to smooth.

It is evident from Fig. 8 that the maller the particles become the reater is the relative effect of their urface roughness for a given value f R. Presumably this is because urface phenomena of small objects ncrease with decrease in size.

At very low values of R for each particle size used, the $C_D : R$ curves or the coal dust particles appear to become tangent to a line parallel o the $C_D : R$ curve for spheres. If these curves do in fact become the same as that for spheres when R becomes very small, then the effects of roughness are nil at very low R. Error in measuring mean particle diameter would account for the separation of this tangent line — dotted in Fig. 8 — from the $C_D : R$ curve for spheres. It seems likely that at this condition flow would be completely laminar, since friction would be the same for both spheres and coal particles, and would be due entirely to fluid viscosity μ and not to fluid density ρ.

Application of Results

In a flowing mixture of solid particles and fluid, consider the motion of a small particle of fluid which contains a much smaller solid particle. Assuming that absolute velocity is much greater than relative velocity between solid and fluid, it may be said that if absolute acceleration remains constant, then relative velocity remains constant. Using the symbols for acceleration and velocity, absolute and relative shown in Fig. 9.

$$A_{abs.} = \frac{F}{M} = K\,V^{a}$$

Hence $$V = \frac{A_{abs.}}{K}^{\frac{1}{a}}$$

This equation approximates closely to actual fact and is used because it is simple. It is seen that a given increase in absolute acceleration results in a lesser increase in relative velocity, since a is greater than one as indicated by test results.

Now if a mixture of solid particles in fluid is to move a given distance, with the least amount of relative motion between solid and fluid, absolute acceleration should be high, up to the running velocity, then it should drop to zero. Thus final running velocity is attained quickly and then remains constant, i.e., its maximum value in practice must be kept as low as circumstances permit. In bringing the mixture to rest, the order must be reversed if the same effect is to be obtained. Relative and absolute distances travelled by the solid particle are indicated by the

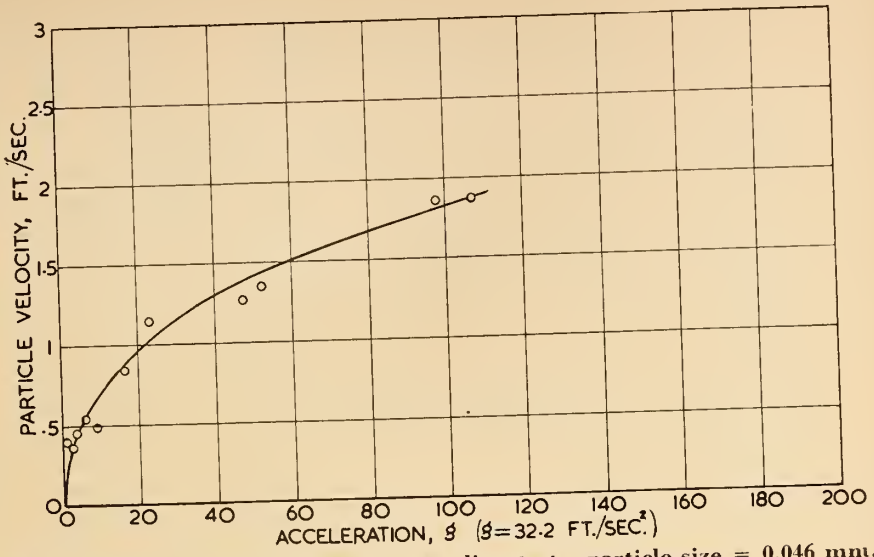

Fig. 6. Results of coal dust particle settling tests: particle size = 0.046 mm.

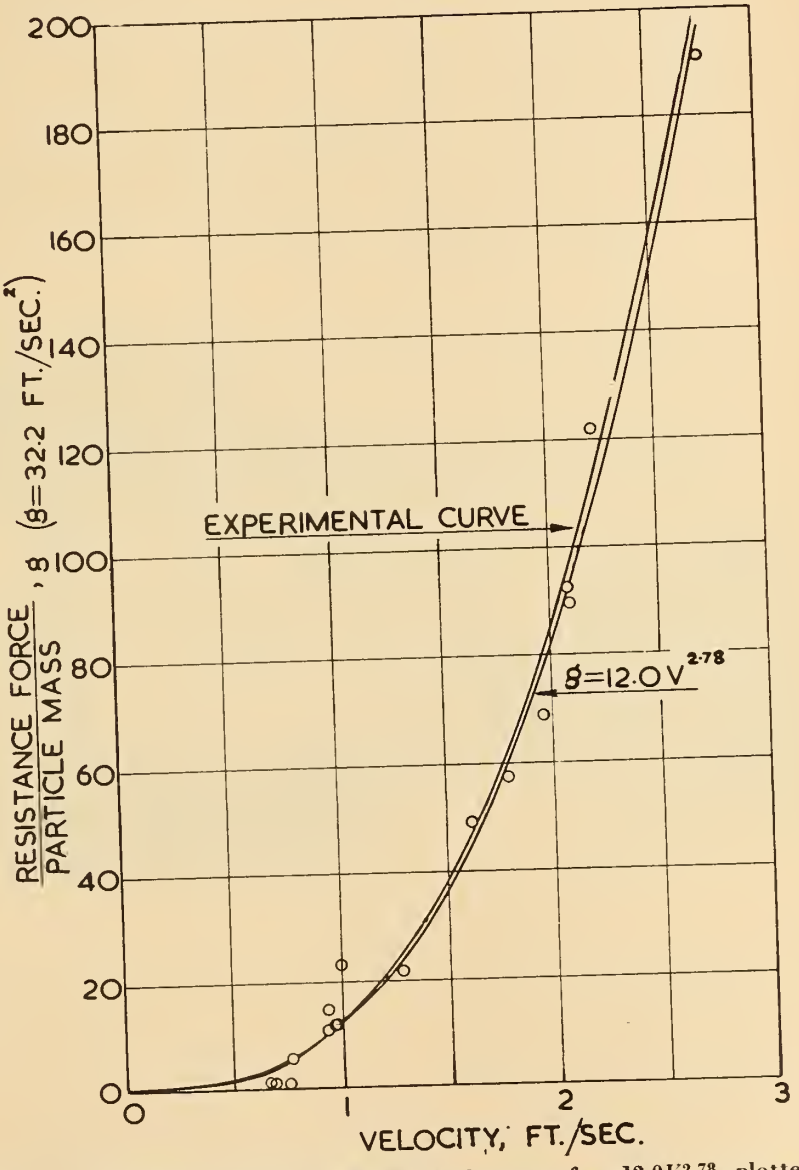

Fig. 7. Experimental curve of Figure 3 and curve of $g = 12.0V^{2.78}$, plotted as resistance: velocity, with velocity as the independent variable.

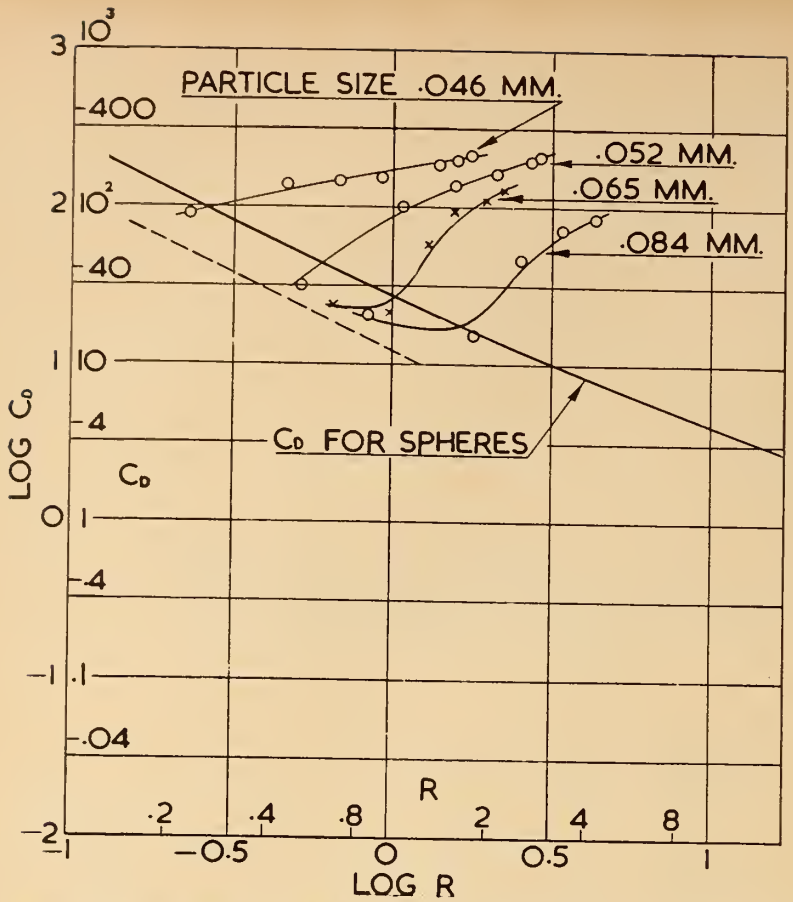

Fig. 8. C_D:R values from tests plotted with the C_D:R curve for spheres.

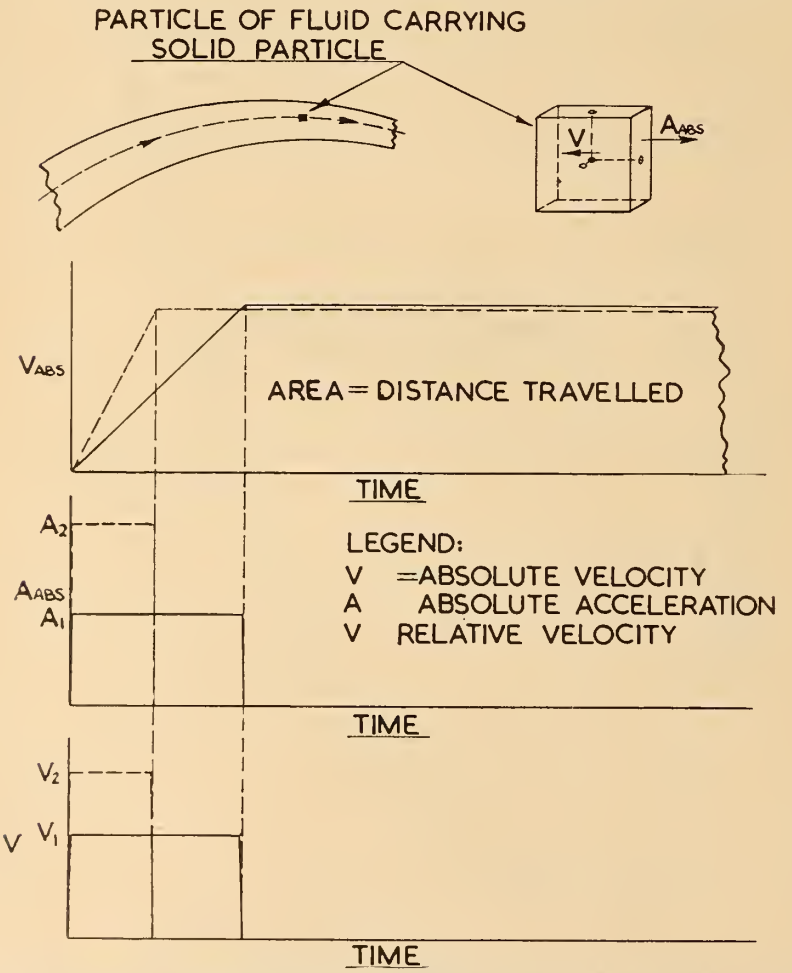

Fig. 9. Velocities and accelerations of fluid and fluid curve solid particles for simple theoretical motion.

areas under the velocity — time curves in Fig. 9.

The advantage may be considered to be made up of two components. First, assume momentarily that relative velocity and absolute acceleration have a direct linear relationship. The higher the acceleration, the more quickly is absolute final velocity attained, so that the latter need not be quite so high to move the solid particle a given distance in a given time, and the relative travel between solid particle and fluid is proportionately decreased. Secondly when $a>1$ (or more precisely when the $V:g$ curve is convex upwards, which was found to be true in fact), if absolute acceleration is to be doubled say, it need not be at the expense of doubling the relative velocity.

At a point in an actual flow system, however, absolute acceleration depends on the square of absolute velocity, and since relative velocity V varies as $A_{abs.}^{\frac{1}{a}}$, then V varies as $V_{abs.}^{\frac{2}{a}}$. Since $\frac{2}{a}<1$ as shown by the tests with coal dust, it is seen that when absolute velocity of a flow system is increased, relative motion between dust particles and carrier fluid is decreased. Thus, for example, if the speed of a dust engine is increased, the chances of fuel clogging and the extent of abrasion of working surfaces are decreased. This refers, of course, to abrasion other than that due to particle impact, such as might occur in turbine blading.

It also follows from the above that in the design of an internal combustion engine for solid fuel, or in any flow system where dust is carried in a gas stream, the points in the flow circuit of the working fluid where velocity is a maximum should be designed so that this maximum value be as low as possible.

When the maximum limit of fuel particle size has been found for a particular set of conditions by engine tests, a reasonably intelligent estimate of the maximum allowable particle size could be made for any other engine and any other operating condition, by use of the appropriate velocity curves for the complete engine cycle.

Summary and Conclusions

Coal particle velocity relative to the air in which the particle is immersed has been found for various values of acceleration of coal-air

nixtures for several different coal particle sizes. Results given in this paper are for particle sizes from 0.084 mm. to 0.046 mm. mean diameter. The maximum value of acceleration used was 191 times that of gravity.

The value of the drag coefficient, C_D, which depends only on Reynolds number, R, for geometrically similar objects immersed in a flowing fluid, was found to increase with R for dust particles over the range of R encountered during the tests (i.e., R between 0.25 and 8 approximately), whereas C_D decreases with increase in R for spheres. This difference is attributed to the difference between the rough surface of the coal particles and the smooth surface of a sphere.

It seems very likely that problems of wear and clogging due to fuel particles in a solid fuel engine would become less important as engine speed increases though this requires confirmation by actual engine tests.

It is not unlikely that solid fuel for internal combustion engines will find useful application in the future, allowing for reasonable development and considering the internal combustion engine to take the form of a combustion gas turbine for large transport applications, e.g., on locomotives or for ships. This possibility becomes greater if reports concerning the limited world supply of liquid fuels are to be taken seriously. The long-term prospects of using solid fuel thus depend simply on engineering economics. Solid fuels other than coal might of course be used.

Acknowledgments

The author gratefully acknowledges his debt to Professor M. A. Hogan, D.Sc., M.I. Mech. E., under whose direction the work was performed, and to other members of the staff, especially to P. Leahy, Ph.D., A.M.I.Mech.E., for much valuable assistance. All these gentlemen are members of the staff of the National University of Ireland.

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Plywood Forms in Hospital Construction

Montreal's new 750-bed General Hospital, now under construction on the south slope of Mount Royal, is being literally poured in plywood.

Costing $15,000,000 (the largest building permit in the history of the City) the hospital is being built with the aid of British Columbia Douglas Fir plywood form panels using a special type of hardware which the contractors estimate will produce a saving of 15 to 20 per cent in form labour costs over ordinary lumber forms and effect an additional economy through the high salvage and re-use value of the plywood forming.

Seventeen thousand five hundred cubic yards of concrete are being poured. Floor slabs will have a total area of 586,000 square feet and area of the foundation formwork is 250,000 square feet.

In pouring floor slabs, operations were facilitated by commencing at the top and working down.

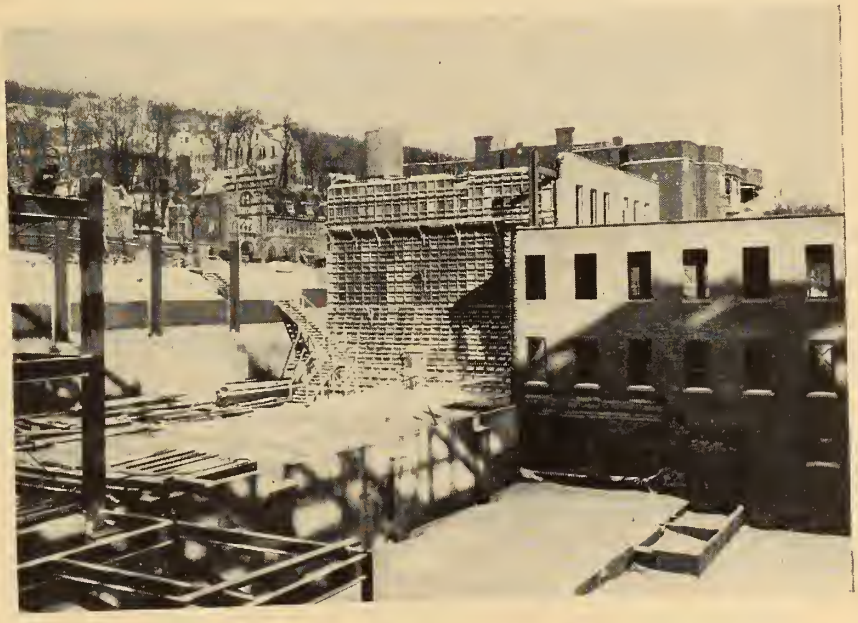
Thickness of slabs varied from 4 in. to 6 in., with 1¾-in. finished floor added. The 2 by 8-ft. plywood form panels and the concrete were carried on 2 by 8-in. joists, spaced 16 in. on centres, spanning 8 ft. to 10 ft. between the steel beams and supported by means of wire hangers. As stated above, panels were hoisted to the top and the roof poured first, it then being necessary simply to lower the panels from floor to floor as the work progressed.

Where a finished ceiling was required, small L-shaped metal clips were driven into the plywood before pouring. When the concrete has set and the forms are removed, the clips remain imbedded in the concrete with a tongue containing a small hole protruding. Channels are then hung from the clips by means of wires passed through these holes and the finished ceiling is attached to the channels. If the concrete is left exposed it is seldom necessary to do more than paint the surface. If fins are noticeable, however, they are easily removed with a small hand-operated carborundum wheel.

Wall forms were also of 2 by 8-ft. plywood panels assembled in the usual manner with double 2 by 4-in. wales spaced every two feet and using the standard hardware, consisting of connecting bolt, tightening wedge and form tie.

Strips of ¼-in plywood, easily bent to the desired radii, supplied the curved forms for the stepped-down seating of the amphitheatre, which will seat 221. Radius varied from 18 to 48 feet in 2 ft. 8 in. intervals, with a rise of 13½ in. from tier to tier.

Work on the massive Montreal General Hospital started on December 11, 1951, and target date for completion has been set for early 1955.



The finished structure will have a floor area of more than 15 acres, with approximately two miles of corridors. The kitchens, it is estimated, will serve up to 5,000 meals per day for patients and staff.

The property is bounded by Pine Avenue on the south and Cedar Avenue on the north and the building will face the intersection of Cote des Neiges and Pine Avenue. √

Canada's Long-Term Economic Outlook

by

O. J. Firestone

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There are good reasons why Canadians, particularly in recent years, have become increasingly concerned with the economic development of the future. Our generation has had full measure of three most disturbing influences affecting the economic welfare of the nation as a whole and of many individuals in particular — a great depression, a world war and protracted post-war inflation.

Now Canada, like many other free nations, is engaged in a re-armament program, necessitated by the war in Korea and uneasy stirrings in other places. The objective of rearmament is twofold; to stop aggression, and to convince unfriendly nations that aggression does not pay.

In recent months we have seen statements by political leaders of the western world that the chief objectives of rearmament are gradually being approached and that perhaps the danger of another world war is gradually receding. Translating this thinking into concrete programming, the suggestion is that the western nations may approach a peak level of defence spending within a year or so and that, after that, barring worsening of the international situation, military outlay might either level off or decline somewhat. The question that many businessmen are asking is, "Does this mean a recession shortly after the defence build-up and how will this affect my business?"

Concern about a possible recession in 1954 or 1955 seems to be based largely on the belief that, if there is a cut in defence spending, people who had been working on armaments orders or related expansion would lose their jobs, and many would be unable to find others; thus unemployment would increase, incomes would decline and business in general would suffer. The basic premise of this talk about a post-rearmament recession appears to be the feeling that there are no alternatives to defence spending.

This seems a peculiar attitude. In the first place, defence spending is likely to remain high. Its level will vary as the international barometer moves from rain to storm and back again to rain. In the second place, if there are reductions in defence spending, is it realistic to assume that Canadians have no alternative ways of putting their resources to good use?

Would anyone argue that the construction of the St. Lawrence Seaway would be insufficient to offset a reduction in the building of airfields and naval installations. Or that an increase in home building could not take the place of building more barracks. Or that equipping a million Canadian homes with television sets could not mean plenty of business for the electronics industry, if it should be faced with a decline in orders for radar equipment and other electronic devices for defence. Or that if taxes were cut with a decline in defence spending, individuals who were thus left with higher net incomes would lack ideas about how to spend them.

Perhaps there is a moral in all this. Businessmen who always see a recession around the corner are likely to miss many an opportunity that an expanding economy offers to the enterprising and the bold. In trying to beat the next recession, they may resort to retrenchment. Then, if demand remains high or continues to rise, they may be unprepared to meet it. Productive capacity may be inadequate; materials may not be on hand in sufficient quantity; good workmen may not be available when most needed. As a result, the businessman who concentrates on beating the next recession may in fact not get his share of the nation's prosperity while it lasts, leaving the field open to his more far-sighted competitor. This is not

Dr. Firestone's paper, read before the Montreal Branch on December 4, 1952, is an attempt to assess what may happen to Canada's economy in the next quarter century. More than any others, engineers should be interested in his remarks, for it is primarily they who have brought our economy to its present high pitch, and it is they who will be chiefly responsible for turning Dr. Firestone's opinions into facts.

There is probably no one in Canada better fitted by training, experience and position to present a survey of this kind than Dr. Firestone, but it must be emphasized that the opinions he expresses here are solely his personal views.

:o say that our economy does not ındergo adjustments from time to :ime. Frequently, when some in-lustries have difficulties, others :ontinue strong. Or Canadians may lose some overseas markets, but make up that loss by expansion in others. It would require a major catastrophe, probably originating abroad, to cause any significant drop in employment and in national income in Canada.

It is therefore highly desirable to keep in proper perspective any talk about a recession after the defence build-up. Some Americans are saying that perhaps their new administration may cut its defence spending by 25 per cent over the next two years. What would a corresponding cut in Canada's defence program—without suggesting that this might or will happen—mean in terms of our gross national product ? The answer is: just 2 per cent. And that is equivalent to the increase in our gross national product this year, which resulted from having a bumper wheat crop instead of an average one.

Some may say that a number of prominent American businessmen and business economists are speaking of the possibility of a recession in 1954 or 1955 — some speak even of late 1953. Are we likely to have one in Canada ? An honest reply is that nobody can answer this question with any degree of assurance.

But there are two things one can say with a measure of confidence. First, there are forces of economic expansion operating in Canada that have little or nothing to do with defence, and that are likely to remain the basic ingredients of Canada's prosperity of tomorrow. Second, Canada has grown into a sturdy country. On at least three occasions since 1900 Canada has been able to avoid most of the consequences of economic disturbances in the United States. The last time was in 1949, when the United States had an "inventory recession", but employment and income in Canada kept on rising and its economy expanded further.

No major industrialized nation in the free world can avoid being affected by serious economic disturbances in the United States. But past experience suggests that Canada may be able to avoid some of the consequences or to minimize their impact. Among the reasons for this state of affairs are the growth of the domestic market, which has been expanding more rapidly than Canada's foreign markets; the impetus of resources and industrial development; the fact that Canadians are continuously endeavouring to narrow the gap in living standards that exists between this country and the United States; the floor that has been put under consumer expenditures through comprehensive social security provisions, and under farm income through agricultural price supports and other provisions; and the attitude of the Canadian people, who have learned to take both success and adversity in their stride.

Limitations of Long-Term Economic Analysis

Before turning to an appraisal of Canada's long-term economic prospects a few words about the limitations of such analysis are in order. It is difficult enough to appraise the economic outlook for a year ahead, but such an appraisal is facilitated by surveys of the major sectors of the economy and of the more important industries. The analyst, in sizing up the likely economic situation for the coming year, is helped not only by these surveys but also by the opportunity of acquainting himself with the current economic situation and with the trends that are apparent at the time he makes his appraisal.

But when it comes to long-term economic appraisals, looking forward say a decade or a quarter of a century, some important tools that facilitate short-term forecasting are lacking. Current trends may change. For example, surveys asking businessmen what they may spend on capital expenditure diminish in usefulness as the time covered is extended. Reasonably good results are obtained from asking businessmen for investment intentions a year ahead, but estimates of capital expenditure plans for a decade ahead are not very meaningful. Some businessmen may have broad views about the long-term future of their enterprise, but understandably they are not prepared to go into much detail. Advance business planning is concerned with formulating long-term objectives towards which management can work step by step, adjusting plans in the light of changing economic conditions, markets and technical developments.

All that one can safely do in attempting to appraise the long-term outlook of a country, is to consider the actual growth of its economy over a lengthy period and then to examine the factors that suggest that the country will continue to grow at the rate of the past, at a more rapid rate, or at a less rapid rate.

Let us look back in general terms over the last quarter century and forward over the next quarter century. Then let us ask ourselves what all this expansion might mean. Are Canadians building a new nation with little resemblance to the old, or is it just a stronger and more self-reliant country, built on the firm foundations of tradition, ability and confidence ?

The end of the next quarter of a century works out arithmetically at 1977. Obviously no one can be sure now that in that particular year Canadians will be making full use of their resources and that unemployment will be as low as at present. Every industrially-advanced country undergoes short-term adjustments. We have had such adjustments in the past and we are likely to have them in the 1970's. But if at any time in the latter part of the 1970's we are making full or near full use of our resources, then the appraisal that we are attempting here may be applicable to this situation. We are really assuming that perhaps for one year, if not for several years, between 1975 and 1980 domestic and foreign markets will be strong and the level of employment and incomes will consequently be high.

Economic Development over the Last Quarter Century

Canadian economic expansion over the last quarter of a century has been rapid. Even the great depression of the 1930's was able only to slow down this expansion. World War II speeded it up. The post-war period made it possible for Canadians to consolidate the gains of the past and to make further advances.

Between 1926 and 1951 Canada's population rose from about 9.5 million to over 14 million, or by 48 per cent (44 per cent excluding Newfoundland). Her foreign trade, both exports and imports, increased from close to $2.3 billion to $8 billion, or 253 per cent in value and 94 per cent in volume. Capital expenditures on plant and equipment by business and on housing rose from some $800 million to over $3.8 billion, an increase of 371 per cent in current dollars and 135 per cent in constant dollars. Expenditures by consumers for food, clothing, shelter and the other necessities and pleasures of life rose from about $3.7 billion to almost $13.1 billion, or by 254 per cent in value terms, or by 124 per cent if allowance is made for changes in price

levels. Expenditures by all levels of government on goods and services rose from over $500 million to about $3.1 billion. If one exeludes defenee expenditures, which were negligible in 1926, the inerease is 284 per eent in eurrent dollar terms and 117 per cent in eonstant dollar terms. As a result of expansion in all these sectors, Canada's gross national produet in this period rose from $5.3 billion in 1926 to $21.2 billion in 1951. This is a four-fold rise, involving more than doubling the volume. But the economy has not stood still during 1952 and the gross national product in that year has reaehed the record total of $23 billion.

What has this expansion meant in terms of resourees development, increasing industrialization of the eeonomy, and rising standards of living and of leisure of the population? From 1926 to 1951 aluminum output increased 23 times; zinc, 4½ times; niekel and eopper, eaeh 4 times; asbestos, 3½ times. Iron ore and petroleum output has risen from negligible quantities to some 3 million tons (4.7 million tons including Newfoundland) and 48 million barrels, respeetively.

Canada's manufacturing industry is now a major source of employment and ineome. Every fourth worker is engaged in secondary industry, and almost every third dollar of our national ineome eomes from manufacturing operations. The gross value of manufaeturing has risen from $3.2 billion in 1926 to $16.3 billion in 1951, five times in value and two and one-half times in volume. In 1926 finished manufactured and partially manufaetured items made up 54 per cent of our total exports. In 1951 that ratio had risen to 70 per cent.

In 1951 per capita ineome after taxes was 147 per cent higher in current prices and 56 per eent higher in terms of 1926 purchasing power. As a result Canadians were able to spend more on the necessities and amenities of life. Food consumption per capita in real terms has risen by 35 per cent and clothing expenditures by 37 per cent. Canadians have also acquired many conveniences and appliances in increasing quantities. Only one in every thirteen Canadians possessed a car in 1926; now one in every seven does. While the increase in the use of appliances was slow in the 1930's, it has been particularly marked over the last decade or so. Only 21 per cent of families owned mechanical refrigerators in 1941, and only 24 per cent had vacuum cleaners; by 1951 the proportions had risen to 47 and 42 per cent.

But not only have Canadians been able to improve their standard of living significantly in real terms; they have been able to obtain and enjoy greater leisure. Hours worked by wage earners in manufaeturing industries have declined from a little over 52 per week in 1926 to about 42 in 1951, or by about 20 per cent.

Also associated with the rise in output over the last quarter century are many changes in the external conditions of life, whieh are nowadays taken for granted. Twenty-five years ago you eould not buy a ticket for an air journey aeross the Atlantic or to Vaneouver. The first "talkie" had yet to be filmed, and television was only a gleam in the eye of some dreamer. Even radio was still a novelty.

Economic Development over the Next Quarter Century

Turning now to the future, two questions arise. Will Canada grow at the same rate, or faster or slower than in the past? What does all this expansion add up to? In my personal opinion the factors of expansion operating in the economy may be even stronger in the next quarter of a century than in the twenty-five years just passed, beeause of the eontinuing growth of the domestic market, and the increasing dependenee of the free world on Canadian sourees of supply, among other factors.

The expansion of the domestic market depends largely on the growth of Canada's population and on the ability of Canadians to inerease the volume of their output and thus the level of their real income. Canada's population has risen over the last quarter of a century at an annual rate of about 1½ per cent eompounded. At that rate Canada's population would exeeed the 20 million mark in the next quarter century. Currently it is increasing by an annual rate of about 2½ per eent. There are good reasons to suppose that Canada might inerease her population at a higher rate than the 1½ per eent of the last 25 years, whieh included the slow growth during the depressed 1930's. Prime Minister St. Laurent has said that Canada's population by the end of this eentury may well reaeh 35 million. This assumes an annual rate of 1.9 per eent eompounded, below the present rate of population inerease. On the basis of a 1.9 per cent rate, Canada's population a quarter eentury hence may be between 22 and 23 million.

Not only has Canada's population risen but, real output per man year has also increased, in spite of the decline in hours worked. With the growing industrialization of the country, the adoption of the latest produetion techniques, and the use of modern machinery and equipment, output per worker is likely to continue to rise even though the pace may vary from time to time. With new technological developments it would not be surprising to find productivity increases matching if not exceeding the rate of the last 25 years. More people and greater productivity will mean greater national output and, if demand is maintained, a considerable expansion of the domestic market.

Foreign Trade

There are at least five reasons for the belief that Canada's foreign markets over the long run are likely to continue to expand, possibly even exceeding the rate of growth over the last 25 years, which amounted to about 2¼ per cent per annum, eompounded, in volume.

Canada is a heavy exporter of basic industrial materials and foodstuffs in raw and proeessed form. Most of these materials and food items are produeed at costs that compare favourably with the production eosts of other nations. Thus a good deal of Canada's industrial raw material and food production is eompetitive in world markets.

The free world is now a smaller world, and trading with Iron Curtain eountries is much redueed. In some fields there are few alternative sources to Canadian supplies.

Where alternative low-cost sources are available some of these are being used up. Perhaps the outstanding example is the deeline in high grade iron ore reserves in the Mesabi range in the United States. This is one of the reasons for the development of Canadian iron ore deposits in the Quebec-Labrador area and at Steep Rock in Ontario. One of the major conelusions by the Paley Commission illustrates this point further. In 1900 the United States produeed 15 per cent more raw materials than it needed for its own use, in 1950 it had to import 9 per eent of its needs and by 1975 it may be obtaining 20 per eent of its requirements from other countries.

There is a growing reeognition that trade is a two-way affair, that nations have to import if they want to export.

International endeavours to facili-

te the flow of trade and to reduce riff barriers and import restrictions are continuing. Some measure success has already been achieved. While it may not be possible to void setbacks, over the long run ood common sense among nations ay gradually prevail and countries ay recognize that they have great deal to gain from increasing ne international division of labour.

Investment

With respect to capital expenditures on plant, equipment and housing, the annual rate of growth has been 3½ per cent, compounded, over the last 25 years. The rate for residential construction is lower, 1½ per cent, and for non-residential construction and machinery and equipment, mainly capital expenditures by business, the rate is higher, 4 per cent. Among the reasons why capital expenditures both on plant and equipment and on housing may continue to grow at this long term rate or possibly exceed it, are:

The trend towards greater processing of raw materials in Canada and towards further development of manufacturing operations is continuing. Capital expenditures per worker are greater in secondary industries than in primary or service industries.

Research and scientific development will continue to facilitate the creation of new materials, new types of energy and kinds of products and services, which frequently can be introduced only by making large capital expenditures. An important example would be the introduction of atomic power.

Rising labour costs are likely to be another factor making for increasing mechanization of Canadian industry as business strives to remain competitive.

Industrialization is accompanied by urban development, the building of homes for new families, and the provision of community facilities that are basic to urban growth. In the housing field particularly, Canadians may not be satisfied merely to keep up with new family formation, but may also want to improve present housing accommodation.

Consumer Expenditures

As events in the past two years have shown, the consumer can be a quite unpredictable customer. You will recall how people went on a buying spree in the first half of 1951 and then curtailed their purchases in the second half of the year, continuing into early 1952. It was only in the latter part of that year that consumers returned to high levels of buying.

But consumers have over the past 25 years significantly increased their purchases of a number of commodities and services so that total consumer expenditures have risen considerably. The annual rate of increase over the past 25-year period works out to about 3¼ per cent, compounded. Here are some of the reasons why consumers may continue to increase their spending at this rate over the long run and possibly do a little better.

More people mean more consumers, and higher real incomes represent an inducement to spend more on the necessities and pleasures of life.

In spite of the great improvement in living standards, particularly so far as the use of motor cars and appliances is concerned, the Canadian market is far from saturated. Therefore, in addition to new families who will want to buy durable consumer items, families who at present cannot afford such articles may enter the market, partly because their incomes may rise, partly because new and possibly cheaper models may come on the market.

Living standards in the United States are higher than in Canada and thus are a continuing stimulus to Canadian families to improve their own standards.

The demand for many services, particularly education, medical and hospital care and holiday facilities, is growing, and so is the demand for greater cultural opportunities.

Government Expenditures

Some observations on government expenditures are necessary to complete the discussion of major factors contributing to economic activity in Canada. As long as international tension continues, defence expenditures may remain high although the actual level will vary, as will the relative burden that such expenditures represent to the Canadian nation.

In the non-defence sector the annual rate of increase of government expenditures on goods and services has been in the order of 3⅛ per cent, compounded, over the past 25 years. At what rate government expenditures will increase in the future depends on the demand of the Canadian people for more government services. Indeed, the long-term rate of increase in government spending could be lower if the Canadian people were to agree with what the Minister of Finance has suggested: "When we have got our productivity up and our tax rates down it will be time enough to consider whether we should undertake large new services."

Gross National Product

The most comprehensive measure of economic activity is the gross national product (or gross national expenditure), that is, the total amount of goods and services produced in a country and sold either at home or abroad. Over the last 25 years Canada's gross national product has risen, by about 3½ per cent per annum, compounded, in volume terms.

If the gross national product were to continue to rise at this rate over the next quarter century, Canada would at the end of that period have a gross national product exceeding $50 billion in 1952 prices. This assumes that this country will be making full or near-full use of its resources. Unemployment could be a little higher than the present very low ratio of about 2 per cent of the labour force, possibly up to about 4 per cent or so.

The rate of growth over the next quarter century, may be a little greater than the rate over the last 25 years. Allowing for the factors that might be responsible for a moderate acceleration of our growth, and assuming a 4 per cent annual rate of increase, compounded, gross national product might exceed $60 billion in 1952 prices 25 years hence. It is suggested, and I am speaking in very approximate terms, that Canada would be capable, by making full or nearly full use of her resources, of producing an output ranging between $50 billion and $60 billion or better in present prices, or between 2¼ and 2¾ times the present output of the nation. Of course, whether the domestic and international situation will be such that Canadians will be able to make full use of these resources is a question which cannot be answered.

All that this exercise in forward thinking suggests is that Canada is an expanding country. Farsighted businessmen will therefore want to take into account in their planning the fact that they are catering and will continue to cater to an expanding market. There is perhaps no need to remind them that this market is not expanding at an even rate, that there are times when that expansion is either halted or slowed down. But if interruptions do occur they are temporary in nature, and after a time expansion continues. And as past experience shows, this expansion is usually

even more rapid, as if some unseen force were driving it to make up for lost time.

Prices

You may ask "Can we achieve rising levels of output without inflation ?" There is some talk about the inevitability of permanent inflation. I personally do not subscribe to this belief.

In Canada the general price level rose by 65 per cent between 1926 and 1951, in terms of the price index implied in the deflated gross national product. In fact, however, this rise is the product of two divergent trends. Between 1926 and 1939 the general price level declined by 15 per cent. Between 1939 and 1951 the price level rose by 93 per cent.

Long-term experience in Canada has been a rapid rise of prices at some times, a slow rise at other times, a decline or levelling off at still other times. On balance the historical trend has been moderately upward. For the period 1926 to 1951 as a whole the annual rate of increase amounted to 2 per cent, compounded.

Prices in the future may vary as they have in the past. Perhaps an encouraging factor is that Canadians have learned a good deal about the dislocations that inflation produces and the means of combatting the basic causes of inflation. They may therefore try to minimize the impact of whatever price fluctuations may be ahead. There are, of course, limitations to what they themselves can do, for Canada is one of the largest trading nations in the world. Thus rising price levels abroad are transmitted relatively easily to our economy through the large volume of Canada's annual imports of raw materials and manufactured products.

Conclusion

First, concern about a recession in Canada after defence spending declines from its peak level is based largely on the belief that there are no alternatives to rearmament orders. This attitude overlooks the fact that there are strong forces of economic expansion operating in the country that have little to do with the defence program and that are likely to continue. A certain amount of caution is indicated in business planning, but the businessman who always see a recession around the corner may miss opportunities that an expanding economy offers to the enterprising and the bold.

Second, Canada's economy has grown rapidly over the last quarter century. Notwithstanding a severe depression in the 1930's Canada's national output has more than doubled in volume over the last 25 years. Strong forces of economic expansion continue to operate here and Canada is likely once again to more than double its gross national product in the next quarter of a century. In fact, there are strong indications that in a number of fields the rate of expansion may be greater over the next 25 years than it has been in the quarter century just passed.

Third, in a free enterprise economy like Canada's, expansion does not proceed at an even rate. Businessmen, in planning to cater to a growing Canadian market, know only too well that, while the expansion of this market is at times rapid, it may at other times be halted or slowed down. But on the whole long-term economic trends in Canada point in an upward direction.

It is my personal belief that Canadians can look to the future with confidence. √

Industrial Preparedness Association Looks at Defence Estimates

The estimates for governmental expenditure for the fiscal year 1953-54 have been tabled in the House, and the details are now available to all sufficiently interested to examine them. Yet the details of the proposed expenditure seldom receive much publicity. As the defence is of such paramount importance these days, it may be of interest to have some of the highlights presented in a general way.

The total of the estimates is $4,404,926,236, compared with last year's estimates of $4,375,737,184. The latter figure includes payments under tax rental agreements not included last year. It would appear, then, that the country is spending some nineteen per cent of the value of its Gross National Product and Services ($23,000,000,000) on Government and Government services. Where does all this money go ?

Firstly, defence, including the Defence Department, Defence Production, Crown Companies and Civil Defence will take $2,080,666,221. Thus it is proposed to spend 47.23 per cent of the total cost of our government on defence. This represents some 9 per cent of our Gross National Product and Services.

The Department of Finance is asking for $846,981,421. Of this, $455,761,426 will go to pay interest on National Debt, while payments to the Provinces total some $328,000,000. In addition, such items as $16,755,989 for payments to the superannuation fund and $7,415,000 in grants to universities are included. Last year's estimate was $797,483,054.

The Department of Health and Welfare is asking for $773,479,165 exclusive of Civil Defence. Last year it asked for $727,666,944. This includes family allowances at $348,852,000, old age pensions at $344,916,000, health grants of $30,000,000, and old age assistance of $22,000,000, as well as the administration of the Quarantine, Food and Drug and other Acts and various other services.

The Department of Veterans Affairs is asking for $233,312,736. Last year the estimate was $234,191,585. Included are some $26,373,000 for War Veterans' Allowances. Veterans of World War I may expect $24,000,000. On account of World War II $1,680,000 is allotted, and for veterans of both world wars $444,000 is provided. For disability and death pensions, a total of $127,054,000 is asked.

To collect the money from the citizens to meet their tax bills, it will cost $50,374,038, which is the requirement of the Department of National Revenue.

If one reviews the continuing costs due to wars since the Riel Rebellion, which include interest on the increase of our National Debt, as well as pensions, one is more than ever convinced that even from a financial viewpoint alone, it is the essence of wisdom to spend whatever is necessary to build our defences up to the point that will deter any possible aggressor from attacking us with any chance of success.

Correction

In the section entitled "Membership and Financial Statements of the Branches as at December 31, 1952", which appeared on pages 124 and 125 of the February *Journal*, 1953, figures indicating Montreal Branch membership were not correct. The following figures should be substituted:

Montreal Branch Membership

Resident:		**Non-Resident:**	
Hon. Members	3	Hon. Members	0
Members	1538	Members	79
Juniors	1062	Juniors	66
Students	1233	Students	32
Affiliates	14	Affiliates	0
	3850		177

Grand Total, Dec. 31st, 1952	4027
Grand Total, Dec. 31st, 1951	3655
Branch Affiliates	4

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

The President in the Maritimes

On what was nearly the last leg of his presidential tour Dr. Stirling left Montreal on Sunday, March 1st. He was accompanied by Mrs. Stirling and the general secretary.

The first stop was Fredericton on Monday when a full program of events got underway immediately on arrival. There was a luncheon at the home of Dr. and Mrs. Turner followed by a radio broadcast by the president, then a meeting with the students of engineering at the University of New Brunswick, and a tour of some of the buildings. The centre of activity shifted from the university to the Lord Beaverbrook Hotel, where a reception was followed by the branch meeting. This was a dinner affair attended by the ladies as well as the members. The special guests besides the president and his wife included Premier H. J. Flemming and Mrs. Flemming, His Worship the Mayor, Dr. H. S. Wright and Mrs. Wright.

After the dinner the officers met with the branch executive. This branch is just one year old but it shows an activity and a vitality worthy of a veteran. It is solid proof of the belief that a branch need not be large in numbers to be useful and effective. The interest shown in many fields such as engineering, municipal affairs, provincial affairs and social affairs, might well be an inspiration and a pattern for other small branches.

The party arrived in Saint John next morning and after lunch met with the executive. That evening there was a reception and a dinner in the main dining room of the Admiral Beatty Hotel, also attended by the ladies. Some excellent wild life movies were shown after dinner and at the intermission there was a short program of music, largely contributed by the audience itself, but none the less enjoyable. The chairman of the branch, A. G. Watt, presided on all occasions.

Just here the weather took a hand in affairs and the earlier plans to motor to Moncton had to be abandoned in favour of the train. This later arrival upset the plans for a meeting with the executive but it was shifted to the following morning without too much difficulty.

On Wednesday evening the members and their wives met for a reception and a dinner with the president at the Brunswick Hotel — a delightful affair followed by some more wild life movies. W. D. G. Stratton was in the chair.

By air the party hopped over to Charlottetown to meet with the members and their wives on Thursday. Here the program followed much the same pattern with a reception and a dinner at the Queen's Hotel. The following morning the president and general secretary called on the premier, J. Walter Jones and Dr. W. J. P. MacMillan, a former premier and a long-time friend of the president.

It was a strange coincidence that took the general secretary to the visitors' gallery of the House just as the premier was announcing that the famous Confederation tables and chairs had been completely overhauled and restored and were now back in their places. He announced also that it was the generous offer of an engineer from Ontario that made this restoration work possible. The engineer is Verne King, M.E.I.C., of Woodstock. Incidentally, the work has been done beautifully and the furniture in its historic setting is indeed something to be seen and of which to be proud.

The return to the mainland was by air and the party was met at Moncton by Mr. and Mrs. J. F. F. Mackenzie who drove them to Amherst for the inauguration of the new branch. On the way there was a stop at Sackville where the president and general secretary spoke to the students. Past-President Dr. McKiel received the party at his home and later presided at the student meeting.

In Nova Scotia

The inauguration at Amherst was a real success. The dinner was held at the Fort Cumberland Hotel with about sixty-five present. Among the distinguished guests were Dr. Wm. T. Ross Flemmington, O.B.E., president and Dr. H. W. McKiel, vice-president of Mount Allison University, the mayor of Sackville and the pro-mayor of Amherst. Past-President Dr. Ira P. Macnab was there and so was the chairman of the Halifax Branch, Frank Bennett and the councillor of the Moncton Branch, N. B. Eagles, both of whom presented cheques and good wishes on behalf of the parent branches. The meeting was under the guidance of the provisional chairman, C. D. Carter, and secretary, R. R. McIntyre.

Under perfect weather conditions Dr. Macnab and Mr. Bennett motored the group to Halifax on Satur-

Cover Picture

Administration building at Dalhousie University, Halifax. The 1953 annual meeting of The Engineering Institute of Canada will be held on the Dalhousie campus. (*Nova Scotia Bureau of Information photo*).

day where a quiet week-end was in prospect.

At noon on Monday, March 9th, the president lunched with the council of the Association of Professional Engineers at the Lord Nelson Hotel, and later participated in their business meeting. This was the first meeting presided over by the new president, G. J. Currie. Later in the afternoon the president met with the executive of the Halifax Branch at the Nova Scotian Hotel.

The branch meeting with the ladies present was held at the Nova Scotian Hotel with the chairman, Frank Bennett, presiding. The Mayor R. A. Donahue was there to extend the welcome on behalf of the city and the Honorable W. T. Dauphinee, Minister of Trade and Industry, represented the provincial government. There were about one hundred present.

There were visits to two universities. In the morning the president accompanied by Past-President Macnab, G. J. Currie, president and D. J. Kline, registrar of the Association of Professional Engineers of Nova Scotia, Frank Bennett, chairman, and W. A. Jefferson, secretary of the Branch, spoke to the engineering students of St. Mary's University at their beautiful new building. Father F. J. Lynch welcomed the group and Dean James Ryan presided at the meeting.

At noon the party visited the Nova Scotia Technical College where they were met by the president, Dr. Alan Cameron. Here also Dr. Stirling and the general secretary spoke to the students.

Program for the Ladies

At every branch there were ladies on hand to take care of Mrs. Stirling. At most centres there were programs of luncheons, teas and sight seeing. For the first time on record every branch meeting in the entire tour was for the ladies as well as the men. It was quite apparent that the engineers' wives in the Maritimes are an active group, much interested in the meetings of the Institute.

At 3.30 a.m. on Tuesday the party arose to catch the only plane that would get them to Sydney in time for the luncheon with the executives and their wives. It was a tough assignment but everything came off very nicely — and it was a nice luncheon.

As usual the branch meeting was a dinner followed by a dance at the Isle Royale Hotel, and as usual the Sydney ladies were a delight to the eye. This branch has established the custom of prescribing that the ladies shall wear evening dress when the president and his wife are the guests, which is a great break for the presidential party. Chairman Rod Wallace presided throughout.

Back to N.B.

The "one-a-day" nature of the tour was broken on Wednesday due to a mix-up about dates. The meeting of the new branch at New Glasgow had to be postponed, but it is expected the president will inaugurate the branch sometime in April. This break was used to good effect by the party, so that when they arrived in Bathurst on Thursday everyone was completely restored.

At Bathurst another branch was started on its way. Here, too, the form of the meeting was a dinner followed by a dance, with about eighty present. The chairman was Robert C. Eddy and L. L. Marshall is the secretary-treasurer. The party broke up just in time to permit the presidential group to catch the train at 1.30 a.m.

In Quebec

Seven a.m. on Friday saw the scene shifted to Rimouski, the present headquarters for the Lower St. Lawrence Branch. There was a meeting with the executive at 11 a.m. followed by a luncheon.

A portion of the afternoon was devoted to an inspection trip through the recently constructed plant of the Canada Wire and Cable Company where the final operations in the manufacture of the great sub-marine cable which is to cross the St. Lawrence are to be carried out. This is quite a project and will be of great interest to engineers in all its stages. The president also visited the marine school which is operated jointly by the provincial and the federal governments.

In the evening there was a dinner meeting at the Hotel St. Louis presided over by Leo McLaren, chairman of the branch. This adjourned early enough that the party could take the 10.30 train back to Montreal, thus concluding what was probably the most intensively developed itinerary ever followed by any president.

The president has yet to visit the Quebec branches — except Montreal — and also Newfoundland. Also it is planned he will inaugurate a branch at Orillia, Ontario, as well as the one at New Glasgow, and one at Corner Brook, Nfld.

There are a number of photographs which are not available in time for this issue of the *Journal*, but they will be in the next one.

Sir John Kennedy Medal Awarded to James A. Vance

James A. Vance, M.E.I.C., of Woodstock, Ontario, has been awarded the Sir John Kennedy Medal of the Engineering Institute for the year 1953.

The Sir John Kennedy Medal is awarded in recognition of outstanding services rendered to the development of Canada, to engineering science and to the profession.

James A. Vance, M.E.I.C.

Mr. Vance was born in Oxford County, Ontario, and studied civil engineering at the University of Toronto. He assumed the direction of the family business of bridge construction following the death of his father in 1914. Under his management, this business, now conducted under his own name, was expanded to include many other branches of general contracting. Mr. Vance is a director of several industrial enterprises and telephone companies, including Avalon Fabrics Limited, of Stratford, Ontario. In addition, he owns and operates a large stock farm near Woodstock.

Mr. Vance has rendered outstanding service to many public bodies, trade and professional associations and service organizations. He is past president of the Woodstock Board of Trade, the Oxford County Tuberculosis Association and the Canadian Forestry Association. He is an Ontario director

(*Continued on page 413*)

Sixty-seventh

ANNUAL GENERAL

AND

PROFESSIONAL MEETING

OF

THE ENGINEERING INSTITUTE OF CANADA

AT

DALHOUSIE UNIVERSITY, HALIFAX, N.S.

May Twentieth to Twenty-second, 1953

GENERAL COMMITTEE

Chairman . . . . . R. F. McALPINE
Vice-Chairman . . . . . J. W. MacDONALD
Secretary. . . . . W. E. JEFFERSON

COMMITTEE MEMBERS

Registration . . . . . J. D. KLINE
Entertainment . . . . . WM. A. DEVEREAUX
Meeting Arrangements . . . . . A. G. MAHON
"Muriel's Room" . . . . . G. V. ROSS, D. C. MacCALLUM
Plant Visits . . . . . G. D. STANFIELD
Technical Papers . . . . . DR. A. E. CAMERON
Publicity . . . . . G. D. ANDERSON
Transportation. . . . . L. C. YOUNG
Accommodation . . . . . R. N. FOURNIER
Finance . . . . . G. F. BENNETT
*Ladies . . . . . J. D. FRASER

*** See separate program for ladies' events.***

*PROGRAM

Wednesday, May 20th

9:00 a.m. REGISTRATION

10:00 a.m. ROOM A

MODERN INSTRUMENTS OF PHYSICAL OCEANOGRAPHY AND THEIR USE IN WATERS OF INTEREST TO CANADA

J. R. Longard, M.Sc.,
Naval Research Establishment,
Dartmouth, N.S.

ROOM B

STEAM GENERATION OF POWER AT NOVA SCOTIA LIGHT & POWER CO. LIMITED

J. W. MacDonald, M.E.I.C.,
Assistant Chief Engineer, Nova Scotia Light & Power Co. Ltd., Halifax, N.S.

11:00 a.m. ROOM A

REFRIGERATION AND STORAGE OF FISH IN TRAWLERS

W. A. McCallum, M.E.I.C.,
Development Engineer, Fisheries Experimental Station, Halifax, N.S.

ROOM B

ECONOMY THROUGH STANDARDIZATION

D. R. Keck, Resident Engineer,
Canadian Chemical Co. Limited,
Edmonton, Alberta.

2:00 p.m. ROOM A

FUNDAMENTAL CONSIDERATION IN THE DESIGN OF EXTERIOR WALLS FOR BUILDINGS

N. B. Hutcheon, M.E.I.C.,
Professor of Mechanical Engineering,
University of Saskatchewan,
Saskatoon.

ROOM B

MECHANIZATION OF THE WABANA MINE

C. M. Anson, M.E.I.C.,
Vice-President and General Manager,
Dominion Iron & Steel Limited,
Sydney, N.S.

3:00 p.m. ROOM A

IMPROVEMENTS IN ELECTRODE BOILERS

Milton Eaton, M.E.I.C.,
Electrical Engineer,
Shawinigan Chemicals Ltd.,
Shawinigan Falls, P.Q.

ROOM B

SYDNEY FOAMED SLAG AS A LIGHTWEIGHT AGGREGATE

M. R. Foran, M.E.I.C.,
Professor Chemical Engineering,
Nova Scotia Technical College.

Spencer Ball, M.E.I.C.,
Professor Civil Engineering,
Nova Scotia Technical College.

R. E. Johnston, Technical Director,
L. E. Shaw Limited, Halifax, N.S.

J. R. Wallace, M.E.I.C.,
Director of Research & Development,
Dominion Iron & Steel Limited,
Sydney, N.S.

4:00 p.m. ROOM B

NATURAL RESOURCES OF THE NORTH WEST TERRITORIES AND YUKON

Maj. Gen. H. A. Young, M.E.I.C.,
Deputy Minister of Resources and Development, Ottawa, Ont.

**6:30 p.m. RECEPTION—
NOVA SCOTIAN HOTEL**

7:00 p.m. DINNER—BALL ROOM—$3.00

Chairman: G. Frank Bennett, M.E.I.C.
Chairman, Halifax Branch.

Speaker: His Worship
R. A. Donohue,
Mayor of Halifax

Subject: NOVA SCOTIA

(Dress Informal.)

**8:30 p.m. BALL ROOM—
NOVA SCOTIAN HOTEL**

ANNUAL GENERAL MEETING

Reports and election of Officers. The President will deliver the annual address. At the conclusion of the meeting there will be a "Social Hour".

*Subject to minor changes.

Thursday, May 21st

):00 a.m. ROOM A

GAS DYNAMICS

D. L. Mordell, M.E.I.C.,
Director, Gas Dynamics
Laboratory of McGill University,
Montreal, P.Q.

ROOM B

THE HALIFAX-DARTMOUTH BRIDGE

Dr. P. L. Pratley, M.E.I.C.,
Consulting Engineer, Montreal, P.Q.

):00 a.m. ROOM A

COMPACTED EARTH FILL DAM FOR MARITIME HYDRO-ELECTRIC PROJECT

J. A. Daniliauskas, M.E.I.C.,
D. F. Coates, Jr., E.I.C.,
Power Corporation of Canada Ltd.,
Montreal.

ROOM B

DEVELOPMENT OF A FISH PROCESSING PLANT AT LOUISBURG, N.S.

J. G. Frost, M.E.I.C.,
Wiggs, Walford, Frost & Lindsay,
Consulting Engineers, Montreal.

1:00 a.m. ROOM B

THE DEVELOPMENT OF POWER FROM ATOMIC ENERGY IN CANADA

I. N. MacKay, M.E.I.C.,
Head, Plant Design Branch,
Chemistry & Engineering Division,
Atomic Energy of Canada, Limited,
Chalk River, Ont.

2:30 p.m. LUNCHEON - BUFFET - $2.75

LORD NELSON HOTEL

2:30 p.m. PLANT VISITS

Halifax Shipyards
Halifax-Dartmouth Bridge
Fish Processing Plant

4:00 p.m. BOAT TRIP - HALIFAX HARBOUR

HOTEL ACCOMMODATION AND TRANSPORTATION

Dalhousie University is to be the headquarters for all technical events and these will be held in the new Arts and Administration Building on the main campus. By courtesy of the University authorities, the living and dining facilities of Shirreff Hall, the beautiful women's residence at the University, have been offered for the use of our members at an exceptionally low rate. There are a few single rooms for men only in the men's dormitory. Blocks of rooms have also been reserved at both the Lord Nelson and Nova Scotian hotels.

You are urged to make requests for room reservations as early as possible. Single hotel rooms are very scarce and it is recommended that those desiring single rooms apply for accommodation at the University, otherwise it will be necessary in most instances to share a twin-bedded double room. In such cases it will, of course, be better if sharing arrangements can be worked out in advance and indicated on the application for reservations.

All requests for reservations should be addressed to —

The General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal 2, Que.

Special reduced convention fares have been authorized for rail travel in Canada. If you require a special fare certificate, it will be mailed to you from headquarters. This entitles you and members of your family to round-trip tickets at one and one-half times the one-way fare plus twenty-five cents.

Trans-Canada Air Lines have special convention rates for parties of ten or more. Your local T.C.A. agent will gladly supply details.

No matter how you travel be sure to make your reservations now to avoid disappointment.

REGISTRATION

Founders' Room, Administration Building
3:00 p.m. to 6:00 p.m. — May 19
9:00 a.m. to 6:00 p.m. — May 20-22
Members $5.00
Juniors $3.00 - Non-members $6.00
Ladies, guests of the Institute, speakers, authors and students — complimentary.

"MURIEL'S ROOM"

"Muriel" will again extend her hospitality to all registered members, ladies and guests, thanks to the continued co-operation of Canadian industry.

You Must Wear Your Registration Badge

PLEASE NOTE
Prices for meals include gratuities. Tickets must be obtained in advance and refunds cannot be made less than three hours in advance of any function.

Friday, May 22nd

9:00 a.m. **ROOM A**
INDUSTRIAL RADIOGRAPHY
R. E. MacDonald, M.E.I.C.,
Naval Research, Dockyard Laboratory,
H.M.C. Dockyard, Halifax, N.S.

ROOM B
MODERN DEVELOPMENTS IN PRESTRESSED CONCRETE
Neils Thorsen,
Chief Engineer,
Freyssinet Co., Inc., New York City.

10:00 a.m. **ROOM A**
SOME MARINE ASPECTS OF CATHODIC PROTECTION
K. N. Barnard, Group Leader,
Physical Chemistry Group,
Naval Research Establishment,
Dartmouth, N.S.

ROOM B
PRESTRESSED CONCRETE BUILDINGS
P. A. Benn, General Manager,
Pre-compressed Concrete
Engineering Co. Ltd.,
Montreal, P.Q.

11:00 a.m. **ROOM A**
THE ATMOSPHERIC CORROSION OF ARCHITECTURAL METALS
Hugh P. Godard,
Head of Chemical Division,
Aluminum Laboratories Ltd.,
Kingston, Ont.

ROOM B
PRESTRESSED CONCRETE BRIDGES IN ALBERTA
L. G. Grimble, M.E.I.C.,
Chief Bridge Engineer,
Department of Highways,
Province of Alberta, Edmonton, Alta.
R. W. McManus, M.E.I.C.,
Assistant Professor,
Department of Civil Engineering,
University of Alberta, Edmonton, Alta.

2:00 p.m. **ROOM A**
CANADA'S AIR DEFENCE
Air Vice-Marshal A. L. James, M.E.I.C.,
Air Officer Commanding
Air Defence Command, R.C.A.F.,
St. Hubert, P.Q.

2:00 p.m. **ROOM B**
A 100% CANADIAN ACCOMPLISHMENT: THE PRESTRESSED CONCRETE GRANDSTAND AT THE BASEBALL STADIUM OF SHERBROOKE, P.Q.
G. M. Demarque, M.E.I.C.,
Chief Engineer,
The Preload Company of Canada, Ltd.
Montreal, P.Q.

3:00 p.m. **ROOM A**
MANAGEMENT PANEL DISCUSSION
"Management — its Responsibility for Equalizing Development of Technical and Social Sciences"

ROOM B
DESIGN OF A PRESTRESSED CONCRETE BRIDGE
A. L. van den Brandeler, M.E.I.C.,
Computer Engineer,
B.C. International Engineering Co.,
Vancouver, B.C.

4:00 p.m. **ROOM A**
MANAGEMENT PANEL — Continued

ROOM B
PRESTRESSED CONCRETE APPLIED TO ROOF JOISTS
A. M. Lount, Jr. E.I.C.,
Assistant Engineer,
Hydro Electric Power Commission of Ontario, Toronto, Ont.

4:30 p.m. CONCLUSION AND SUMMATION
R. F. Legget, M.E.I.C., Director,
Division of Building Research,
National Research Council,
Ottawa, Ont.

6:30 p.m. **RECEPTION—**
H.M.C.S. Stadacona

7:15 p.m. **THE ANNUAL BANQUET**
Dinner — The Gymnasium —
$5.00 per person (including dance)
Speaker: Sir Robert Watson-Watt,
C.B., F.R.S., M.E.I.C.,
President, Adalia Limited,
Montreal, P.Q.
Chairman: Dr. J. B. Stirling,
President of the Institute.
Presentation of medals and prizes, introducing the new president, R. L. Dobbin and new members of Council.
(Dress optional.)

10:00 p.m. **ANNUAL DANCE**
The Gymnasium, H.M.C.S. Stadacona,
Mart Kenney and his
"Western Gentlemen"
$3.00 per person (dance only).

RECEPTION

After the banquet there will be an informal reception when members and guests may meet the incoming and retiring presidents; the Chairman of the Halifax branch, Mr. G. F. C. Bennett; the Chairman of the Annual Meeting Committee, Mr. R. F. McAlpine, and their wives.

SIR JOHN KENNEDY MEDAL
(Continued from page 408)

of the Canadian Chamber of Commerce and is on the Board of Directors of the Canadian Independent Telephone Association, Toronto. He also headed the Victory Loan Campaign in Oxford County for nine consecutive years.

Mr. Vance joined the Engineering Institute as a Student in 1914 and as he rose in professional status held many offices, finally becoming President in 1950.

McGill Conference on Construction Integration

A group of some 130 leading educators, architects, research directors, engineers, builders, suppliers, town planners, insurance executives, welfare officials, sociologists and McGill students gathered in Montreal, March 11th and 12th for a two-day discussion of "How greater integration of the construction industry could be achieved."

Sponsored by the School of Architecture of McGill University at the termination of a demonstration students training course in industry integration, emphasis was placed on recent advances in educational techniques developed by the technical assistance administration of United Nations, through a mission to the Inter-American Housing Centre at Bogotá, Colombia, later used as a pattern for training at the McGill school of architecture. Featured also was a visit to the Montreal Building Trades Apprenticeship Centre, used by McGill students as a "construction laboratory", where creative thinking is developed in three-dimensional materials of construction rather than through mathematical computations and two-dimensional drawings. Here delegates examined an almost full scale mock-up five-room house built by students of McGill and of l'Ecole des Beaux Arts, at a cost said to be just over $4,000, less than half the cost of the small house of today.

John Bland, Director of the School of Architecture, told delegates the broad ultimate objective of the conference was nothing less than the substantial improvement of man's physical environment through closer integration of construction, through more effective work methods, greater understanding between segments of the industry and effective use of laboratory techniques. He felt it was possible to get significantly better structures at lower prices.

Various speakers observed that co-ordination of purpose rather than of products and details, was what was needed; that more attention to human needs was the real necessity; that any integrated program must include an all-embracing social, cultural and spiritual quality. Others contended that the greatest need was for prior organization of all phases of the construction trades; that 85 per cent of today's research was centred on highways, with almost none for housing; that educators the world over were working on the same problem without any correlation for a basic research plan.

Speakers representing the construction industry expressed regrets at early press reports of the conference, which had pictured the construction industry as having done a poor job on integration, whereas co-ordination between owner, architect, engineer and contractor was the first consideration of the builder, and this spirit of co-operation could be extended through every phase.

The McGill Conference is a new approach to an old theme. Serious study was devoted some eight years ago to "stabilizing the industry", by the National Planning Association in the U.S. Recommendations included wide facilities for technical research, a works control authority for timing federal construction, equal allocation of tax sources among various levels of government, and expansion of credit. During the last war Doctors Marsh and Firestone, then of the Dept. of Veterans Affairs at Ottawa, published an exhaustive analysis of ways for integrating the construction industry in Canada. Some of their recommendations have already been carried out. A Division of Building Research has been established at National Research. The National Building Code has been revised. A special materials committee was set up after VJ Day by the Canadian Construction Association which did much towards speeding up and bringing into balance the production of various building materials and towards avoiding the problems of shortages plaguing the housing program in early postwar years. But as long as the present demand for construction and the current housing shortage continue, little incentive exists to spur further efforts towards cheaper dwellings, beyond what is already being done.

Expressing the view that McGill University was the ideal choice for leading the move toward cheaper housing units, delegates voted a resolution at the close of the meeting commending McGill and all other organizations participating with it, for their efforts in organizing the Conference. They also recommended that McGill should work out a detailed program for integration of construction in Canada and that the Building Research Advisory Board in the United States should be asked to take the lead there with a similar program. Appeals would also be addressed to the Pan American Union and the United Nations, to lead in sound and effective integration programs throughout the world.

Presentation of 1953 James Watt International Medal

The 1953 James Watt International Medal was presented to Sir Harry R. Ricardo, B.A., LL.D., Hon. M.I.Mech.E., F.R.S., at the general meeting of the Institution of Mechanical Engineers on January 23. The award was made to Sir Harry for his contributions to knowledge of the fundamental principles of internal-combustion engines and the application of these principles to design and development.

Sir Harry Ricardo was educated at Rottingdean Preparatory School, Rugby School, and Cambridge University where he graduated B.A. He received the honorary degree of LL.D. in 1943 at the University of Birmingham.

In 1907 he joined Messrs. Rendel and Robertson, consulting engineers (later Rendel, Palmer and Tritton).

During 1916 he began practising as an independent consulting engineer, and in 1918 formed a company (now known as Ricardo and Company, Engineers (1927) Ltd.), of which he is chairman of directors. The Company built an experimental laboratory at Shoreham-by-Sea, Sussex, for research and development in connection with internal combustion engines.

Sir Harry was elected a fellow of the Royal Society in 1929, and

served on its council from 1936 to 1938. In 1942 he was elected an honorary member of the American Society of Mechanical Engineers.

He has held many important offices, among which may be mentioned those of consulting engineer to the Mechanical Warfare Department (1914-18 war) and later to the Air Ministry and the Tank Department. He also served on the War Cabinet Engineering Advisory Committee (1941) and on the Coal and Gas Engines Research Committee, and has been a member of the Engine Subcommittee of the Aeronautical Research Committee since 1919; in 1946 he was its chairman. He is a member of the Scientific Advisory Committee, Ministry of Fuel and Power.

He was elected a member of the Institution of Mechanical Engineers in 1933, and served on the council from 1937 to 1941. He became a vice-president in 1942 and president in 1944, and served on the council as a past-president from 1945 to 1949. He was elected and admitted to honorary membership in 1949.

Sir Harry has read many papers before institutions and conferences at home and abroad, and has delivered memorial and other lectures before several kindred societies. He is the recipient of many award medals. In 1933 he delivered the sixth Thomas Lowe Gray Lecture entitled "High-speed Diesel Engines for Marine Service", and in 1950 the thirty-seventh Thomas Hawksley Lecture on "The Supercharging of Internal Combustion Engines". He has also contributed several papers to the Proceedings on the subject of internal combustion engines, and he prepared the report on the papers in Group 11, Engine Lubrication (Internal Combustion Engines), at the General Discussion on Lubrication and Lubricants in 1937. He was awarded the 1950 James Clayton Prize.

The James Watt International Medal was founded to commemorate the bi-centenary of the birth of James Watt, on January 19, 1736, an event which was destined to bring about a revolution in the utilization of power. It takes the form of an award every two years of a gold medal to an engineer of any nationality who is deemed worthy of the highest honour the Institution can bestow and that a mechanical engineer can receive. In making the award, the Institution has secured the co-operation of the principal engineering institutions and societies in all parts of the world as nominating authorities. The Engineering Institute of Canada has participated on behalf of this country.

Previous recipients of the medal have been:

Sir John A. F. Aspinall (Britain), 1937; Henry Ford (U.S.A.), 1939; Professor Aurel Stodola (Switzerland), 1941; A. F. M. Mitchell (Australia), 1943; Dr. F. W. Lanchester (Britain), 1945; Professor Stepan Timoshenko (U.S.A.), 1947; Dr. Fredrik Ljungstrom (Sweden), 1949; Dr. H. H. Blache (Denmark), 1951.

Professional Associations Mark Progress at Annual Meetings

Association of Professional Engineers of Ontario

The annual meeting of the Association of Professional Engineers of Ontario was held at the Royal York Hotel in Toronto on January 24, 1953. Presiding at the meeting was 1952 President O. D. Johnston, M.E.I.C., and representing sister organizations were R. M. Richardson, M.E.I.C., president of the Dominion Council of Professional Engineers; Louis O'Sullivan, M.E.I.C., president of the Corporation of Professional Engineers of Quebec; B. A. Monkman, M.E.I.C., president of the Newfoundland Association; and Leopold Nadeau, M.E.I.C., general secretary of the Quebec Corporation.

The guest of honour and guest speaker at the luncheon was Sir Robert Alexander Watson-Watt, C.B., F.R.S., who was introduced by Dean K. F. Tupper, M.E.I.C., of the University of Toronto.

Sir Robert, who is credited with the discovery of radar, chose as his subject, "Is the Customer Always Right?" Speaking directly to the members of the engineering profession, he said that their education should be carried much farther than a knowledge of their particular branch of engineering.

In presenting his report covering the year's activities, Past-President O. D. Johnston attributed the steadily growing general activity of the Association to the effective public relations program and the increasing assistance of members. In his opinion the highlight of the year was the establishment of the new committee on "professional status". A group income protection insurance plan was also instituted during the year. In the national field the outstanding event of 1952 was the formation of a licensing body in Newfoundland. Standardization of registration across Canada was responsible for the longest period of

Left to right: O. D. Johnston, M.E.I.C., 1952 president; Sir Robert Watson-Watt, C.B., M.E.I.C., speaker at the annual meeting, and J. Herbert Smith, M.E.I.C., the new president of the Ontario Association.

discussion. Considerable progress was made, but nothing as yet has been finalized. The schedule of minimum salaries had its full share of consideration with the result that Quebec, British Columbia, Nova Scotia and Ontario are presently using the same set-up.

In addition to the business sessions and the luncheon, the exhibition of paintings by members of the Association, who include art as one of their hobbies, attracted much interest and evoked highly complimentary reports from art critics of the press who viewed the exhibition.

The 1953 council of the Association comprises J. H. Smith, M.E.I.C., of Toronto, as president; W. L. Sagar, M.E.I.C., of Toronto, as first vice-president; J. R. Montague, M.E.I.C., of Toronto, as second vice-president; and O. D. Johnston, M.E.I.C., of Toronto, as past-president.

The civil branch councillors are N. A. Eager, M.E.I.C., of Hamilton; D. S. Ellis, M.E.I.C., of Kingston; and R. C. McMordie, M.E.I.C., of Toronto. The chemical and metallurgical councillors are G. W. Ames, M.E.I.C., of Sarnia; C. T. Carson of Windsor; and G. R. Smye of Hamilton. The electrical branch councillors are W. J. Gilson of Toronto; R. V. L. Handforth of Toronto; and A. W. Murdock of Toronto. The mechanical and industrial branch councillors and J. H. Fox, M.E.I.C., of Toronto; G. R. Lord, M.E.I.C., of Toronto; and L. C. Sentance, M.E.I.C., of Hamilton. The mining branch councillors are M. W. Hotchin of Kirkland Lake; W. A. Hutchison, of South Porcupine; and R. C. Mott of Falconbridge.

The Nova Scotia Association of Professional Engineers

The 1953 officers of council of the Association of Professional Engineers of Nova Scotia are President G. J. Currie, M.E.I.C., of Halifax, senior civil and hydraulic engineer of the Nova Scotia Light and Power Company; Vice-President J. E. Clarke, M.E.I.C., of Middleton, divisional engineer of the Provincial Department of Highways; and Past-President D. J. MacNeil, M.E.I.C., of Antigonish, professor of geology at St. Francis Xavier University.

The councillors for the Halifax area are T. P. Lusby, M.E.I.C., of Halifax, chief engineer of the Provincial Department of Public Works; K. E. Whitman, M.E.I.C., of Halifax, consulting engineer; V. M. Coy, M.E.I.C. of Halifax, senior electrical engineer of Nova Scotia Light and Power Company Limited; and M. F. Dean, M.E.I.C., of Dartmouth, civil engineer of Starr Manufacturing Works Limited. Councillors elected from points outside the Halifax area are J. N. Ritchie, M.E.I.C., of Amherst, plant engineer of Robb Engineering Works; C. M. Anson, M.E.I.C., of Sydney, vice-president and general manager of Dominion Iron and Steel Company Limited; and L. D. Wickwire of Liverpool, assistant chief engineer of Mersey Paper Company Limited.

Association of Professional Engineers of New Brunswick

The Association of Professional Engineers of New Brunswick held its annual meeting on January 29, 1953, at the Admiral Beatty Hotel in Saint John.

Guest speaker at the dinner following day-long business sessions of the provincial association was R. M. Richardson, M.E.I.C., president of the Dominion Council of Professional Engineers, who spoke to a joint gathering of Association members and members of the Engineering Institute.

Speaking on the unity of the engineering profession, Mr. Richardson said, "There should be no conflict between Dominion Council as the representation of the provincial associations and the other engineer organizations. The time has come to forget personalities and pull together as one profession, each organization playing its part in the work it is best suited to do."

Mr. Richardson was introduced by A. G. Watt, M.E.I.C., chairman of the Saint John Branch of the Engineering Institute who presided at the dinner. He was thanked by Dean E. O. Turner, M.E.I.C., of the University of New Brunswick.

One of the highlights of the occasion was the presentation of the association scholarship to R. I. MacDormand, S.E.I.C., fourth-year engineering student of the University of New Brunswick.

Elected as president of the New Brunswick Association for 1953 was J. D. MacKay, M.E.I.C. Mr. MacKay died very suddenly on February 5, shortly after this announcement was made. Please see *Obituaries* in this issue. J. M. M. Lamb, M.E.I.C., was elected vice-president. R. D. C. Clark, M.E.I.C., is secretary-registrar; and D. O. Turnbull, M.E.I.C., past-president.

The councillors elected for the Saint John area are D. R. Webb, M.E.I.C., and A. R. Bonnell, M.E.I.C.; for Moncton, N. B. Eagles, M.E.I.C., and W. D. G. Stratton, M.E.I.C.; for Fredericton, E. E. Wheatley, M.E.I.C., and S. B. Cassidy, M.E.I.C.; and for Chatham, H. G. Rogers, JR.E.I.C.

News of Other Societies

There has been established at the Ontario Research Foundation a fellowship sponsored by the **Tin Research Institute,** London, England. The purpose of the project is to provide free technical information and service to users of tin in all its applications across Canada.

Its office, known as the "Technical Service Centre for Tin", will be located at the Ontario Research Foundation, 43 Queen's Park, Toronto 5, Ont., and E. A. Lanchester has been appointed development engineer of the Service.

The 36th annual conference of **The Chemical Institute of Canada** (18 Rideau St., Ottawa 2, Ont.) to be held at Windsor, Ont., June 4, 5, and 6, will be an international meeting. The Windsor conference committee and the members of the Essex-Kent Section of the Chemical Institute are receiving whole-hearted co-operation from similar scientific and technical groups in Detroit.

The preliminary program of the 73rd annual convention of the **American Water Works Association Inc.** (521 Fifth Avenue, New York 17, N.Y.) is available from the Association. The convention will take place at Grand Rapids, Michigan, May 10 to 15, 1953.

Notice has been received of the spring meeting of the **Society for Experimental Stress Analysis** (Central Square Station, Cambridge 29, Mass.) at Hotel Schroeder, Milwaukee, Wisconsin, May 20-22, 1953.

The Class of 1953

Once again the cycle is complete. The universities are making the final test of their teaching and of the students' ability to absorb it. By the time this is published it will be over; the hundreds of earnest anxious young men will know the worst; the working population of Canada will be augmented materially.

The Engineering Institute of

Canada welcome the engineering graduates into the profession. They come like a blood transfusion into a body that needs them and can use them to great advantage. The task of developing this finest country in the world is largely theirs. They are the future, and the future belongs to Canada.

The long task is over. The years of close confinement, of concentration, of worry and doubt and of direction are now a part of the past, but a part upon which so much of the future will be built. The need of study and deep thought is not over but the fixed pattern of university education is complete. It is no mean task to meet these requirements, and every graduate may well feel proud that he came through, that he survived the long ordeal.

Sometimes people speak of becoming engineers "the hard way". They are referring to the few—a diminishing few in this country—who do not graduate from an engineering course but who get their knowledge in the field or in the shop. Anyone who considers that form of learning as the hard way has never taken an engineering course at a university. There are few things—if any—that a young man has to do that are as hard to accomplish as graduation in engineering. That is the real hard way—no fooling! That is why the Institute can so sincerely congratulate these young men. They have stuck to the job to the end. Victory is theirs—a victory which opens the door to a future full of opportunity and responsibility.

The Engineering Institute covers Canada. Its almost 16,000 members are in every centre. They extend their hands in welcome and in offer of friendship and assistance to these new engineers. They can be of real assistance to the young man either as members of a branch or as individuals. To the young man they say "Look to us and to the Institute to help you reach your objectives and your place in the social and professional world. It will be a pleasure to work with you."

The Institute salutes the class of 1953. May theirs be a life of opportunity and challenge, and may good fortune wait on all their efforts.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, March 27th, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

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J. F. Curran, *Uplands*
R. F. Eskell, *Montreal*
J. E. Harrington, *Chicago*
T. K. Hartglas, *Montreal*
P. A. E. Hess, *Camp Borden*
M. Hunka, *Lethbridge*
E. H. King, *S. Ste. Marie*
G. V. Knowles, *Montreal*
D. P. Lambert, *Toronto*
C. A. Leicht, *Kitchener*
W. R. Liobel, *Montreal*
J. Lunde, *Falconbridge*
J. P. McArthur, *Kemano*
A. H. Mack, *Toronto*
P. Maguire, *Windsor*
W. J. Nichols, *Montreal*
B. J. Palmer, *St. John's, Nfld.*
N. Perquin, *Montreal*
E. Poliansky, *Montreal*
W. H. Powell, *Peterborough*
W. T. N. Reeve, *Toronto*
A. G. Shack, *Toronto*
J. A. Sharp, *Kingston*
H. L. Sieber, *Bathurst*
R. H. Stuart, *Peterborough*
G. Urwin, *Toronto*
J. L. Ward, *Burlington*
R. A. Watson-Watt, *Montreal*
W. J. Weymark, *Montreal*
E. F. Wilson, *Toronto*

Juniors:

P. G. Andrews, *Hamilton*
J. J. Arnason, *Winnipeg*
L. A. Barth, *Montreal*
E. O. Butts, *Picton, Ont.*
R. E. Corrall, *Toronto*
G. Crevier, *Shipshaw*
W. Francl, *Vauxhall, Alta.*
T. L. Gibson, *Arvida*
R. A. Gunst, *Hamilton*
G. M. Harper, *Toronto*
F. A. Keddy, *Halifax*
P. H. Langlais, *Quebec*
R. A. Macdonald, *Vancouver*
C. H. Osborne, *London*
N. Partyka, *E. Kildonan*
E. R. Quinn, *Bathurst*
L. W. Skonieczny, *Toronto*
D. M. Stankiewicz, *Toronto*
G. L. Wilson, *London*

Transferred from the class of Junior to that of Member:

R. D. Archibald, *Trinidad*
A. E. Argue, *Belleville*
A. M. Berbrayer, *Indianapolis*
E. H. Fisher, *Windsor*
D. E. Haig, *Winipeg*
R. J. Hope, *Toronto*
M. Kostiuck, *Flin Flon*
S. J. Medwadowski, *Montreal*
J. K. C. Mulherin, *Montreal*
E. W. Nelson, *Port Arthur*
J. H. Nicholls, *Devon, Alta.*
C. W. Poole, *Swift Current*
P. D. Spector, *Boston*
L. H. Snelgrove, *Cornwall*

Transferred from the class of Student to that of Junior:

G. N. Farantatos, *Toronto*
R. R. Smith, *Calgary*

The following Students were admitted:

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J. Hyczdanski — S. Hiyashita
T. F. Jacobs — W. R. Musgrove
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J. Levy — C. A. Millar
D. M. McLaurin — M. J. Shelley

QUEEN'S UNIVERSITY

E. R. Corneil — P. G. Hill
W. S. Gard

UNIVERSITY OF TORONTO

D. B. Black — G. L. Oliver
B. A. M. Norel

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J. C. Bliss

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By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

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A. D. Tidsbury

Juniors:

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Junior to Member:

P. L. Fowler — J. G. Spencer

SASKATCHEWAN

Members:

M. Aaston — E.N. Spice
R. H. Barnett — W. M. Sproul
M. Kamen-Kaye — R. J. Tomlinson
W. W. Rechenmacher — A. H. Vossen
R. A. Schwieder

Juniors:

P. E. M. Noonan — L. E. Toth

Students:

W. M. Backlund — D. G. Munro
D. D. Barkwell — J. O. Pitts
P. W. Brown — J. E. Preece
J. W. Campbell — R. R. Real
M. J. Delisle — R. J. Schramm
L. S. Dillon — Z. D. Simo
R. W. Durie — J. C. Stamberg
V. F. Elliott — J. E. Sworder
J. A. Forrest — A. R. Towell
R. E. Francis — J. G. Trotter
E. H. Hanson — E. H. Watson
J. D. Henderson — A. B. Webb
N. D. Knowles — V. M. Whelen
D. D. McCormac — L. F. Wiebe
A. Mazuk — T. R. Windsor

Junior to Member:

W. J. Bunn — E. D. Ortloff
B. A. Deshaye — R. A. Scott
D. A. Ferguson — S. I. Stothers

Student to Junior:

J. C. MacKay — E. K. Sauer

NOVA SCOTIA

Members:

W. B. Bancroft — W. D. Hill
A. T. Dean — B. J. Keating

Junior to Member:

W. Angevine — B. St. C. Langille
R. P. Harrison — N. E. MacLean

QUEBEC

Members:

D. T. Nagle — E. M. Sloan
J. L. Ricard

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c/o Canadian Westinghouse Co.
Ltd., Hamilton, Ont.

Ross L. Dobbin, M.E.I.C.

President

of

The Engineering Institute of Canada

1953

Mr. Dobbin was born in Lindsay, Ontario but his family moved to Peterborough soon afterwards and all of his early education was received at the public and high schools there. Later he attended the Faculty of Applied Science and Engineering at the University of Toronto from which he graduated in mechanical engineering in 1910, receiving his degree of B.A.Sc. in 1911.

Like his immediate predecessor, J. B. Stirling, Mr. Dobbin gained his first engineering experience in Western Canada, where he served as resident engineer for Walter J. Francis & Company on the construction of the Moose Jaw Water Supply. Three years later he was appointed waterworks superintendent for the Peterborough Utilities Commission. Subsequently he was made acting manager and in 1927 became general manager, which position he held continuously until his retirement on April 1 of the present year.

Mr. Dobbin having been connected with the waterworks field ever since his graduation, it was natural that he should have had a long and active connection with the American Waterworks Association, which he first joined in 1914. During his long connection with the Association he presented before it many technical papers and was awarded its Diven Memorial Medal. He became chairman of the Canadian Section in 1922 and was elected president at the fifty-first convention of the Association in 1931, becoming the second Canadian to hold this high office in the long history of that body. Mr. Dobbin has likewise been a member of the Association of Professional Engineers of Ontario and of the Association of Municipal Electric Utilities for many years, and served as councillor of the former in 1927 and 1928, as well as president of the latter in 1930. Another important appointment held by Mr. Dobbin was that of member of the Senate of the University of Toronto from 1927 to 1932.

As a lifelong resident of the City of Peterborough and a prominent member of the community, Mr. Dobbin has set an outstanding example to our profession in his public service. Almost every worthwhile organization has received his whole-hearted support. He has served as president or director of the Red Cross, Y.M.C.A., Y.W.C.A., Children's Aid Society, Fair Board and the Nicholls Park Trust; to say nothing of his life-long interest in athletics and athletic organizations, service clubs and fraternal bodies.

Notwithstanding these many associations of long standing, Mr. Dobbin's connection with The Engineering Institute pre-dates all of the others. He became a Student member in 1910, transferred to Associate member in 1914 and became a Member in 1919. He was a charter member of the Peterborough Branch and served as its secretary for ten years before becoming its chairman. He was councillor for the Branch for fourteen years and was elected a vice-president of the Institute in 1936 and 1937.

With such a background of experience, Mr. Dobbin can be looked to for a contribution to the long record of Institute presidents in keeping with the high standards they have established. Furthermore, having retired from active business prior to taking office, he hopes to be able to devote much of his time to Institute affairs.

Newly Elected Officers of the Institute

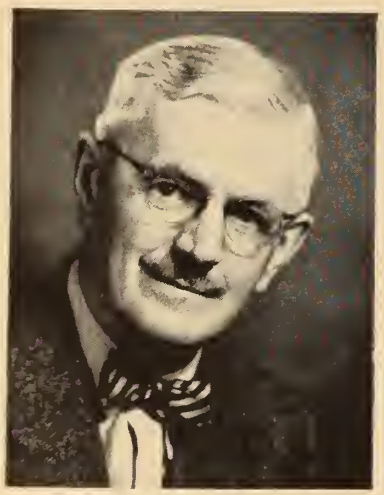
Prof. I. M. Fraser, M.E.I.C., head of the mechanical engineering department of University of Saskatchewan, has been elected vice-president of the Institute to represent the Western Provinces.

Professor Fraser's appointment as dean of the college of engineering of the University of Saskatchewan was announced some months ago, to be effective June 30, 1953, upon the retirement of Dean R. A. Spencer, M.E.I.C.

Professor Fraser, a past councillor of the Saskatchewan Branch of the Institute, joined the Institute in 1920 as a Junior.

He was born at Pictou, N.S., and received his early education there. He attended Dalhousie University, Halifax, and McGill University, Montreal, graduating from McGill with the degree of bachelor of science in applied science in 1919.

After working for one year as an instructor at McGill University and for a



I. M. Fraser, M.E.I.C.

year as a draughtsman with Dominion Engineering Works, Ltd., in Montreal, he went to the engineering staff of the University of Saskatchewan in 1921. He was assistant professor of mechanical engineering, being appointed professor in 1926, and head of the department in 1937.

Professor Fraser has been active in the work of the Institute, and in that of the Association of Professional Engineers of Saskatchewan. He was president of the Association in 1939, and councillor of the Institute in 1941. Recently he was appointed to the Fisheries Research Board of Canada.

G. R. Henderson, M.E.I.C., has been elected a vice-president of the Institute to represent the Province of Ontario.

Mr. Henderson's appointment as manager of the Sun Oil Company's refinery now under construction at Sarnia, Ont., was announced in February this year.

Before joining Sun Oil Company Mr. Henderson was vice-president and general manager of Catalytic Construction of Canada, Ltd., directing that Company's Canadian activities which include the building of Sun's Sarnia refinery. He had been chief engineer of the Polymer Corporation in Sarnia prior to his association with Catalytic Construction Company.

G. R. Henderson, M.E.I.C.

Mr. Henderson was born in London, Ontario. In 1925 he graduated with honours from Queen's University, Kingston, Ontario, where he received a degree in civil engineering. He served a two-year student apprenticeship with the Ontario Hydro-Electric Power Commission and later worked in various engineering capacities with Dominion Engineering Works, Ltd., and Power Corporation of Canada, Ltd., both of Montreal.

He joined the engineering staff of Shell Oil Company of Canada in 1932, advancing to chief engineer of Shell's Montreal refinery in 1936. During the critical war days of 1940, he went to England to supervise the building of Shell Oil's refinery at Heysham, Lancs. Two years later he was named chief engineer.

Returning to Canada in 1943, he joined Polymer Corporation, Ltd., as petroleum engineer on design and construction of its synthetic rubber plant, the only fully integrated rubber production project in the world, and later became chief engineer.

Mr. Henderson is a member of the Association of Professional Engineers of the Province of Ontario. He is a director of the Sarnia Chamber of Commerce, and a past chairman of the Sarnia Branch of the Engineering Institute.

I. R. Tait, M.E.I.C.

I. R. Tait, M.E.I.C., has been re-elected a vice-president of the Institute to represent the Province of Quebec. Mr. Tait had been elected in 1952 to the vice-presidency to replace Dr. J. B. Stirling, on the latter's nomination for the presidency.

Mr. Tait is consulting engineer of Canadian Industries Limited having relinquished his post as chief engineer of the Company in 1952. He had joined C-I-L as an electrical engineer in 1915, becoming assistant chief engineer in 1929, and chief engineer in 1939.

Mr. Tait was born in Montreal and studied at McGill University, graduating with a B.Sc. degree in electrical engineering in 1913; he also made a special study of electrochemistry. After graduation, he worked for two years with the Canadian Westinghouse Company at Hamilton, Ontario.

Mr. Tait holds membership in the Associations of Professional Engineers of Ontario, Manitoba, British Columbia, and in the Corporation of Professional Engineers of Quebec. He is affiliated also with the American Society for Testing Materials, the Electrochemical Society and the National Fire Protection Association.

Mr. Tait joined the Institute in 1922 as an Associate Member, transferring to Member in 1940. He has served the Montreal Branch as chairman and as a

councillor. He has aided in the work of the Institute as a member and chairman of the publication and finance committees, and on the committee on employment conditions.

He is also a member of the metropolitan board of directors of the Montreal Y.M.C.A.

T. A. J. Leach, M.E.I.C., will represent

T. A. J. Leach, M.E.I.C.

the Vancouver Island Branch on the Council of the Institute.

Mr. Leach is from Kamsack, Saskatchewan, a graduate of University of Saskatchewan in the civil engineering class of 1938.

He was a junior engineer with the Prairie Farm Rehabilitation Board in Saskatchewan for two years, and an engineer with the Department of Transport on airport location and construction for a further two years. He served from 1942 to 1946 as a lieutenant with the R.C.E., being stationed in North West Europe with the No. 2 Field Survey Company. On his return he worked for a year as resident engineer for the Saskatchewan Department of Highways. In 1947 he went to his present position as chief hydraulic engineer of the Water Rights Branch, Department of Lands and Forests, Victoria.

Mr. Leach is a former chairman of the Vancouver Island Branch of the Institute. He is a member of the Association of Professional Engineers of British Columbia, and an associate member of the American Society of Civil Engineers.

J. E. Macdonald, M.E.I.C., has been elected a councillor of the Institute to represent the Vancouver Branch.

A past chairman of the Vancouver Branch of the Institute, he is construction superintendent of the British Columbia Electric Company Limited.

Born in Vancouver, Mr. Macdonald is a graduate in mechanical engineering from the University of British Columbia, class of 1931. He was associated with the West Kootenay Power and Light Company for eight and a half years before going to the B.C. Electric Company in 1939.

In 1940 he joined the R.C.A.F., on leave of absence. Overseas twice, he was engaged in aeronautical engineering and specialized in construction and acceptance of Canadian-built Mosquito bombers. He was a squadron leader when leaving the R.C.A.F. and he returned to the Company as a construction engi-

John E. Macdonald, M.E.I.C.

neer. A year later he received the appointment as superintendent of construction.

M. L. Wade, M.E.I.C., has been re-elected to represent the Central British Columbia Branch on the Council of the Institute.

Mr. Wade has been active in the work of the Central British Columbia Branch since its inauguration in 1949. He is also a member of the Association of Professional Engineers of British Columbia.

Originally from San Francisco, Calif., Mr. Wade attended public and high schools in British Columbia. He studied also at McGill University, graduating in electrical engineering in 1912.

He was employed in construction and municipal engineering in British Columbia for the next two years, after which he was associated with Canadian Westinghouse Company as an erecting engineer in Montreal and Hamilton, and as a sales engineer in Winnipeg. He practised engineering in Regina for two years, and from 1921 to 1923 was associated with Canadian General Electric Company at Vancouver as a service engineer.

He joined the East Kootenay Power Company Limited as superintendent of generating stations in 1923, being appointed general superintendent the following year. In 1930 he was construction superintendent for the Adams River site investigation for the West Kootenay

Ernest Mason, M.E.I.C.

Power & Light Company. During the next few years he was associated with municipal projects at Salmon Arm, B.C., and Cranbrook, B.C. He joined the Department of Public Works of British Columbia in 1934 as assistant district engineer at Kamloops. He has been a consulting electrical and hydraulic engineer at Kamloops for many years.

Ernest Mason, M.E.I.C., chief design engineer of The Consolidated Mining and Smelting Company of Canada Limited, Trail, B.C., has been elected to represent the Kootenay Branch of the Institute as councillor.

Mr. Mason is a charter member and past chairman of the Kootenay Branch. He is also a member of the Association of Professional Engineers of British Columbia and past chairman of the eastern district advisory council of the Association.

A past chairman of the Trail Town Planning Commission, Mr. Mason serves also as a member of the committee appointed to consider revisions to the British Columbia boiler code.

Born at Bolton, Lancashire, England, he studied engineering at Bolton Technical School and Manchester College of Technology. He has been employed by The Consolidated Mining and Smelting Company of Canada Limited continuously since 1922 as designer, chief draughtsman, and assistant to the chief engineer. He was appointed chief design engineer in 1945. He is chairman of the pressure vessels committee of the Company.

Before coming to Canada in 1922, Mr Mason was employed as a designer of small tools and machine tools in England by Rolls Royce, Derby; Dobson and Barlow Limited, Bolton; Hans Renold, Manchester; Thomas Ryder Limited, Bolton; and Chatwood Safe Company, Bolton. From 1913 to 1916 he was employed as a machinist in Hamilton, Ontario.

E. L. Smith, M.E.I.C., will represent the

E. L. Smith, M.E.I.C.

Edmonton Branch on the Council of the Institute.

Mr. Smith was born in Wentworth, N.S., and moved to the Edmonton District in 1918 with his parents. He completed high school and normal school training in Edmonton. He graduated with the degree of bachelor of science in chemical engineering from University of Alberta in 1930. While attending uni-

versity and during the years after he worked as assistant chemist and chief chemist with the Marlboro Cement Company.

G. W. Parkinson, M.E.I.C.

During the university year, 1931-32, he took post graduate work in physical chemistry. However during the depression of the thirties he went back to school teaching for a time.

Mr. Smith joined the staff of the City of Edmonton municipally-owned power plant and water treatment plant in 1935. He was the chemical engineer in charge of the boiler feed water treatment for high pressure steam plant, and of water treatment and softening for the city supply. He is at present employed with the City of Edmonton power plant department.

Mr. Smith was chairman of the Edmonton Branch of the Institute in 1951-52. He had served on the Branch executive for three years previously. He is a member of the Association of Professional Engineers of Alberta, and of the Western Canada Water and Sewage Conference.

G. W. Parkinson, M.E.I.C., is the councillor of the Institute representing the Saskatchewan Branch.

Mr. Parkinson is chief of the design division, Prairie Farm Rehabilitaton, Department of Agriculture.

He is a graduate of the University of Saskatchewan, having received a B.Sc. degree in civil engineering in 1929. For two years he followed graduate studies at Lehigh University, Bethlehem, Pa., and was awarded an M.Sc. degree in civil engineering.

Returning to Saskatoon, Mr. Parkinson was with the city engineer's department in 1931, and worked at designing and estimating on various projects until 1936. Then he joined the staff of the Saskatoon Technical Collegiate as an instructor in mechanical drawing. He returned to the University of Saskatchewan in 1938 as an instructor and lecturer, and remained until 1946, when he joined the P.F.R.A. as a designing engineer.

Mr. Parkinson has been active in the work of the Institute, serving in 1950 as chairman of the Saskatchewan Branch. He has been on the Council previously, the representative of the Association of Professional Engineers of Saskatchewan.

H. M. Olsson, M.E.I.C., will represent the Lakehead Branch on the Council of the Institute.

H. M. Olsson, M.E.I.C.

Mr. Olsson came to Canada in 1925 after completing his engineering studies in Sweden and Germany, and graduating that year.

On arriving in Winnipeg he worked first with the Canadian National Railways there. He was employed on the foundation of a new hotel in Minaki, Manitoba, and later on the construction of the Hudson Bay store in Winnipeg for Carter Halls Aldinger Company, the contractors.

In 1926, he worked for a time as a draughtsman with the Dominion Bridge Company in Winnipeg and in December of the same year he joined the staff of the C. D. Howe Company on designing and draughting. He has been with this Company since that time, except during the years 1932-1935, when he was employed with MacDonald Engineering Company, Toronto, and also with Anglin Norcross, contractors, on the new Ontario Hydro office building on University Avenue, Toronto.

He returned to C. D. Howe Company, Limited, in Port Arthur, Ont., in 1935 and was promoted to chief engineer in 1946 and to manager of the Port Arthur office in 1950, which position he still holds.

Mr. Olsson has been active in the Lakehead Branch of the Institute, serving as its chairman in 1949.

E. R. Eaton, M.E.I.C., has been re-elected to the Council of the Institute to represent the Sudbury Branch.

A charter member of Sudbury Branch on its formation in 1950, Mr. Eaton was its first councillor. He has been a member of the Institute since 1943. He is also a member of the Association of Professional Engineers of Ontario.

Born at Orillia, Ontario, he received his earlier education there. He attended the University of Toronto, graduating with the degree of B.A.Sc. in mechanical engineering in 1936.

Following graduation he joined the Steel Company of Canada Ltd., at Canada Works, in Hamilton, working on the improved performance of cold heading tools. In 1939 Mr. Eaton was appointed plant superintendent of the East Mill, and in 1945 project engineer for Canada Works.

Early in 1947 he joined Canadian Johns-Manville, and since that time has been located in Sudbury as district sales engineer.

E. R. Eaton, M.E.I.C.

A. K. Grimmer, M.E.I.C., of Temiskaming, Ont., has been elected to the Council of the Institute to represent the recently inaugurated Nipissing and Upper Ottawa Branch.

Mr. Grimmer is a graduate of the University of New Brunswick, having received B.A. and M.Sc. degrees in 1905 and 1906.

A. K. Grimmer, M.E.I.C.

He was city engineer at Fredericton for four years before going to the University of Manitoba as assistant professor of civil engineering for one year. From 1910 to 1915 he was city engineer at Medicine Hat, Alberta, after which he returned to Fredericton and worked as a consulting engineer. He designed and built the mechanical filtration plant for Woodstock, N.B., and other engineering works in the Province. He was employed in 1918-1919 on the reconstruction of Halifax after the explosion, being in charge of the construction of 250 new houses, and other projects. He

later supervised the construction of a seaplane base in North Sydney.

He went to Temiskaming in 1919 as town department engineer, later becoming town department manager for Riordon Company, and its successor, Canadian International Paper Company, Limited. Last year he retired as town department manager and is now consulting engineer on municipal engineering for the Company. He has been in charge of the development of Temiskaming into the present town of 3,000 population, incorporating modern installations of water, sewers, automatic telephone system, etc. He also supervised the construction of the Townsite of Thorne, Ont.

He is mayor of Temiskaming, and has been for 29 years. He has been chairman of all Victory Loan campaigns, and of the ration board during World War II. He is the regional chairman of the Canadian Federation of Mayors and Municipalities.

He is a member of the American Water Works Association, of the International City Managers Association, and of the Associations of Professional Engineers of Quebec and Ontario.

N. C. Cowie, M.E.I.C., will represent the North Eastern Ontario Branch on the Council of the Institute.

Mr. Cowie is from Espanola, Ont., an electrical engineering graduate of the University of Toronto, class of 1931.

N. C. Cowie, M.E.I.C.

He was associated from 1931 to 1946 with Great Lakes Power Company, at Sault Ste. Marie. He did general engineering work connected with operating and building hydro-electric supplies and public utility facilities. He then worked for two years as an electrical and hydraulic engineer in the Iroquois Falls Division of Abitibi Power & Paper Company, Iroquois Falls, Ontario. In 1948 he was appointed to his present position of assistant mill manager of the Iroquois Falls Division.

During 1945 and 1946 Mr. Cowie was the executive secretary of the Northern Ontario Reconstruction Council, Department of Reconstruction, on loan from the Great Lakes Power Company. He participated in the fifth annual management training course at the University of Western Ontario in 1952.

Interested in the work of the Institute, Mr. Cowie served for three years as secretary-treasurer and for one year as chairman of the Sault Ste. Marie Branch. He was appointed provisional chairman of the North Eastern Ontario Branch on its formation in 1951.

He is a member of the American Institute of Electrical Engineers and of the Association of Professional Engineers of Ontario. He was chairman of the North Eastern Ontario Branch, technical section, of the Canadian Pulp & Paper Association in 1951-52.

Mr. Cowie participates in church and community work. He served on the Sault Ste. Marie municipal council in 1945 and 1946.

J. G. Hoba, M.E.I.C., is the councillor of the Institute representing the Border Cities Branch.

Mr. Hoba, a past chairman of the Branch, is from Thorold, Ont. He studied mechanical engineering at Queen's University, graduating in 1940.

He was for a time a field construction engineer for Brunner Mond Company, Ltd., at Amherstburg, Ont. In 1941 he joined the Kelsey Wheel Company, Ltd., working on time study, production routing, and cost estimating, and in 1944 he became an industrial engineer for the Company. He joined the Ford Motor Company of Canada, at Windsor, Ont., in 1949. He worked in the overseas operations division of the Company, until August, 1950, after which he returned to the Kelsey Wheel Company, Ltd., at Windsor, Ont., and has become the assistant chief engineer.

J. G. Hoba, M.E.I.C.

W. H. Paterson, M.E.I.C., has been elected to the Council of the Institute representing the Toronto Branch.

Mr. Paterson who has been chief engineer of the Toronto Transportation Commission since May 1st, 1949, was born at Owen Sound, Ontario. He graduated from Queen's University with the degree of B.Sc. in civil engineering in 1934.

He obtained varied engineering experience in the eight years after graduation working successively with McArthur Construction Co., Clinton, Ont., as foreman; with the City of Owen Sound, Ont., as assistant city engineer; with McArthur Company, Allison, Ont., as resident engineer; General Supply Co., Toronto, as sales engineer, and

W. H. Paterson, M.E.I.C.

the Tropical Oil Co., Barranca, Bermeja, Colombia, South America, as engineer.

Mr. Paterson entered the Toronto Transportation Commission service in 1942, as assistant engineer. A year later he was appointed office engineer of the Rapid Transit Department and in 1946 engineer of rapid transit. In 1948 he was made executive assistant to the assistant general manager.

Mr. Paterson is a past chairman of the Toronto Branch of the Engineering Institute, a member of the Association of Professional Engineers of the Province of Ontario and of the American Society of Civil Engineers, and an associate member of the Institute of Professional Town Planners.

V. A. McKillop, M.E.I.C.

V. A. McKillop, M.E.I.C., has been re-elected the councillor of the Institute to represent the London Branch for the fourth successive term. A past chairman of the London Branch, Mr. McKillop is a trustee of the Harry F. Bennett Educational Fund.

Mr. McKillop was appointed general manager of the London Public Utilities Commission and London Railway Commission in May, 1952. He had been, since 1949, assistant general manager and secretary. He joined the staff of the Commission in 1924, serving as assistant engineer, engineer, and assist-

ant manager, prior to his 1949 appointment.

Mr. McKillop was born in West Lorne, and studied engineering at the University of Toronto, graduating in 1924 with a B.A.Sc. degree. He commenced a term as president of the London Kiwanis Club on January 1, 1953. Among his many professional interests, also, is his work as a trustee of the Canadian Section of the American Water Works Association.

T. Foulkes, M.E.I.C., will represent the Ottawa Branch on the Council of the Institute.

T. Foulkes, M.E.I.C.

Mr. Foulkes is from Campbellton, N.B. He graduated in 1926 in electrical engineering from University of New Brunswick.

That year he joined Canadian General Electric Company, completing their test course, and worked for a short time in the design engineering office. He spent ten years with the Spruce Falls Power and Paper Company working first as an electrician and later as a maintenance engineer in the mechanical department. He joined the operation and maintenance staff of J. R. Booth Limited in Ottawa in 1938, becoming plant engineer.

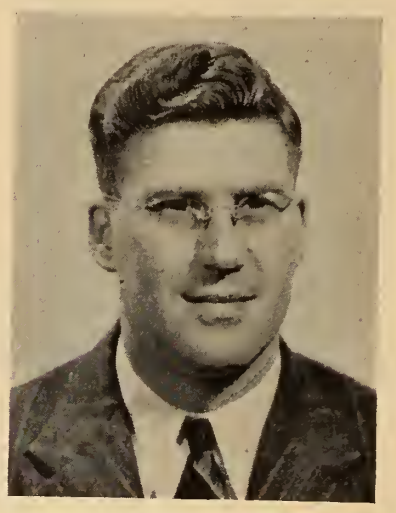
In 1946 after the amalgamation of the Booth and Eddy Mills, Mr. Foulkes was appointed steam and power engineer in charge of the electrical and steam departments. He held this position until 1952, when he was appointed to the position of chief plant engineer in charge of mechanical maintenance, construction, and the electrical and steam department.

Mr. Foulkes has been active in the Ottawa Branch of the Institute, serving on the management committee, and as Branch chairman in 1952.

D. L. Rigsby, M.E.I.C., will represent the Kingston Branch on the Council of the Institute. He is the general superintendent of engineering and services at Kingston for Aluminum Company of Canada, Limited.

He joined the Company in 1942 to work on production engineering. He had previously worked for two years with the British Air Commission. He was stationed in Montreal for the Commission at Canadian Car & Foundry Company, Limited, and later of the Consolidated Aircraft Corporation at San Diego, California.

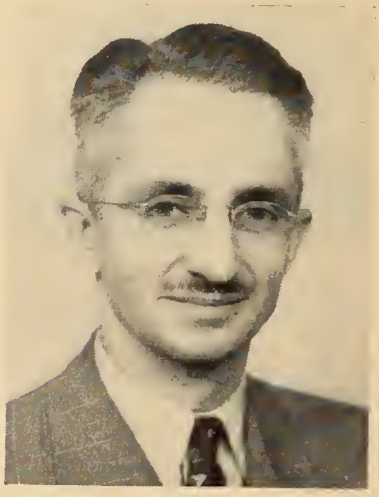
Coming from Galt, Ontario, Mr. Rigsby graduated from Queen's University in the mechanical engineering class of 1940.



D. L. Rigsby, M.E.I.C.

He joined the Engineering Institute as a Student in 1937. He is a past secretary-treasurer of the Kingston Branch, and a member of the Branch executive. He is affiliated also with the Association of Professional Engineers of Ontario, and with the Association of Iron and Steel Engineers.

Sydney Sillitoe, M.E.I.C., has been elected to represent the Belleville Branch on the Council of the Institute.



S. Sillitoe, M.E.I.C.

Mr. Sillitoe is production superintendent of the Belleville Plant of Northern Electric Company, Limited.

Born in Edmonton, Alta., he graduated from the University of Alberta in electrical engineering in 1931. He had earlier worked in railroad construction, in geological surveying, and in electrical engineering in the Edmonton Electric Light & Power Department. He was an instructor in draughting and physics at Alberta and McGill Universities from 1932 to 1934. He received the degree of M.Sc. from the University of Alberta in 1933.

He joined Northern Electric in 1934 as a junior engineer. He was appointed a technical engineer in charge of production engineering in 1943 and he was appointed broadcast equipment design engineer in 1946. Going to the Belleville plant in 1947, he was an equipment engineer, working later as an audio systems engineer, and on procurement service scheduling and inspection. He was appointed assistant superintendent at the Belleville plant in 1950, and in 1951 was made production superintendent.

Mr. Sillitoe is a member of the Association of Professional Engineers of Ontario, and an associate member of the Institute of Radio Engineers. He was a charter member of the Montreal Section of I.R.E., serving as its secretary in 1937-38 and its chairman in 1938-39. He has been associated with the work of the Canadian Radio Technical Planning Board, and of the Radio Manufacturers Association of Canada. He has served also on the rehabilitation advisory committee of the School of Electronics, of Ryerson Institute. He was secretary of the E.I.C. Belleville Branch on its formation in 1950, and has served previously as councillor for the Branch.

Mr. Sillitoe has presented technical papers to branches of the Engineering Institute and the Canadian Electrical Association, and at an annual meeting of the Canadian Institute of Mining and Metallurgy.

J. M. Jordan, M.E.I.C.

J. M. Jordan, M.E.I.C., is the councillor of the Institute representing the Port Hope Branch.

Mr. Jordan is the counties' engineer and road superintendent of the United Counties of Northumberland and Durham, Ont., and engineer and road superintendent for the Trenton Suburban Road Commission.

He is from Fenelon Falls, Ont. After attending school there and at Lindsay Collegiate, he went to University of Toronto, graduating in civil engineering in 1934.

He was associated for a year with the Ontario Department of Highways, and for two years with Curran & Briggs Limited, highway contractors, in Toronto. He spent one year on airport construction for the Department of Na-

tional Defence; and three years in mining with the McLeod-Cockshutt Gold Mines Ltd.

This was followed by five years' service with the Royal Canadian Engineers, during which time he was for two and one-half years overseas as a field engineer with the 3rd Battalion, R.C.E.

Returning to Canada he was a works officer in the Toronto area for a time, and was discharged with the rank of captain. Since 1946 he has been in his present position.

Jacques Benoit, M.E.I.C., has been elected a councillor of the Institute representing the Montreal Branch.

Born in Montreal, Mr. Benoit is a graduate of Ecole Polytechnique, Montreal, class of 1933, with the degree of bachelor of applied sciences.

He was for three years a sales engineer for Wallace & Tiernan Ltd., after which he was district sales manager in Montreal for the Company from 1937 to 1949. He has been associated since that time with H. W. Lea, consulting engineer, Montreal.

Mr. Benoit joined the Institute as a student in 1933. He has served the Montreal Branch as a member of the executive and is now a member of the Institute's Committee on Training and Welfare of the Young Engineer. He is a member of the Corporation of Professional Engineers of Quebec, of the American Water Works Association and of the Canadian Institute on Sewage and Sanitation.

Jacques Benoit, M.E.I.C.

E. D. Gray-Donald, M.E.I.C., vice-president and chief engineer and a director of Shawinigan Water and Power Company, has been elected a councillor of the Institute representing the Montreal Branch.

Mr. Gray-Donald has previously been a member of Council. In 1942, and again in 1948 he was elected to represent the Quebec Branch. He was chairman of that Branch in 1944. He is a past president of the Canadian Electrical Association, and of the Canadian Transit Association.

Born at Amoy, China, he came to Western Canada at an early age, and was educated at Collegiate School, Victoria, B.C. In 1915 he went to Great Britain and completed his schooling at George Watson's College, Edinburgh. Subsequently he worked at Vickers Ltd., in London and after the war he spent two years in Palestine on general engineering work, returning to Canada in 1921.

He attended McGill University, obtaining a B.Sc. degree in electrical engineering in 1926. After postgraduate studies at Laval University, Quebec, he obtained the degree of M.ès Sc. in 1934.

In June 1926, immediately after graduation, Mr. Gray-Donald joined The Shawinigan Water and Power Company and followed its apprenticeship course, being transferred to the Quebec Power Company in 1927. He filled successively the positions of assistant superintendent and superintendent of the power division; assistant general superintendent, and, from 1937 to 1942, general superintendent of Quebec Power Company and The Quebec Railway, Light & Power Company. He was then appointed chief engineer for both companies. He received the appointment to his present position in January 1950 and his election as a director of the Company was announced in March, 1953.

E. D. Gray-Donald, M.E.I.C.

Mr. Gray-Donald holds membership in the Institution of Electrical Engineers (Great Britain), the American Institute of Electrical Engineers, the Society of Automotive Engineers, the Corporation of Professional Engineers of Quebec, and the Canadian Electrical Association.

From 1940 to 1950 he was actively engaged in the work of the Reserve Army, and at retirement held the appointment of commander at Headquarters of the Fourth Division, Royal Canadian Electrical & Mechanical Engineers with rank of lieutenant-colonel.

F. L. Lawton, M.E.I.C., of Montreal, recently elected a councillor of the Institute, is a well-known Canadian hydro-electric engineer.

Graduating from the University of Toronto in 1923, he was for a short while with Canadian Westinghouse Company, Limited at Hamilton, following which he joined the General Electric Company at Schenectady, N.Y., on their test course. On completion of this, he was placed in charge of extensive large-scale tests designed to develop the theory underlying the steady-state and transient stability of long-distance power transmission systems.

In 1925, Mr. Lawton joined the Quebec Development Company, then completing the construction of the Isle Maligne hydro-electric power development, as an electrical engineer. In 1927 he became associated with the Duke-Price Power Company, Limited as assistant to the superintendent of operation, and in 1937 was appointed chief engineer of the successor Saguenay Power Company, Limited.

He soon assumed broader responsibilities in the Canadian aluminum industry, firstly as assistant chief engineer, Aluminum Company of Canada, Limited, in 1941, and then as chief engineer, Power Department, Aluminium Laboratories Limited in 1948.

He was intimately associated with the design and construction of the 1,200,000-hp. Shipshaw power development and the related Lake Manouan and Passe Dangereuse storage reservoirs, as well as the mercury-arc power-conversion fa-

F. L. Lawton, M.E.I.C.

cilities and associated power supply arrangements at Arvida.

He has investigated numerous hydro-electric projects in many parts of the world, and has written a number of papers on hydro-electric and related subjects. As a past chairman of the Saguenay and Montreal Branches of the Engineering Institute of Canada, a fellow and past vice-president of the American Institute of Electrical Engineers, and a member of the American Society of Civil Engineers and of the Corporation of Professional Engineers of Quebec, he has taken a very active part in professional activities. He is president of the Canadian Electrical Association.

Gaetan J. Cote, M.E.I.C., senior partner of the firm Cote, Lemieux, Carignan & Bourque, Sherbrooke, Que., will represent the Sherbrooke Branch on the Council of the Institute.

Lt.-Col. Cote was born at Sherbrooke. He obtained his education at the St. Jean Baptiste Academy, at St. Louis College, and at Ecole Polytechnique, Montreal. He received the degree of B.A.Sc. in civil engineering in 1936. He is a member of the Corporation of Professional Engineers of the Province of Quebec.

He had done survey work before graduation, and afterwards joined the firm Crepeau & Cote, of which he was the junior partner until 1940. For the firm he supervised municipal projects and bridge constructions.

He was in the Royal Canadian Engineers during the years 1940 to 1945, as a major, being in the French-German

Gaetan J. Cote, M.E.I.C.

H. R. Fee, M.E.I.C.

John Reed, M.E.I.C.

Campaign. He has served since his discharge as officer commanding the Fusiliers de Sherbrooke, until June, 1952.

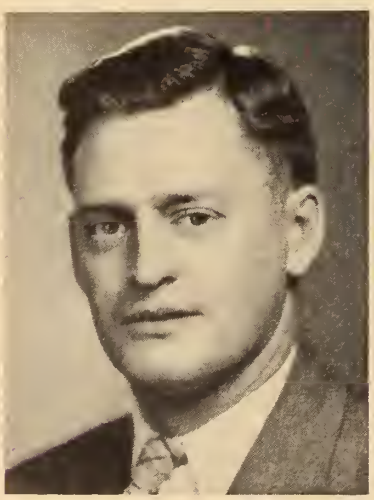
On his return he was appointed the senior associate member of the firm, Crepeau & Cote. Later the firm Cote, Lemieux, Carignan & Bourque was formed.

Edward E. Copping, M.E.I.C., is the newly elected councillor of the Institute, representing the St. Maurice Valley Branch.

Mr. Copping has been with Shawinigan Water and Power Company since 1941, and is now the Company's district superintendent for the Substation Division, Three Rivers District.

Born at Joliette, Quebec, he attended high school in Montreal. He studied at McGill University, graduating in electrical engineering in 1941. He first became assocated with Shawinigan as a student in 1937. In 1941 he was a relay engineer at the Rapide Blanc Power House, being made supervisor of operation there in 1943. He was from 1945 to 1948 supervisor of electrical maintenance at the Shawinigan Falls power house of the Company.

Mr. Copping holds membership in the Corporation of Professional Engineers of Quebec and in the Canadian Electrical Association.



E. E. Copping, M.E.I.C.

H. R. Fee, M.E.I.C., who will represent the Saguenay Branch on the Council of the Institute, is manager of power generation for Aluminum Company of Canada Limited, at Shipshaw, Que.

He is from Killam, Alberta, a graduate in electrical engineering from the University of Alberta, in the class of 1934. He was engaged for three years after graduation in private contracting work. From 1937 to 1941 he was with International Nickel Company of Canada Limited, and in 1941 he went to the Aluminum Company of Canada Limited. He was first employed in the test department of the Saguenay Power Company at Arvida and became plant engineer. He was appointed system operating engineer of Aluminum Company at Shipshaw in 1942.

In 1947 Mr. Fee was appointed general superintendent of Saguenay Power Company, Ltd., at Isle Maligne. In July, 1951 he was transferred back to Shipshaw as assistant manager of power generation, and he was promoted to his present position later that year.

Mr. Fee has been for years associated with the work of the Saguenay Branch, having served as secretary-treasurer, and as chairman.

L. P. Dancose, M.E.I.C., of Mont Joli, Que., has been elected a councillor of the Institute to represent the Lower St. Lawrence Branch.

Mr. Dancose was born at St. Evariste, Frontenac County, Province of Quebec. He received his B.A. degree from Laval University and his B.A.Sc. degree in civil engineering from Ecole Polytechnique, Montreal, in 1942.

After his graduation he was employed for five years in the engineering department, Levis division, of the Canadian National Railways. He was then promoted to assistant division engineer at Quebec, for the Laurentian Division. At the beginning of 1948 he joined the Canada and Gulf Terminal Railway Company as engineer and assistant superintendent and, at the end of the same year, was promoted to superintendent, which position he is holding at the present time.

Mr. Dancose joined the Institute as a Student in 1942. He has been active in the Lower St. Lawrence Branch since its inauguration in 1952, and was appointed its first councillor.

John Reed, M.E.I.C., has been elected a councillor of the Institute representing the Saint John Branch.

Mr. Reed is chief engineer of the structural department of Saint John Dry Dock Co. Ltd.

He received his early school training and high school in Montreal, and attended McGill University. He was overseas from 1915 to 1919 with the Ambulance Corps and with the Engineers, Canadian Army.

He was employed as a draughtsman and assistant chief draughtsman with Phoenix Bridge Company, Montreal, from 1911 to 1923. He transferred in May 1923 to Canadian Vickers Limited as chief draughtsman and received appointments as design and sales engineer and later assistant chief engineer of the structural steel department. He transferred in February, 1928, to the Saint John Dry Dock Company, Ltd., to his present position as chief engineer.

Mr. Reed, the immediate past chairman of the Saint John Branch, E.I.C., is a member of the Association of Professional Engineers of New Brunswick.

H. G. Hughson, M.E.I.C., who will again represent the Fredericton Branch of the Institute on the Council, was active in the formation of the Fredericton Branch in 1951.

Mr. Hughson was born at Corn Hill, Kings County, N.B. He studied at Acadia University and at the University of New Brunswick, graduating in civil engineering in 1932.

He worked for four years with the New Brunswick Department of Public Works on highway construction in various parts of the Province. During the war years he was a resident engineer on airport construction with the federal Department of Transport. Since 1946 he has been associated with the provincial Department of Public Works, as resident highway engineer at Fredericton, with the exception of one year. During that time he was general construction superintendent for Trynor Construction Company on a housing development for Central Mortgage and Housing at St. John's, Newfoundland.

He is a member of the Association of Professional Engineers of New Brunswick.

A. R. Harrington, M.E.I.C., assistant manager of the Nova Scotia Light and Power Company Limited, will represent the Halifax Branch on the Council of the Institute.

J. N. Ritchie, M.E.I.C.

Mr. Harrington, a former chairman of the Halifax Branch, received his appointment as assistant manager in 1952.

A. R. Harrington, M.E.I.C.

He has been with the company since 1936 and had previously worked with the Company as a student. He has done design and supervision of canals, dams, and hydraulic works for the Company.

Mr. Harrington was born at Sydney, N.S. He received his early education there and at Halifax schools. He received the diploma of engineering from Dalhousie University in 1934, going on to Nova Scotia Technical College, where he graduated in electrical engineering in 1936. He is a member of the Association of Professional Engineers of Nova Scotia.

J. Norman Ritchie, M.E.I.C., is the newly-elected councillor for the Amherst Branch of the Institute.

Mr. Ritchie was born at New Glasgow, N.S.

After serving overseas from 1916 to 1919, he attended Dalhousie University until 1921. He graduated from the Pratt Institute in Brooklyn, N.Y., in mechanical engineering in 1924.

He worked on steel structures in New York for several years before returning to Canada. He then joined Robb Engineering Works Ltd., in Amherst, N.S., to work on structural design and detail. He is still with the Company.

Mr. Ritchie is a member of the Association of Professional Engineers of Nova Scotia.

G. J. Hayes, M.E.I.C., councillor of the Institute representing the Prince Edward Island Branch, is a construction engineer for Curran and Briggs Ltd., Summerside, P.E.I.

Mr. Hayes was born at Renous, N.B. He studied at St. Thomas University, Chatham, N.B., at St. Francis-Xavier University, Antigonish, N.S., and at Nova Scotia Technical College, Halifax. He received the degree of B.Sc. in electrical engineering in 1933.

Associated with the Department of Highways of New Brunswick for five years after his graduation he worked as an instrumentman on highway location and as an assistant resident engineer. He transferred to the Department of Transport as an instrumentman, and served later as resident engineer. He joined the firm of Curran and Briggs, Ltd., pavers and contractors in 1945.

Ernest Dickinson, M.E.I.C.

Ernest Dickinson, M.E.I.C., will represent the Newfoundland Branch on the Council of the Institute.

Mr. Dickinson was born in Yorkshire, England, and emigrated to Fernie, B.C., as a child, attending public and high schools there. He attended Bliss Electrical School in Washington, D.C., and graduated in 1921.

He worked with the East Kootenay Power Company during construction of their hydro-electric plant at Bull River, B.C., in 1922. He was the plant and mine electrician with Consolidated Mining & Smelting Company of Canada Ltd., at Kimberley, B.C., from 1922 to 1928. Then he joined Calgary Power Company, and was located in Regina, Sask., until 1936 as transmission and distribution engineer for a rural electrification program covering south-eastern Saskatchewan. He transferred to Montreal Engineering Company, Montreal, and was located in La Paz, Bolivia, S.A., as general superintendent, Bolivian Power Company, until 1940. He went to St. John's, Newfoundland, as electrical engineer for Newfoundland Light & Power Company. Since 1946 he has been with United Towns Electric Company, and subsidiary companies as electrical engineer and general superintendent.

Mr. Dickinson is a member of the Association of Professional Engineers of British Columbia; of the Association of Professional Engineers of Saskatchewan; and of the Association of Professional Engineers of Newfoundland.

Eric Hinton, M.E.I.C., has been elected a councillor of the Institute to represent the Corner Brook Branch.

Mr. Hinton was born at Warwick, England. He completed high school there and served as an articled pupil to the borough engineer of Penzance, England, from 1918 to 1923.

Eric Hinton, M.E.I.C.

He was an assistant engineer for Sir W. G. Armstrong, Whitworth & Co. Ltd., in 1924 and 1925, on the construction of the hydro-electric development at Deer Lake, Nfld. Thereafter he was, until 1942, a hydro-electric engineer for the Newfoundland Power & Paper Co. Ltd., International Power & Paper Co., Ltd., and Bowater's Newfoundland Pulp & Paper Mills Ltd. Since 1942 he has been the hydro-electric manager for Bowater's Newfoundland Pulp & Paper Mills Ltd.

During the interval November 1947 to December 1948, he also acted as assistant chief engineer in charge of construction of the paper mill extension at Corner Brook.

Mr. Hinton has been active in the Newfoundland Branch of the Institute since its formation in 1949.

Personals

News of the Personal Activities of Members of the Institute

Roderick B. Young, M.E.I.C., assistant director of research for the Hydro-Electric Power Commission of Ontario, was elected to honorary membership in the American Concrete Institute, on February 18. The announcement was made by President A. T. Goldbeck during the Institute's 49th annual convention held in Boston.

Mr. Young, a past-president of the A.C.I., has served on its board of direction and has been active on several technical and administrative committees. Author of numerous papers on concrete, he received the A.C.I. Wason Medal for "the most meritorious paper" on his 1937 paper "Concrete—Its Maintenance and Repair", and was awarded the Thomas F. Rowland Prize of the Society of Civil Engineers in 1928.

Mr. Young has been actively interested in studies of the durability of concrete control and inspection, winter concreting, construction and maintenance and repair methods.

In 1950 he was appointed chairman of the committee on Concrete and Reinforced Concrete of the Canadian Standards Association. He was also one of the original organizers of the National Ready Mixed Concrete Association and is now an honorary member of the organization. He has participated in activities of the Engineering Institute of Canada, the Association of Professional Engineers of Ontario, and the American Society for Testing Materials.

Though born in Minneapolis, Minn., Mr. Young has spent most of his active years in Canada. Since his graduation from the University of Toronto in 1913 he has been with the Hydro-Electric Power Commission of Ontario in various capacities.

Professor W. S. Pardoe, M.E.I.C., retired as professor of hydraulic engineering of the University of Pennsylvania last June and was elected emeritus professor of civil engineering by the trustees of the University. He is now associated with the staff of the Alden Hydraulic Laboratory of the Worcester Polytechnic Institute where he will continue his experimental work.

Professor Pardoe, a Life Member of the Engineering Institute, is a graduate in civil and mechanical engineering from the University of Toronto.

C. G. R. Armstrong, M.E.I.C., has been nominated chairman of the Canadian Section of the American Water Works Association for 1953-54.

Mr. Armstrong is a graduate of the University of Toronto and has operated his own business under the name of C. G. Russell Armstrong, consulting engineer and Ontario land surveyor.

He is an active member of the Border Cities Branch of the Institute. He is a past chairman and has served two years as councillor. He represented the Province of Ontario as vice-president of the Institute during 1951 and 1952. He has also been president of the Ontario Land Surveyors Association.

S. Logan Kerr, M.E.I.C.

S. Logan Kerr, M.E.I.C., has been elected a Fellow of the American Society of Mechanical Engineers. He is president of the consulting engineering firm of S. Logan Kerr and Company, Inc., in Flourtown, Penn., and has been vice-president and general manager of Lyophile-Cryochem Corp. of Baltimore, Md., since 1946.

Mr. Kerr is widely known for his work as a hydraulic engineer, particularly in the fields of water power, public water supply, pumping, water hammer and surge control.

During his early career with the I. P. Morris Company as hydraulic engineer and assistant chief engineer, he developed an automatic frequency and load control system for hydro-electric plant and electric generating systems. Later he aided in the solution of water hammer problems in motor-driven water works pumping systems, including the Croton Lake Pumping Plant for New York City; the City of Toledo, Ohio; St. Louis County Water Company and many others.

In 1935 he joined the U.S. Engineer Office and was in charge of the mechanical section of the Passamaquoddy Tidal Power Project, Eastport, Me. From 1937 until 1945 he was with United Engineers & Constructors, Inc., in various capacities, including the design of chemical plants, circulating water systems for steel mills and utility plants and similar important assignments, including four years as Washington representative of the Company.

Since 1945 he has been in private consulting practice working on a number of projects in various fields.

Oswald H. Scott, M.E.I.C., general manager of the Public Utilities Commission at Belleville, Ont., has been awarded the Fuller Award by the Canadian Section of American Water Works.

Mr. Scott is a life member of the Association of Municipal Electrical Utilities.

Lyall G. Renner, M.E.I.C., of the Public Service Commission of Halifax is this year's recipient of the Hunt Award presented by the Canadian Section of the American Water Works Association for efficient water works operation.

Gordon D. Stanfield, M.E.I.C., was elected a director of the Acadia Trust Company at their recent annual meeting.

Mr. Stanfield is managing director of The Starr Manufacturing Company, Limited, director of Central Agencies Limited, and interested in several Maritime Province enterprises.

He is a graduate of Dalhousie and McGill universities.

G. R. Connor, M.E.I.C., formerly chief engineer of the industrial department of Alchem Limited, has been appointed manager of this department.

Mr. Connor was previously with Aluminate Chemicals Limited in Tor-

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onto, and with the Spruce Falls Power & Paper Company in Kapuskasing, Ont. He is a graduate chemical engineer from the University of Toronto, class of 1928.

Dr. N. A. D. Parlee, M.E.I.C., has been appointed professor in the chemical and metallurgical engineering department at Purdue University at Lafayette, Indiana.

He was previously director of research for Dominion Steel & Coal Corporation.

Mr. Parlee graduated with a B.Sc. degree in chemistry from Dalhousie University in 1935. Awarded a National Research Council Bursary in 1936, he carried on research at Dalhousie on reaction kinetics, leading to a M.Sc. degree in physical chemistry. He was awarded a National Research Council Bursary in 1937 and a studentship in 1938 which were held at McGill University where he specialized in physical chemistry and did research on atomic reactions, receiving his Ph.D. degree in 1939.

Dr. Parlee joined Dominion Steel & Coal Corporation in 1939 and held positions as analytical chemist, metallographer, research chemist, assistant chief metallurgist and director of research.

W. B. Proudfoot, M.E.I.C., has been appointed Montreal and district manager of Railway and Power Engineering Corporation Limited of Montreal.

Mr. Proudfoot comes to his present appointment from the position of sales engineer.

He is a 1932 graduate in electrical engineering from the University of Toronto.

Elsie Gregory MacGill, M.E.I.C.

Elsie Gregory MacGill, M.E.I.C., Toronto aeronautical consulting engineer, was presented the highest award of the United States Society of Women Engineers for her "meritorious contribution to engineering" at a dinner in the Statler Hotel on March 29, 1953.

An engineer for 26 years, Miss MacGill helped produce the British Hawker Hurricane fighter plane and the United States Navy's Hell Diver during World War II. She is now engaged in special work for the Canadian Government.

A native of Vancouver, Miss MacGill received her B.A.Sc. degree from the University of Toronto in 1927, and her M.S.E. degree from the University of Michigan in 1929. In 1939 she was appointed chief aeronautical engineer of the Canada Car and Foundry Company in Fort William.

In 1940 Miss MacGill was awarded the Gzowski Medal for her paper "Factors Affecting the Mass Production of Aeroplanes", and she has made many contributions to the literature on the art and science of flying, including a paper before the Ottawa Branch of the Royal Aeronautical Society, and a paper presented at the 1940 annual meeting of the Engineering Institute in Toronto.

Miss MacGill attended the Montreal conference of PICAO as technical adviser in 1946, thus adding to the many distinguished "firsts" which characterize her career. She was the first woman in the world to receive a master's degree in aeronautical engineering, the first woman on the continent to become chief aeronautical engineer with any company, and the first woman to design, build and test her own aeroplane.

She is an Associate Fellow of the Royal Aeronautical Society.

When Miss MacGill joined the Engineering Institute in 1938, it was the first time in the history of the organization that a woman was elected to corporate membership. In 1942 she was elected chairman of the Lakehead Branch of the Engineering Institute.

R. Pocock, M.E.I.C., previously crane design engineer with John T. Hepburn Limited in Toronto, has established the Canada Crane and Hoist Company in Toronto. The new Company will manufacture small cranes and material handling systems and will also represent several British manufacturers of cranes, hoists, conveyors, construction equipment and material handling equipment.

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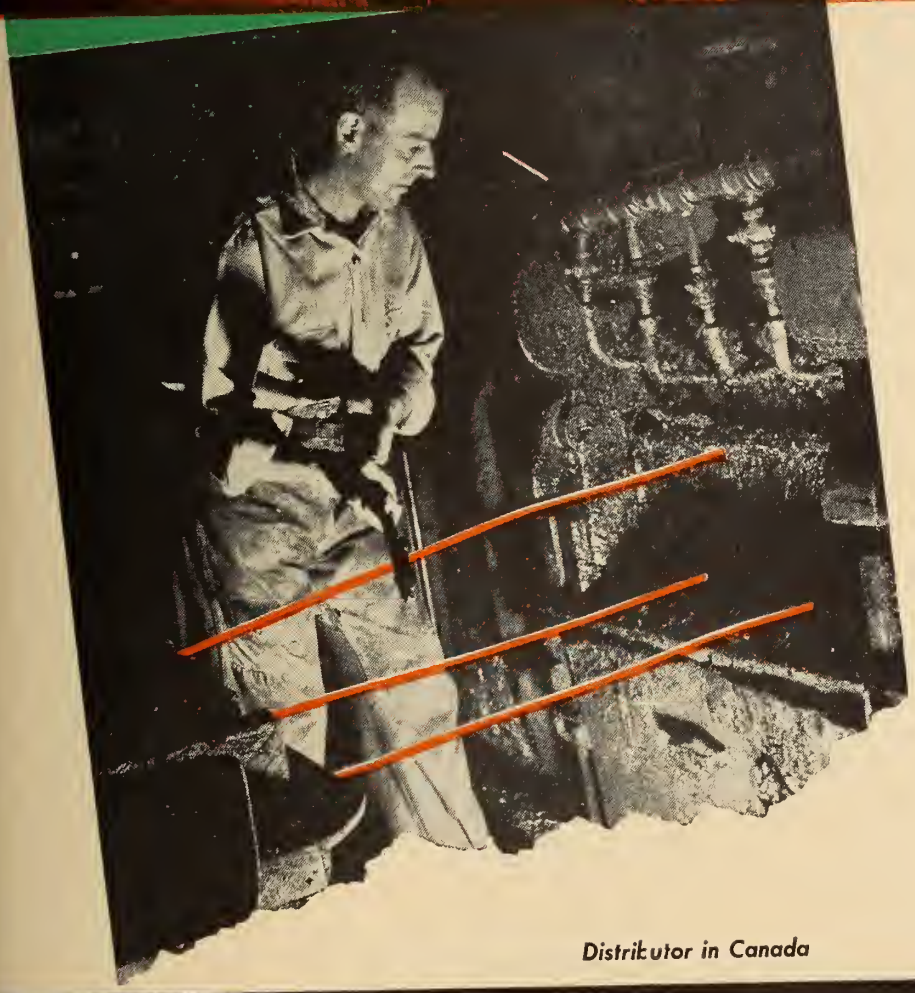

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Mr. Pocock holds the higher national certificate in mechanical engineering from Salford College of Technology in England, class of 1948.

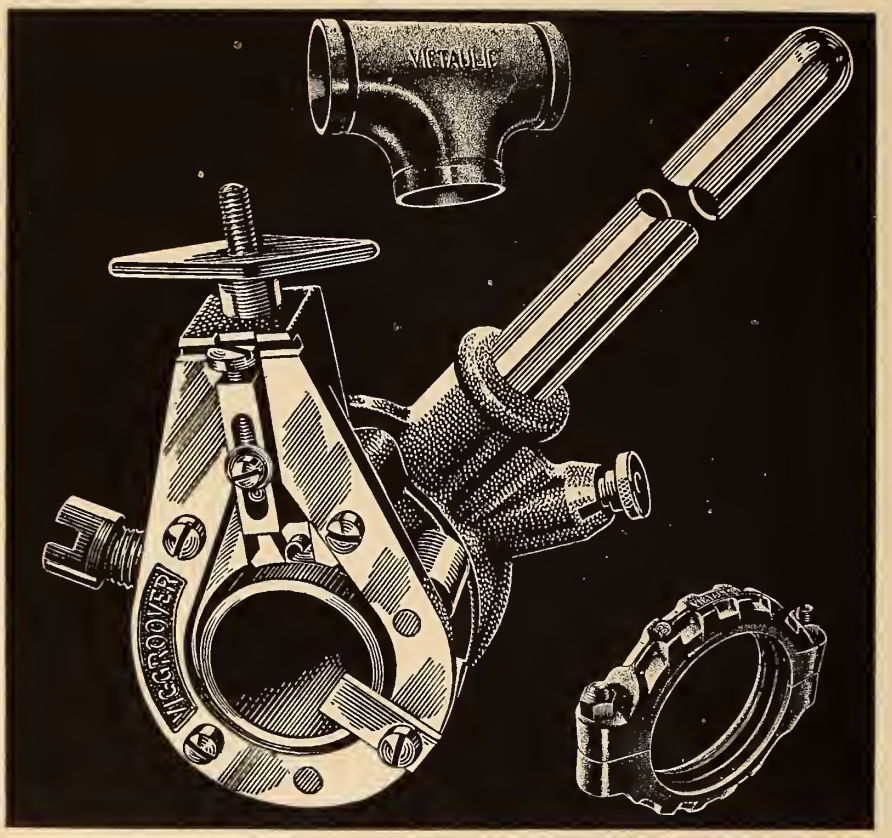
H. M. Scott, M.E.I.C., associated with Ditto of Canada Limited, since 1945, has been transferred to Chicago to become manager of the chemical development and supply production for Ditto, Inc.

From 1950 until his present appointment, Mr. Scott acted as assistant general manager at Ditto of Canada Ltd., in Toronto. A graduate chemical engineer from the University of Toronto, his background includes experience in sales, research and manufacturing. He started with the Company as salesman at the Toronto branch, was subsequently connected with the manufacturing and spent two years in charge of all production at Ditto of Canada, Ltd.

A. H. Harris, Jr., M.E.I.C., has been appointed vice-president and manager of the newly-formed Winnipeg & Central Gas Company which has acquired all rights, privileges and responsibilities of the Winnipeg Electric Company insofar as its former gas business is concerned.

Mr. Harris was previously manager of gas utility of the Winnipeg Electric Company.

He is a graduate of the Stevens Institute of Technology in mechanical engineering, class of 1911.



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J. M. M. Lamb, M.E.I.C., Department of Transport agent at Saint John, N.B., has been elected vice-president of the Association of Professional Engineers of New Brunswick. Mr. Lamb joined the Department of Public Works as assistant engineer in 1913, and has been in the service of the Dominion Government since that time. He was promoted to his present position of agent in 1942 after serving as district engineer for two years.

Mr. Lamb is a past chairman of the Saint John Branch of the Engineering Institute.

G. J. Currie, M.E.I.C., has been elected president of the Association of Professional Engineers of Nova Scotia. He has been with the Nova Scotia Light and Power Company in Halifax since graduation from the Nova Scotia Technical College in 1931.

Mr. Currie served as vice-president of the Nova Scotia Association last year. An active member of the Engineering Institute, Mr. Currie was elected chairman of the Halifax Branch in 1944. He also served as councillor during the two succeeding years.

J. E. Clarke, M.E.I.C., has been appointed vice-president of the Association of Professional Engineers of Nova Scotia. He is divisional engineer of the Provincial Department of Highways. A graduate of Acadia University, class of 1929, Mr Clarke was employed by Canadian National Railways in various positions before joining the Department of Highways.

J. H. Smith, M.E.I.C., has been elected president of the Association of Professional Engineers of Ontario. He is general manager of the Wholesale Division of the Canadian General Electric Company. He was formerly manager of the Apparatus Division of the Company's Toronto district.

Mr. Smith is a graduate of the University of New Brunswick in electrical engineering, receiving his M.Sc. degree in 1942. He followed the Canadian General Electric's test training and held a number of sales engineering appointments in Toronto and Hamilton. In the Toronto district he was Supply Division manager from 1945 until 1948, and Apparatus Division manager from 1948 until 1951.

He is a member of the A.I.E.E. and of the Toronto Board of Trade, and last year served as vice-president of the Ontario Association of Professional Engineers.

W. L. Sagar, M.E.I.C., has been appointed first vice-president of the Association of Professional Engineers of Ontario. He is associate professor of civil engineering at the University of Toronto and is also well known in the consulting field. A graduate of the University of Toronto, he holds the professional degree of C.E.

Professor Sagar is a veteran of two world wars. During World War II he served with the Royal Electrical and Mechanical Engineers as a workshop commander with the rank of lieutenant-colonel. On his return to the University after the war, he took over the command of the C.O.T.C. and continued in this capacity until recently.

J. R. Montague, M.E.I.C., has been appointed second vice-president of the Association of Professional Engineers of

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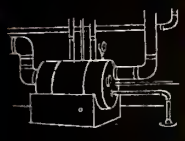

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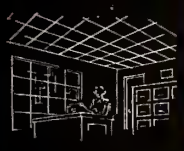

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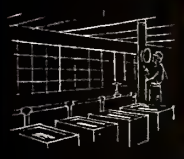

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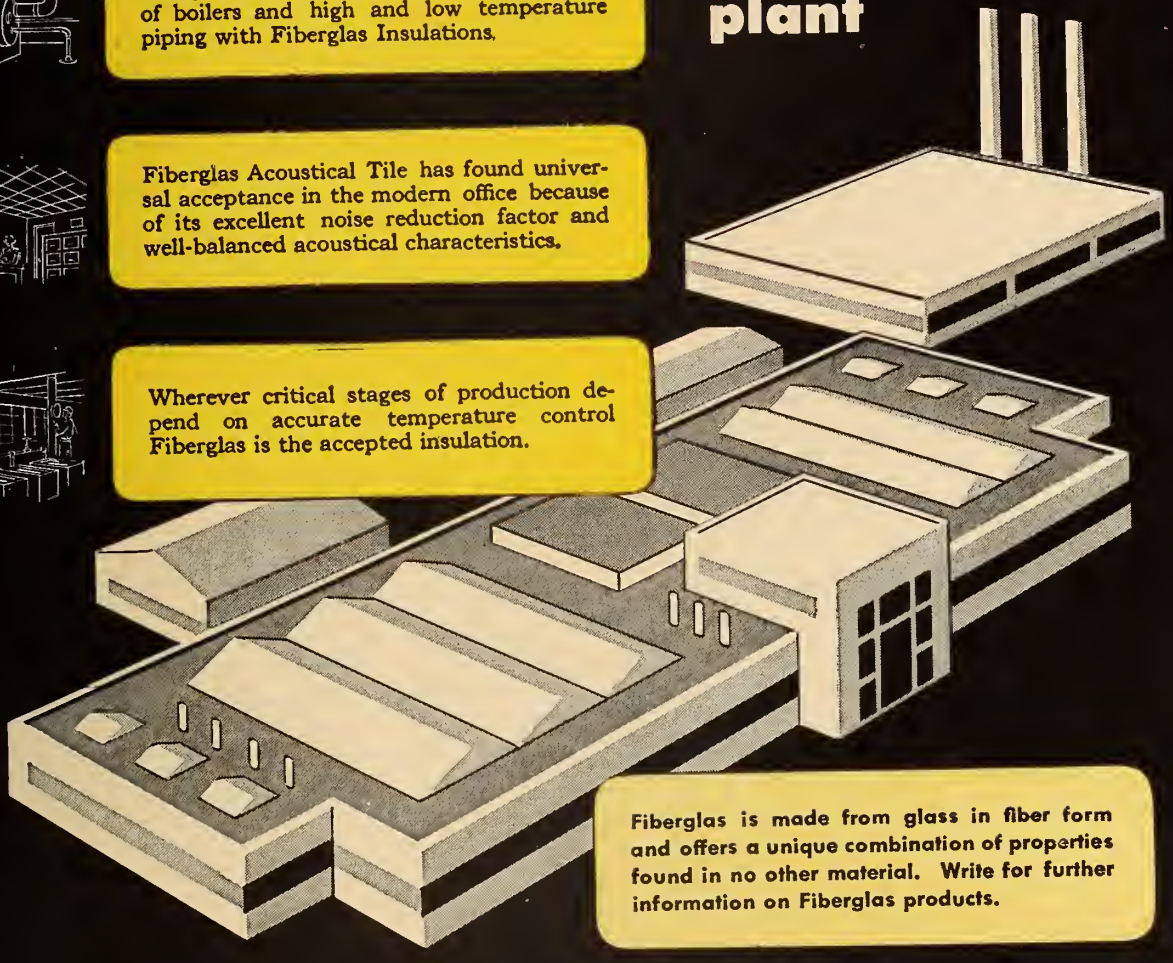

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Ontario. He is director of engineering of the Hydro-Electric Power Commission of Ontario. A 1914 graduate of the University of Toronto and holder of the professional degree of C.E., Mr. Montague entered the Hydro-Electric Power Commission in 1918 as design engineer.

H. L. Eberts, M.E.I.C., is managing director of Fleet Manufacturing Limited in Fort Erie, Ont.

Mr. Eberts was formerly purchasing agent for Canadair Limited, Montreal.

He is a graduate of the Royal Military College and McGill University. He has held positions in the General Electric Company, Schenectady; Montreal Tramways Co.; Small Electric Motors (Canada) Ltd., Stevenson and Kellogg Ltd.; and Federal Electric Manufacturing Co. Ltd.

K. B. Dundas, M.E.I.C., has been transferred by Dominion Tar & Chemical Company, Limited in Transcona, Man., to Leaside, Ont. He was works manager in Transcona. With the transfer to Ontario he becomes superintendent of production for the Eastern Region of the Creosoting Division.

Mr. Dundas is a graduate in civil engineering from the University of Saskatchewan, class of 1940.

W. F. Lever, M.E.I.C., is construction superintendent of Manwell Construction Co. Ltd., in Vancouver, B.C.

Mr. Lever was formerly with Kitimat Constructors in Kitimat, B.C.

E. W. Wheatley, M.E.I.C.

E. W. Wheatley, M.E.I.C., has been appointed manager of the Winnipeg office of John Inglis Co. Limited, replacing the late Mr. A. A. Paoli.

Mr. Wheatley has been with the Company since 1948 after graduating in mechanical engineering from the University of Toronto. He has served in the Montreal, Calgary and Edmonton offices.

Cyril Hugh Bell, M.E.I.C., has joined Evans Construction Company, Limited, as general superintendent. He was formerly estimating and cost engineer with the International Petroleum Company in Peru, and has held various positions with the Hydro-Electric Power Commission of Ontario, the Northern Pigament Company, Limited, and Underwood and McLellan.

He is a 1947 mechanical engineering graduate of the University of Saskatchewan.

H. E. Dickson, M.E.I.C., is president of Eastern Equipment Ltd., in Halifax, N.S.

He was previously manager of Wm. Stairs, Son & Morrow Ltd., in Saint John, N.B.

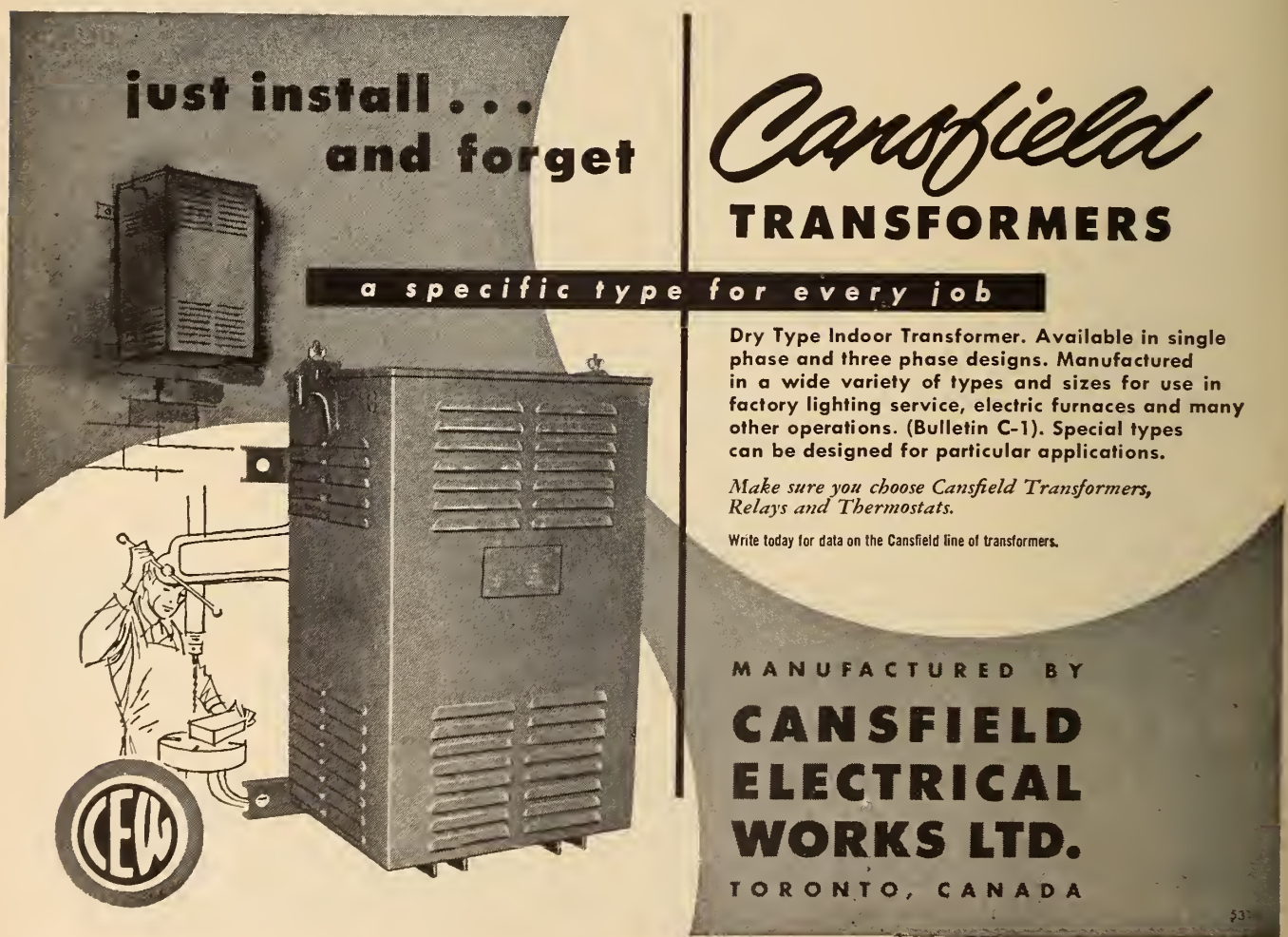
Mr. Dickson is a graduate in mining engineering from the Nova Scotia Technical College, class of 1938.

A. G. W. Lamont, M.E.I.C., has joined the Catalytic Construction Company in Philadelphia. He was previously chief engineer in charge of development with Eldorado Mining & Refining (1944) Ltd. in Port Hope, Ont.

Mr. Lamont graduated from Queen's University in chemical engineering in 1943.

H. R. Welch, M.E.I.C., president and general manager of Welch and Johnston Ltd., in Ottawa, is chairman of the Ottawa Transportation Commission which operates the transportation system of the city.

Mr. Welch has been a member of



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the Commission since its formation in 1948, and its chairman since the Spring of 1952.

Major-General G. R. Turner, C.B., M.C. & Bar, D.C.M., M.E.I.C., formerly Inspector General of the Army in Western Canada, was appointed a member of the Ottawa Transportation Commission on January 1, 1953.

E. K. Phillips, M.E.I.C., is a partner in the Saskatoon firm, Phillips, Stewart and Phillips, professional engineers and land surveyors.

He is a Dominion Land Surveyor and a Saskatchewan Land Surveyor.

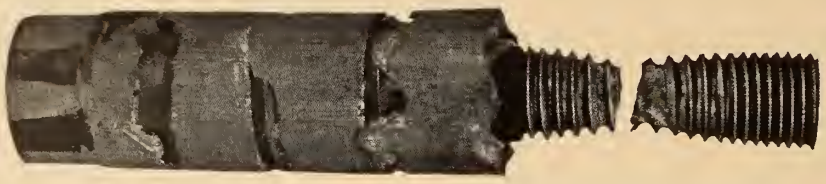
Mr. Phillips received his B.Sc. degree and his M.Sc. degree in 1927 from the University of Saskatchewan.

Major K. F. Collins, M.E.I.C., has been promoted from the rank of captain. He is presently stationed in Ottawa.

Major Collins is a graduate in chemical engineering from Queen's University, class of 1941.

Edwin W. Christian, M.E.I.C., is vice-president and general manager of The Imperial Pipe Line Co. Ltd., in Edmonton, Alta.

Mr. Christian is a graduate of the Nova Scotia Technical College, class of 1936.



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Major Pierre Martel, M.E.I.C., has been promoted recently from the rank of captain. He is with the Directorate of Armament Development in Ottawa.

Major Martel graduated in civil engineering from Ecole Polytechnique in 1941.

A. L. Swanson, M.E.I.C., who has been practicing as a consulting engineer in Vancouver, B.C., since 1948, recently announced the formation of A. L. Swanson & Company in Vancouver. Mr. Swanson's organization plans to specialize in concrete, steel and timber, building and construction; industrial heating and ventilation, sawmill and planing mills, and steam power plants.

Gerald Allen Blackburn, M.E.I.C., is personnel selection officer with the Civil Service Commission in Ottawa.

Mr. Blackburn is a graduate of the Nova Scotia Technical College, class of 1935.

J. S. Galbraith, M.E.I.C., Toronto civil engineer, sailed aboard *S.S. Exeter* with Mrs. Galbraith from Jersey City on February 13, on a 47-day Mediterranean cruise. They visited Spain, France, Italy, Egypt, Lebanon, Syria, Turkey and Greece, and returned to Toronto around Easter Sunday.

Bernard N. Cain, M.E.I.C., is dean of Applied Science at Acadia University.

Dean Cain is an electrical engineering graduate of the Nova Scotia Technical College, class of 1935.

W. J. Bichan, M.E.I.C., is with the E. J. Longyear Company in Mozambique, Portuguese East Africa.

Mr. Bichan was previously president of Mineral Associates Ltd., in Calgary, Alta.

He is a graduate of London University in mining engineering, class of 1932.

Helmut Wittnich, M.E.I.C., has joined the staff of R.C.A. Victor Company in Montreal. He was previously with Canadian Allis Chalmers Ltd., in Lachine, Que.

Mr. Wittnich is a graduate of the

Helmut Wittnich, M.E.I.C.

Engineering School in Hamburg, Germany.

Lewis J. Barron, M.E.I.C., is a project manager with the Foundation Company

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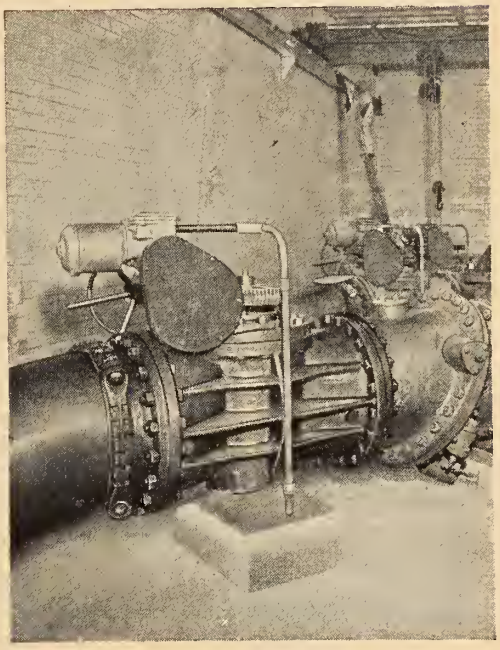

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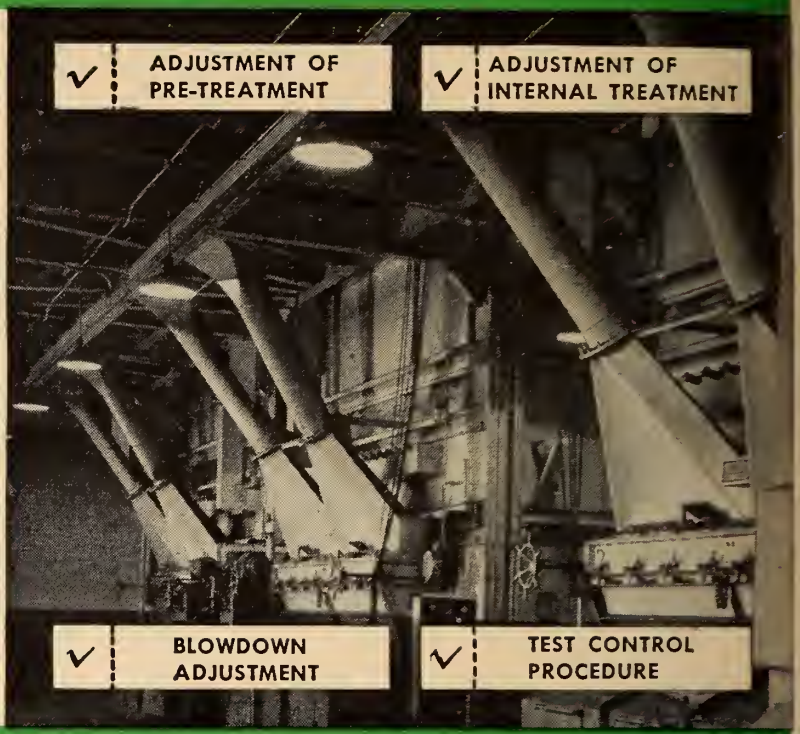

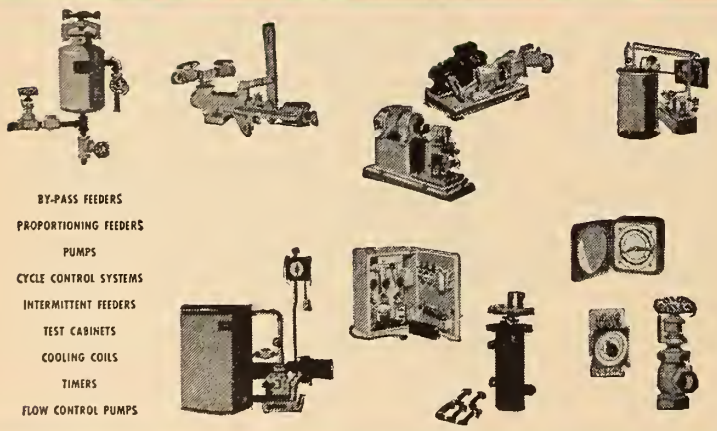

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of Canada Limited in Montreal. He was previously project engineer.

Mr. Barron graduated in civil engineering in 1941 from the Nova Scotia Technical College.

John E. Lee, M.E.I.C., is general superintendent of works for The Consumers' Gas Company of Toronto. He was formerly chief chemist.

Mr. Lee received his B.A. degree in physics and chemistry from the University of Western Ontario in 1937 and his M.A. degree in chemistry from the University of Toronto in 1940.

F. T. Simson, M.E.I.C., is manager of the mechanical division of Canadian-Brazilian Services Limited in Toronto.

He was previously hydraulic engineer with the Canadian and General Finance Company, entering the Brazilian organization in 1948.

Mr. Simson is a graduate of the University of Toronto in mechanical engineering class of 1923.

R. R. Keith, M.E.I.C., is acting power production superintendent of the Saskatchewan Power Corporation in Regina. He was previously district superintendent in Prince Albert, Sask.

Mr. Keith is a graduate in mechanical engineering from the University of Saskatchewan, class of 1937.

John M. Hawkes, M.E.I.C.

John M. Hawkes, M.E.I.C., owner of Parisien Beverages in Cornwall, Ontario, has been appointed chairman of the Cornwall Branch of the Institute.

He was born in Oshawa, Ont., and received his early education at Oshawa public and high school and Kings' College. He attended Adelaide University in Australia from 1927 to 1928 and received his B.Sc. degree from Queen's University in 1932.

Mr. Hawkes spent the summer of 1931 in the engineering department of General Motors in Oshawa. Upon graduation he worked intermittently for General Motors and the Skinner Bumper Company in Oshawa for the next three years. In 1935, he joined the staff of the Duplate Glass Company in Oshawa and a year later became chief engineer and production manager of the Pepsi-Cola Company of Canada, Limited, in Montreal.

Mr. Hawkes continued with this firm until 1945 when he became owner of Parisien Beverages.

Wiston D. Stothert, M.E.I.C., has joined Brown & Root Limited, in Edmonton, Alta., as electrical engineer. He was formerly with the mechanical branch for the Province of Alberta government.

Mr. Stothert obtained his B.Sc. degree in electrical engineering from the University of Alberta in 1945, and his M.Sc. degree from the University of Toronto in 1948.

Thomas B. Doherty, M.E.I.C., has been transferred by Imperial Oil Limited from the Edmonton Refinery to the manufacturing department in Toronto. He has been with the Company since his discharge from the Army in 1945.

Mr. Doherty received his B.Sc. degree in chemical engineering from Queen's University in 1936 and his M.Sc. degree from the Massachusetts Institute of Technology in 1938.

W. H. McPherson, M.E.I.C., has joined the McPhar Engineering Company of Canada Limited in Toronto. He was formerly program planning and control engineer with the Hydro-Electric Power Commission of Ontario.

Mr. McPherson is a graduate of the University of Toronto in engineering physics, class of 1938.

J. G. Todds, M.E.I.C., is assistant superintendent of development engineering at Northern Electric Company, Limited in Belleville, Ontario.

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April, 1953.

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General Manager.

Lieut.-Colonel G. W. Holbrook, M.E.I.C., has recently been promoted from the rank of major. He is stationed at Vimy Barracks, Kingston, Ont.

Lieut.-Colonel Holbrook received his B.Sc. degree from the University of England in 1938 and his M.Sc. degree in electrical engineering in 1949.

M. A. Matheson, M.E.I.C., has recently been transferred from Lima, Peru, where he was general sales manager for International Petroleum Company to Coral Gables, Florida, as the Company's marketing advisor on Latin American operations.

Mr. Matheson is a graduate of the University of Saskatchewan in mechanical engineering, class of 1933.

Charles Crowdis, M.E.I.C., is manager of Crowdis and Lewis Engineering Limited in Truro, N.S.

Mr. Crowdis is a graduate in electrical engineering from the Nova Scotia Technical College, class of 1943.

D. A. Welsh, M.E.I.C., of the British Columbia Department of Public Works, has been transferred as district engineer to Burns Lake, B.C. He was previously district engineer at Prince George, B.C.

Mr. Welsh is a graduate of the University of British Columbia in civil engineering, class of 1949.

John Edward Bulley, M.E.I.C., has his own business in Halifax under the firm name of John E. Bulley Engineering Machinery.

Mr. Bulley is a 1941 mechanical engineering graduate of the Nova Scotia Technical College.

Ralph A. Bowie, M.E.I.C., is with Canadian Industries Limited as resident engineer in Edmonton, Alta.

After graduation in electrical engineering from McGill University in 1942, he joined the Army and served with the rank of captain with the R.C.E.M.E.

Upon his discharge he was employed as builder and contractor in Lachine, Que., subsequently joining the Imperial Tobacco Company of Canada Limited early in 1948 as construction engineer.

Leon Wigdor, M.E.I.C., is presently associated with Atlas Asbestos Company, Limited.

He was formerly on the research staff of the Ault and Wiborg Company, in Toronto, and previous to that with the engineering department of Distillers Corporation Limited, Ville LaSalle, Que.

Mr. Wigdor is a graduate of 1941 from McGill University.

E. I. W. Jardine, M.E.I.C., is in private practice as a consulting engineer in Victoria, B.C. He was previously with the Public Utilities Commission of British Columbia in Victoria, B.C.

J. N. Siddall, M.E.I.C., has joined the Cockshutt Farm Machinery Limited in Brantford, Ont.

He was formerly with the National Research Council in Ottawa.

Mr. Siddall received his B.Sc. degree in mechanical engineering from the University of Saskatchewan in 1944, and did post-graduate work at the Massachusetts Institute of Technology.

R. H. Wisney, M.E.I.C., has joined the staff of Godfrey Engineering Co. Ltd., in Montreal.

He was previously project engineer with Robert A. Rankin & Company in Montreal.

Mr. Wisney is a graduate of Glasgow University, class of 1943. After R.A.F. service, he worked as designer for Humphreys & Glasgow Limited in London. He also lectured at McGill University.

Raymond V. Beck, M.E.I.C., is assistant to the Port engineer of Halifax Harbour, Halifax, N.S. He was previously assistant engineer.

Mr. Beck graduated in civil engineering from the Nova Scotia Technical College in 1946.

Major F. J. Sergi, M.E.I.C., is presently with the United States Army Language School in Presidio of Monterey, Calif. He was previously with R.C.E.M.E. Headquarters in Ottawa.

Major F. J. Sergi is a 1941 graduate in mechanical engineering from McGill University.

Kenneth Barlow, Jr.E.I.C., has joined the recently formed firm of A. L. Swanson & Company, consulting engineers, in Vancouver, B.C.

Mr. Barlow graduated from Liverpool University in 1948 with first class honours, after serving in the R.A.F. during the war.

On coming to Canda he became an instructor in the engineering department at the University of British Columbia, later joining the firm of Pearson & Phillips as structural designer.

In 1951 he joined the engineering department of Alaska Pine & Cellulose where he remained until becoming a member of A. L. Swanson & Company. In 1950 he obtained his master of engineering degree from Liverpool University.

S. W. Grossmith, Jr.E.I.C., is with *H.M.C.S. Shearwater* in Dartmouth, N.S.

He was previously in the Canadian Westinghouse Technical training course in Hamilton, Ont.

Mr. Grossmith graduated in electrical engineering from McGill University in 1951.

C. S. White, Jr.E.I.C., formerly with the Canadian General Electric Company in Ottawa, has joined the Aircraft Equipment Company in Montreal as sales engineer.

Mr. White is a 1950 mechanical engineering graduate of the University of British Columbia.

Scott J. Babin, Jr.E.I.C., has joined Community Enterprises, Saint John, N.B.

He was previously with Defence Construction Limited, Ottawa, and with Central Mortgage and Housing Corporation, Montreal.

Mr. Babin is a graduate of 1949 from the University of New Brunswick in civil engineering.

Joseph Badzioch, Jr.E.I.C., has joined Cia Alumbrado Electrico in San Salvador, El Salvador.

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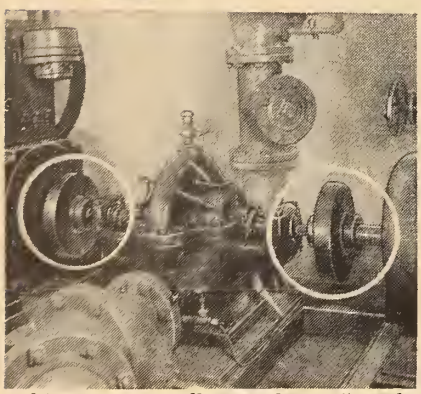

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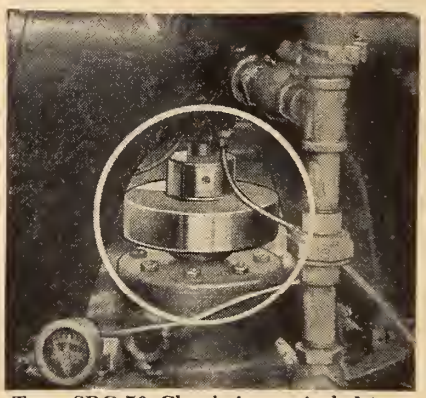

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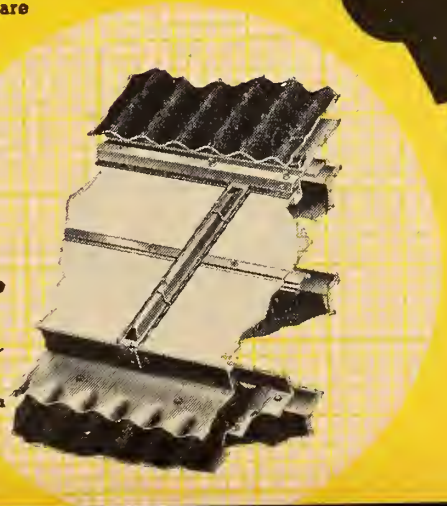
We invite you to consult Robertson Daylighting Specialists . . . to take advantage of "measured daylight" in your plant.



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A graduate of the University of Alberta in 1950, Mr. Badzioch took a two-year post-graduate course with A. Reyrolle & Co. Ltd., electrical manufacturers in Durham, England, and with C. A. Parsons Co. Ltd., turbine manufacturers.

D. D. Dogherty, JR.E.I.C., is scheduling supervisor at Canadair Limited in the industrial engineering department. He was previously with Fleet Manufacturing Company in Fort Erie, Ont.

Mr. Dogherty graduated with a B.Sc. degree in mechanical engineering in 1949 and undertook post-graduate work at Harvard University.

Roy H. Reynolds, JR.E.I.C., has joined Babcock-Wilcox & Goldie-McCulloch Ltd., as sales engineer and is presently engaged in the sales training program in Galt, Ont.

Mr. Reynolds graduated in electrical engineering from the University of Alberta in 1951.

W. C. Leith, JR.E.I.C., has joined the hydraulic division of Dominion Engineering Works, in Lachine, Que.

He was previously in the design office of the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C.

Mr. Leith graduated in mechanical engineering from the University of British Columbia in 1948, and received his M.A.Sc. degree in 1949.

C. H. Triandis, JR.E.I.C., is plant methods engineer at the Hamilton factory of Proctor and Gamble Company of Canada.

Mr. Triandis entered the Company upon graduation from McGill University in mechanical engineering in 1951.

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R. F. Brooks, JR.E.I.C., is assistant superintendent of Shawinigan Falls Power Developments for the Shawinigan Water & Power Company in Shawinigan Falls, Que. He joined the Company as a graduate in training in 1949.

Mr. Brooks is an electrical engineering graduate of the University of New Brunswick.

Ronald T. McLaughlin, JR.E.I.C., is assistant research officer with the National Research Council in Ottawa. He was formerly at the California Institute of Technology in Pasadena, Calif.

Mr. McLaughlin is a 1951 graduate of Queen's University in civil engineering.

R. F. Sworder, JR.E.I.C., has joined the staff of Underwood, McLellan and Associates Ltd. of Saskatoon, Sask.

He was formerly with the City of Hamilton engineering department.

Mr. Sworder is a graduate of the University of Saskatchewan in civil engineering, class of 1951.

William J. Swanson, JR.E.I.C., has been transferred by Foundation Company of Canada Limited to Montreal from Billings Bridge, Ont.

Mr. Swanson has been with the Company since graduation in civil engineering from the University of British Columbia in 1951.

B. G. Cameron, JR.E.I.C., has accepted employment with Canadian Arsenals Limited in Montreal.

He was formerly an engineer in training with Canadian Westinghouse Co. Ltd., in Hamilton, Ont.

Mr. Cameron graduated in 1948 from the University of New Brunswick in electrical engineering.

Hugo Vajk, JR.E.I.C., is in his second year of studies at the Graduate School of Industrial Administration of the Carnegie Institute of Technology in Pittsburgh, Penn. He is specializing in the methods of operations research and linear programing.

Mr. Vajk graduated with honours in mechanical engineering from McGill University in 1951.

Carl A. Hennigar, JR.E.I.C., is now employed with E. L. Dodington, consulting engineer, in St. Catharines, Ont.

He was formerly with the Montreal East refinery of the British American Oil Company of Canada Ltd.

Mr. Henniger graduated in electrical engineering in 1950 from McGill University.

V. Zvarich, JR.E.I.C., is design engineer in the induction motor engineering unit of the Canadian General Electric Company in Peterborough, Ont.

Mr. Zvarich is a 1951 graduate in electrical engineering from the University of Toronto.

E. A. Mahr, JR.E.I.C., is assistant resident engineer in the employ of Central Mortgage and Housing Corporation at Shilo, Man.

Mr. Mahr is a 1951 graduate from the University of Manitoba in civil engineering.

J. Curtis Haslam, JR.E.I.C., is a junior chemical engineer with Canadian Resins and Chemicals Ltd. in Shawinigan Falls, Que. He was previously with

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Mr. Haslam is a 1950 chemical engineering graduate of McGill University.

V. L. Horte, Jr.E.I.C., has joined the firm of De Golyer & MacNaughton in Dallas, Texas. He was formerly chemical engineer with Chemical & Geological Laboratories in Edmonton, Alta.

Mr. Horte is a 1949 graduate from the University of Alberta in chemical engineering.

Robert Allen Cameron, Jr.E.I.C., is plant superintendent with Trafalgar Mills Ltd. at South Nelson, N.B.

Mr. Cameron is a graduate of the Nova Scotia Technical College in chemical engineering, class of 1949.

J. Oliver Sturk, Jr.E.I.C., is employed by the Defence Research Board at the Canadian Armament Research and Development Establishment at Valcartier, Que. He was previously chemical engineer with the Naval Research Establishment in Halifax, N.S.

Mr. Sturk graduated in 1950 from the Nova Scotia Technical College.

Michael Shayna, Jr.E.I.C., is employed by the National Porcelain Limited in Medicine Hat, Alta., manufacturers of low and high tension electrical porcelain. His position is that of ceramic engineer.

Previous to September, 1951, Mr. Shayna was soils specialist with the Dominion Experimental Station at Swift Current, Sask.

He is a graduate in ceramic engineering from the University of Saskatchewan, class of 1951.

B. L. Farrand, Jr.E.I.C., is manager of construction in Disher and Farrand in Toronto.

Mr. Farrand is a 1951 graduate of Queen's University in civil engineering.

J. W. Breed, Jr.E.I.C., is junior engineer in the production department of the City of Winnipeg Hydro Electric System where he is engaged in the supervising of operation and maintenance of electrical equipment.

He was previously a student engineer in training with Canadian Westinghouse Company in Hamilton, Ont.

Mr. Breed graduated in electrical engineering from the University of Manitoba in 1951.

Arthur John Crouse, Jr.E.I.C., is a technical assistant in the C.I.L. Nylon Division in Kingston, Ont.

Mr. Crouse is a chemical engineering graduate of the Nova Scotia Technical College, class of 1951.

H. G. Giles, Jr.E.I.C., is employed by H. G. Acres & Company, as assistant electrical engineer at the J. Clark Keith Generating Station of the Hydro-Electric Power Commission of Ontario in Windsor, Ont. He was previously on the Pine Falls Power Development of the Manitoba Hydro Board at Pine Falls, Man.

Mr. Giles graduated in 1950 from the University of Manitoba in electrical engineering.

B. H. Newington, Jr.E.I.C., has been transferred from Ottawa by the Trans-Canada Highway Division of the Department of Resources and Development to Banff, Alta.

Mr. Newington is a graduate civil engineer of McGill University, class of 1951.

G. L. Anderson, Jr.E.I.C., is now with T. W. Hand Fireworks Company, Limited, as plant manager in Papineauville, Que.

Mr. Anderson graduated in 1950 from the University of Toronto in chemical engineering.

V. F. Zubko, Jr.E.I.C., has joined the Sun Oil Company in Wetaskiwin, Alta.

Mr. Zubko graduated in 1949 from the University of Saskatchewan in mechanical engineering.

W. Donald Paton, Jr.E.I.C., has accepted the position of designing engineer with Pre-Compressed Concrete Engineering Co. Ltd. in Montreal. He was previously with the International Paper Company in Hawkesbury, Ont.

Mr. Paton is a graduate civil engineer of the University of Toronto, class of 1950.

J. M. Veness, Jr.E.I.C., is acting superintendent of the Engineering and Architectural Division of National Parks in Banff, Alta. He was previously with the Cape Breton Highlands National Park at Ingonish Beach, N.S.

Mr. Veness is a 1950 graduate in civil engineering from the University of New Brunswick.

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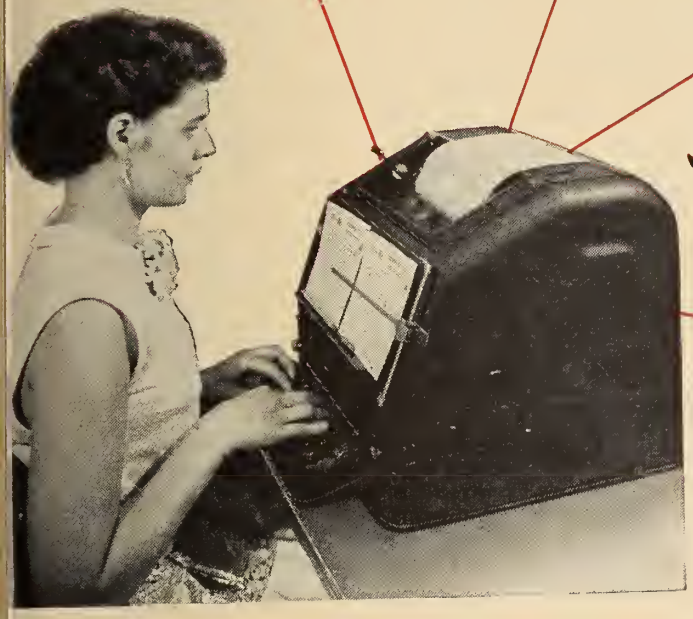

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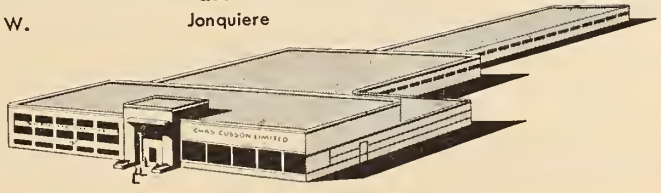

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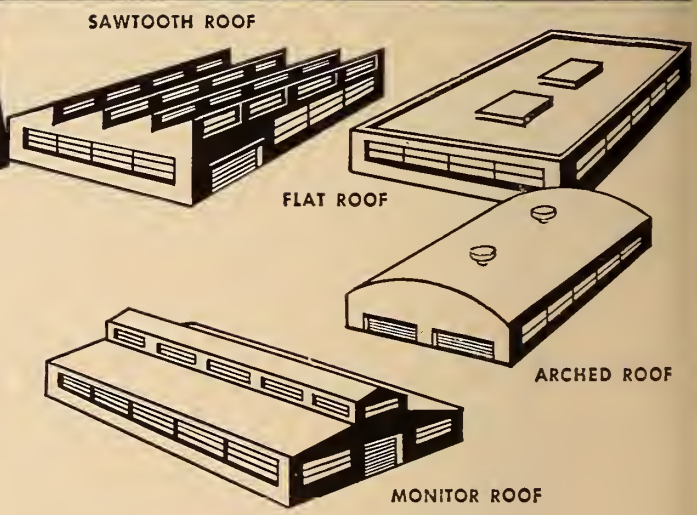

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C. E. James Blaiklock, JR.E.I.C., has joined The Foundation Company of Canada Limited in Montreal.

Mr. Blaiklock graduated in mechanical engineering from the University of Toronto in 1951.

Wm. Delahay, JR.E.I.C., has joined Imperial Oil Limited in Guelph, Ont.

Mr. Delahay is a 1950 graduate in mechanical engineering from Queen's University.

J. M. Ferguson, JR.E.I.C., has joined Calgary Power Limited in Cochrane, Alta. He was formerly with the Montreal Engineering Company in Chicoutimi, Que.

Mr. Ferguson is a graduate of the University of Saskatchewan in civil engineering, class of 1946.

H. M. Whittles, D.F.C., JR.E.I.C., instrument man with the International Nickel Company of Canada, Limited in Sudbury, Ont., and former Flying Officer in the R.C.A.F., was recently invested with the Distinguished Flying Cross in a ceremony at R.C.A.F. Station, North Bay, Ont., before a parade of some 300 station personnel by Air Vice-Marshall A. L. James, C.B.E., C.D., air officer commanding air defence command, St. Hubert, Que.

The citation accompanying his investment was as follows: "This officer completed a tour of operational sorties which included attacks against numerous enemy cities.

"On one of these missions a Focke-Wulf 190 was engaged and destroyed with his co-operation.

"On another occasion, this officer flew without oxygen most of the way to the target and entire flight home, and in spite of extremely adverse weather conditions he displayed exceptional skill in navigation and the target was bombed on time.

"This officer has always shown courage, determination and a great devotion to duty."

Mr. Whittles is a mining engineering graduate of the University of Alberta, class of 1949.

Charles F. Olive, JR.E.I.C., is presently employed by Mathews Conveyor Company Limited in Port Hope, Ont.

Mr. Olive graduated in 1951 from the Nova Scotia Technical College in mechanical engineering.

H. W. Dodge, JR.E.I.C., is a control department engineer with Bathurst Power & Paper Co. Ltd. in Bathurst, N.B.

Mr. Dodge is a chemical engineering graduate of the Nova Scotia Technical College, class of 1951.

J. Relich, JR.E.I.C., formerly with Gypsum Lime and Alabastine Company Limited in Caledonia, Ont., has joined Brunner Mond Canada Limited in Amherstburg, Ont.

Mr. Relich is a 1951 chemical engineering graduate from the Polish University College.

G. L. Gooding, JR.E.I.C., is now employed by the Central Bridge Company as estimating engineer.

Mr. Gooding graduated in 1950 from the University of Toronto in civil engineering.

John K. Cavers, JR.E.I.C., has joined Bepco Canada Limited in Toronto.

Mr. Cavers graduated in 1951 from the University of British Columbia in mechanical engineering.

Michael J. Nugent, JR.E.I.C., is application engineer in the air conditioning department of Canadian General Electric Company Ltd. in Toronto. He was previously in the apparatus department of the Company.

Mr. Nugent graduated in 1951 in mechanical engineering from the Nova Scotia Technical College.

Wm. Lloyd Dodson, JR.E.I.C., is employed by the Dominion Steel and Coal Company at Sydney, N.S.

Mr. Dodson is a mechanical engineering graduate of the Nova Scotia Technical College, class of 1946.

T. G. Sughrue, president of the Boston and Maine Railroad, signs the visitors' book at the Institute headquarters in Montreal during his visit on March 2, 1953. On hand to greet Mr. Sughrue were I. R. Tait (left) vice-president of the Institute, and A. W. Whitaker, Jr. (right).

C. G. Forberg, JR.E.I.C., has been appointed town engineer of Wallaceburg, Ont. He was formerly assistant city engineer in St. Thomas, Ont.

Mr. Forberg graduated in civil engineering from Queen's University in 1949.

George Frederick Bishop, JR.E.I.C., is a field supervisor with Angus, Butler & Associates, consulting engineers in Edmonton, Alta.

Mr. Bishop is a graduate in mechanical engineering from the Nova Scotia Technical College, class of 1949.

Henry Bily, JR.E.I.C., has recently been appointed supervisor of materials handling methods in the plant layout and material handling methods engineering department of the Ford Motor Company in Windsor, Ont.

Mr. Bily is a 1950 graduate in mechanical engineering from the University of Saskatchewan.

Roy William Vokey, JR.E.I.C., has joined the Bell Telephone Company of Canada as equipment engineer.

Mr. Vokey is a graduate in electrical engineering from McGill University, class of 1951.

G. E. Estey, JR.E.I.C., formerly in the construction department of Hydro-Electric Power Commission of Ontario, has recently entered Canadian Copco Limited in Toronto.

Mr. Estey graduated in electrical engineering from the University of New Brunswick in 1947.

J. T. Wieckowski, JR.E.I.C., formerly with the Northern Power & Industrial Piping Company in Toronto, is now employed by the Hydro-Electric Power Commission of Ontario.

Mr. Wieckowski is a graduate of the University of London in mechanical engineering, class of 1950.

Frank B. Matthews, JR. E.I.C., has been transferred by Maloney-Crawford Tank & Manufacturing Company to Glendive, Montana, from Edmonton, Alta.

Mr. Matthews is a graduate of chemical engineering from the University of Alberta in 1949.

T. M. Medzwiecki, JR.E.I.C., is at present mechanical engineer in the control department of Anglo-Newfoundland Development Company in Grand Falls, Newfoundland.

Mr. Medzwiecki was previously design engineer with Stadler, Hurter & Co., consulting engineers, in Montreal.

He is a mechanical engineering graduate of McGill University, class of 1947.

Victor Le Guerrier, JR.E.I.C., has joined the Sherbrooke Glassheat & Supplies, Inc. in Sherbrooke, Que.

Mr. Le Guerrier is a graduate of Ecole Polytechnique in civil engineering, class of 1951.

Lieut. (E) A. Geoffrey Ford, R.C.N., JR.E.I.C., is at present engaged in the marine engineering course at the Royal Navy Engineering College in Plymouth, England. He will complete the course in December of this year.

Lieutenant Ford was previously stationed in Esquimalt, B.C.

He is a graduate of the University of British Columbia in mechanical engineering, class of 1951.

A. G. Fairhead, JR.E.I.C., has joined the J. H. Ryder Machinery Company in Toronto. He was previously with International Harvester Company in Hamilton, Ont.

Mr. Fairhead is a graduate of the University of Toronto in mechanical engineering, class of 1948.

Gaston E. Boucher, JR.E.I.C., has joined the staff of Southern Canada Power Co. Ltd. in Montreal.

Mr. Boucher graduated in 1950 from Laval University in electrical engineering.

W. R. Wiggins, JR.E.I.C., has been transferred to the Saskatchewan Power Corp. in Saskatoon, Sask. He was previously assistant engineer in Regina, Sask.

Mr. Wiggins is an electrical engineering graduate of the University of Saskatchewan, class of 1949.

Capt. S. M. Bancroft, R.C.E., JR.E.I.C., is with the Northwest Highway System in Whitehorse, Yukon Territory. He was previously with the R.C.S.M.E. in Chilliwack, B.C.

Captain Bancroft graduated in 1949 in civil engineering from the Nova Scotia Technical College.

Wm. Jas. Phillips, JR.E.I.C., has been employed by the Nova Scotia Light & Power Company since graduation in electrical engineering from the Nova Scotia Technical College in 1950.

W. R. Newcombe, JR.E.I.C., has joined the preliminary design section of Canadian Westinghouse Company Limited in Hamilton, Ont. He entered the Company as an engineering apprentice in 1950.

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Canada Vitrified Products Limited, St. Thomas, Ont.
National Sewer Pipe Company Limited, Toronto, Ont.

Mr. Newcombe is a graduate of the Nova Scotia Technical College in mechanical engineering, class of 1950.

Raymond Boisjoly, JR.E.I.C., is employed in the engineering department of the Consolidated Paper Corporation in Shawinigan Falls, Que.

Mr. Boisjoly is a graduate of the Nova Scotia Technical College in mechanical engineering, class of 1948.

S. Stoller, JR.E.I.C., has recently been discharged from active duty in the United States Army and has returned to his former firm, Gibbs and Hill Inc., consulting engineers and constructors, in South Gate, Calif.

Mr. Stoller is a 1949 graduate of the University of Manitoba in electrical engineering.

Fernand Bourassa, JR.E.I.C., is now chief engineer of the municipality of La Tuque, Que. He was previously field engineer with Anglin Norcross Company, Ltd. in Montreal.

Mr. Bourassa graduated in 1951 from McGill University in civil engineering.

Cyril Gerard Breau, JR.E.I.C., is assistant to the design engineer of the New Brunswick Power Commisison in Fredericton.

Mr. Breau graduated in electrical engineering from the Nova Scotia Technical College in 1947.

R. R. Bernard, JR.E.I.C., has joined Raymond Concrete Pile Company Limited in Montreal as assistant chief engineer. He was previously project engineer with J. L. E. Price Company Limited in Montreal.

Mr. Bernard graduated in 1949 in civil engineering from McGill University.

J. E. Boucher, JR.E.I.C., has joined Sperry Gyroscope Company of Canada Limited in Ottawa.

Mr. Boucher received his B.Sc. degree in engineering physics in 1950 from the University of Alberta, and his M.Sc. degree in electrical engineering from McGill University in 1951.

C. F. Charters, JR.E.I.C., has joined St. Regis Paper Company (Canada) Limited in St. Johns, Que.

Mr. Charters is a 1950 graduate of McGill University in chemical engineering.

Stanley Z. Mack, JR.E.I.C., is now defence research service officer with Canadian Armament Research and Development Establishment in Valcartier, Que.

Mr. Mack is a 1948 graduate in engineering physics from the University of Toronto.

Delphis F. Amirault, JR.E.I.C., is employed with Fraser-Brace Engineering Company at Isle Maligne, Que.

Mr. Amirault graduated from the Nova Scotia Technical College in civil engineering in 1951.

George M. Stephen, JR.E.I.C., has joined the staff of Fraser Brace & Roane-Anderson Company in Calhoun, Tenn. He was previously with the Fraser-Brace Engineering Company at St. Joseph d'Alma, Que.

Mr. Stephen is a graduate of McGill University in civil engineering, class of 1951.

F/O A. V. Rugienius, R.C.A.F., JR.E.I.C., has been transferred from Montreal to Ottawa.

Mr. Rugienius graduated in chemical engineering from McGill University in 1951.

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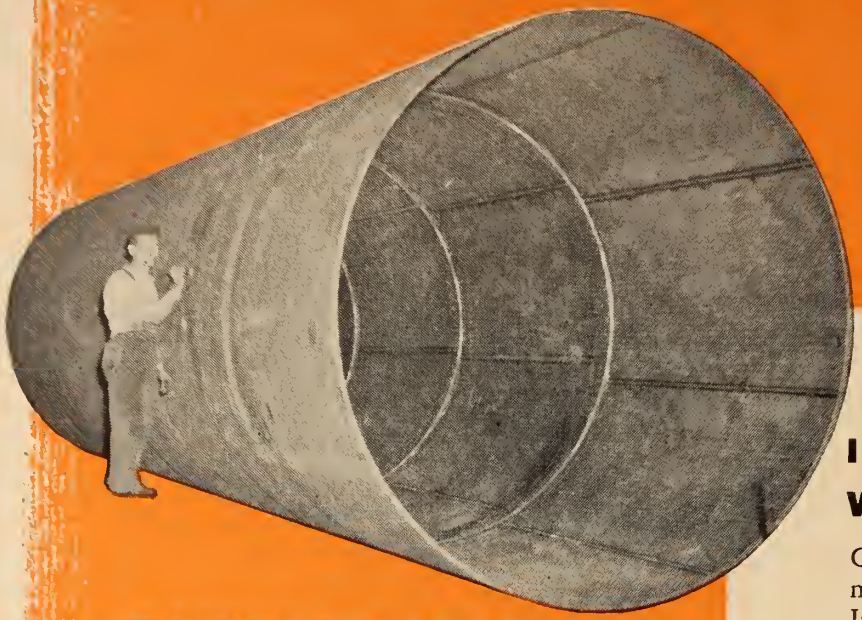

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S/L C. R. Thompson, R.C.A.F., JR.E.I.C., is now employed as chief project engineer with the CEPE Climatic Detachment at Namao, Alta.

Squadron Leader Thompson is a 1949 graduate of the University of Alberta in engineering physics.

Ferris J. Abbass, JR.E.I.C., is a quantity engineer with Canadian Westinghouse Company Limited in Three Rivers, Que. He was previously in the lamp and tube division of the Company's plant in Hamilton, Ont.

Mr. Abbass is a 1950 graduate in electrical engineering from the Nova Scotia Technical College.

Terrence Thos. Kiernan, S.E.I.C., has recently entered the employ of Champlain Oil Products.

He is a 1952 civil engineering graduate of McGill University.

R. Ross Smith, S.E.I.C., is now in the employ of the Shell Oil Company in Calgary, Alta.

Mr. Smith is a 1952 graduate of McGill University in civil engineering.

N. O'Brien, S.E.I.C., has accepted employment with Asbestos Corporation in Thetford Mines, Que.

Mr. O'Brien was formerly junior engineer with International Nickel Company of Canada Limited in Copper Cliff, Ont.

F. J. Robinson, S.E.I.C., has joined Stone & Webster (Canada) Ltd. in Trail, B.C.

J. R. Buttle, S.E.I.C., has returned to the University of Alberta after having served at the Reserve Naval Training Establishment in Esquimalt, B.C.

Leo. A. Yaskowich, S.E.I.C., has joined the staff of Angus Butler & Associates Limited, consulting engineers, Edmonton, Alta.

Mr. Yaskowich is a 1952 graduate in mechanical engineering of the University of Saskatchewan.

Denis F. Savignac, S.E.I.C., has joined Germain & Frere in Three Rivers, Que.

Mr. Savignac graduated in 1952 in mechanical engineering from Ecole Polytechnique.

Bernard G. King, S.E.I.C., is field engineer with C. D. Howe Company Ltd. in Ottawa. He was previously with Fraser-Brace Engineering Co. Ltd. at Isle Maligne, Que.

Mr. King is a 1952 civil engineering graduate of McGill University.

A. Senneville, S.E.I.C., is now associated with Dominion Bridge Company, Limited in Montreal.

Mr. Senneville graduated in 1952 in civil engineering from Ecole Polytechnique.

S/Lt(L) G. A. Kastner, R.C.N., S.E.I.C., is presently engaged on a course with the Naval Electrical School in Halifax, N.S.

Sub-Lieutenant Kastner is a 1952 graduate in electrical engineering from the University of New Brunswick.

E. Snowball, S.E.I.C., is now employed by the Naval Department of the Department of National Defence in Ottawa.

He was previously plant engineer with the Saguenay Power Company in Isle Maligne, Que.

Mr. Snowball is a 1952 graduate in electrical engineering from the University of Manitoba.

W. C. Belschner, S.E.I.C., is with the Pentagon Construction Company in Montreal.

Mr. Belschner graduated in 1952 as a civil engineer from the Nova Scotia Technical College.

Douglas L. Brown, S.E.I.C., has joined the staff of Willards Chocolates Limited as mechanical engineer. He was previously with A. V. Roe (Canada) Ltd. in Toronto.

Mr. Brown received his B.Sc. degree in mechanical engineering from the University of Manitoba in 1952.

F. Joseph Hauser, S.E.I.C., has joined the Aluminum Company of Canada, Limited in Kemano, B.C.

Mr. Hauser is a 1952 graduate in civil engineering from the University of British Columbia.

Michel Corriveau, S.E.I.C., formerly in the employ of Price Brothers and Co. Ltd. in Chicoutimi, Que., has joined Vaillancourt & Corriveau in Chicoutimi.

Pierre Bergeron, S.E.I.C., has been appointed resident engineer with the Department of Roads for the Province of Quebec in St. Jacques des Piles in Laviolette County, Que.

Mr. Bergeron is a graduate of Laval University in civil engineering, class of 1952.

James P. Archibald, S.E.I.C., is mechanical department foreman with National Gypsum (Canada) Ltd. at Dingwall, N.S.

Mr. Archibald is a 1952 graduate in mechanical engineering from the Nova Scotia Technical College.

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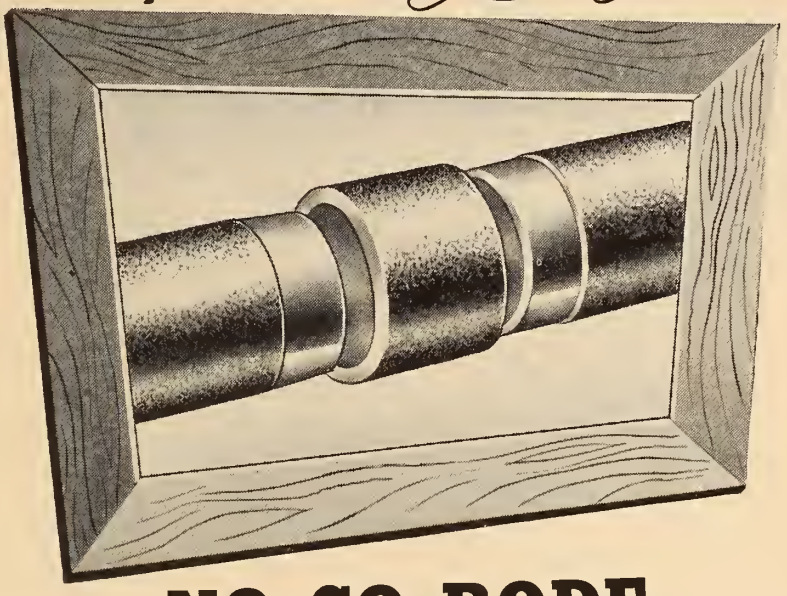

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Paul A. Berube, S.E.I.C., is enrolled in the Canadian General Electric training course in Peterborough, Ont.

Mr. Berube graduated in electrical engineering from the Nova Scotia Technical College in 1952.

Gerald C. Boyd, S.E.I.C., is employed by the Montreal Engineering Company, Limited in Millertown, Nfld.

Mr. Boyd is a civil engineering graduate of the Nova Scotia Technical College, class of 1952.

Eugene Dontigny, S.E.I.C., has joined the staff of H. G. Acres and Company in Lac Casse, Que.

Mr. Dontigny is a 1952 graduate of McGill University in civil engineering.

Somers Prikler, S.E.I.C., is employed at the H.M.C. Dockyard in Halifax, N.S.

Mr. Prikler graduated in electrical engineering from the Nova Scotia Technical College in 1952.

Jean-Louis Chollet, S.E.I.C., and **Paul Roberge,** S.E.I.C., have been awarded Athlone scholarships allowing them two years of post-graduate work in Britain after graduation from Laval University this spring.

Mr. Chollet is in chemical engineering and Mr. Roberge is in civil engineering.

The scholarships, established by the British Government in 1951, provide the winners with all expenses and tuition fees while in Britain plus £360 a year.

Harry A. Cottenden, S.E.I.C., is with Canadian General Electric Company, Limited in Toronto.

Mr. Cottenden is a 1952 electrical engineering graduate of the Nova Scotia Technical College.

B. Lederman, S.E.I.C., has joined Bepco Canada Limited of Montreal.

Mr. Lederman is a 1952 graduate in electrical engineering from McGill University.

T. R. Giovannetti, S.E.I.C., has been transferred by Canadian Industries Limited from the engineering office in Windsor to the plant maintenance department where he will serve as engineer assistant to the maintenance and construction engineer.

Mr. Giovannetti graduated from the Nova Scotia Technical College in mechanical enginering in 1952.

Visitors to Headquarters

Keith B. Jolly, Berlin, New Hampshire, February 27, 1953.

E. W. Izard, M.E.I.C., Victoria, B.C., February 27, 1953.

T. G. Sughrue, Boston, Massachusetts, March 2, 1953.

R. M. Edgar, Boston, Massachusetts, March 2, 1953.

Kyung Mo Ahn, Pusan, Korea, March 2, 1953.

E. W. Montgomery, M.E.I.C., Sorel, Quebec, March 1, 1953.

John Grieve, M.E.I.C., Toronto, Ontario, March 16, 1953.

Maj. Gen. G. R. Turner, M.E.I.C., Ottawa, Ontario, March 20, 1953.

H. W. Tate, M.E.I.C., Toronto, Ontario, March 20, 1953.

R. J. Trafford, Jr.E.I.C., Toronto, Ontario, March 24, 1953.

R. M. Richardson, M.E.I.C., Saint John, New Brunswick, March 25, 1953.

V. A. McKillop, M.E.I.C., London, Ontario, March 27, 1953.

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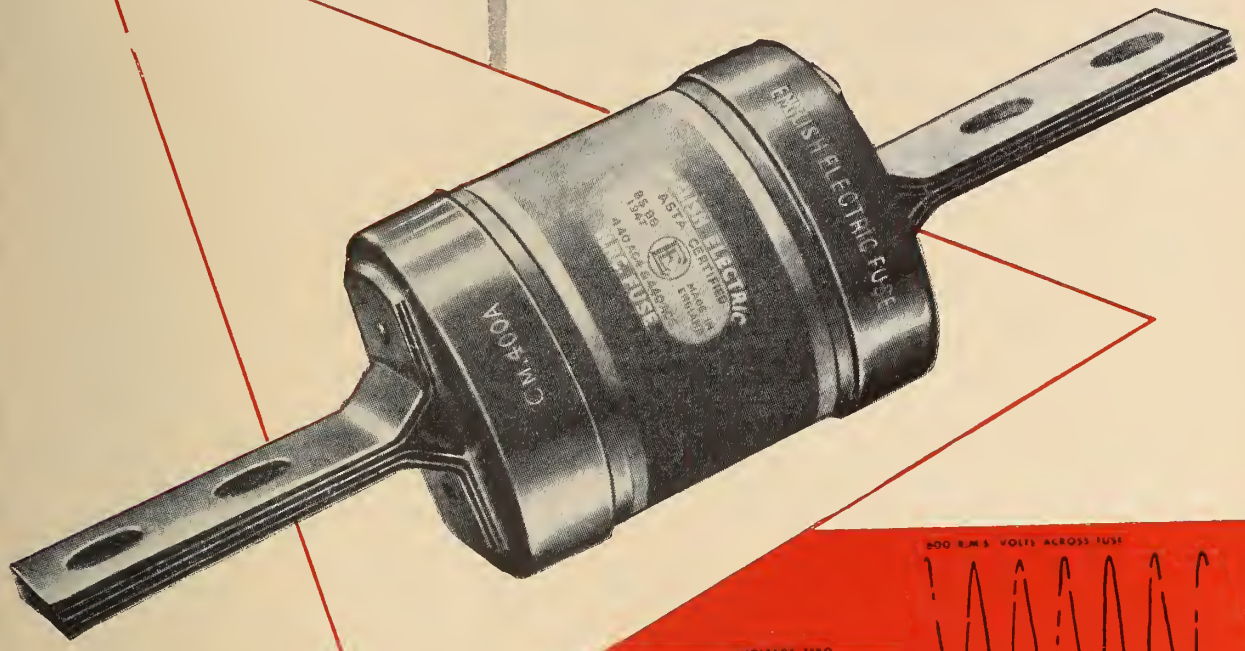

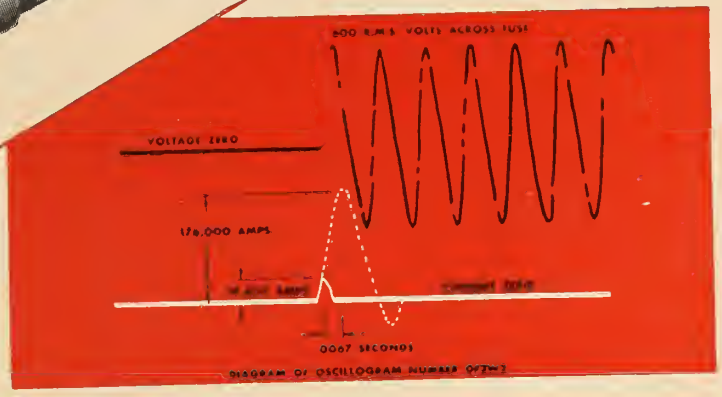

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Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Charles Vandyke Corless, M.E.I.C., of Tillsonburg, Ont., former general manager and director of the Mond Nickel Company, died on February 7, 1953, after a brief illness.

Mr. Corless was born at New Durham, Ont., on July 30, 1868. He received his B.Sc. degree with honours in mining engineering from McGill University in 1902, and his M.Sc. degree from the same university in 1903. He was later granted the degree of Doctor of Laws by both McGill University and Queen's University.

Mr. Corless entered the Mond Nickel Company after finishing his postgraduate work at McGill University and was placed in charge of mining operations, and later, smelting operations. By 1907 he was appointed manager of the Company, after having been responsible for the construction of the hydro-electric plant, three substations, two mining plants, and the rebuilding of the smelting and converting plant.

When he resigned as manager of the Mond Nickel Company he was retained as consultant for several years, a position he also held for some time after the Company was acquired by the International Nickel Company.

Mr. Corless served as president of the Canadian Institute of Mining and Metallurgy, president and director of the Ontario Mining Association, and as a member of the Dominion and the Ontario Research Councils.

Believing staunchly in the tremendous mineral possibilities of the Canadian Pre-Cambrian Shield, and Canadian mining as a whole, he presented the facts as he had garnered them, first in an electrifying presidential address to the Canadian Mining Institute in 1922 and again in 1924. The response from all quarters was heartening. The stability of Canadian business during the world-wide depression that followed some years later, and the vast developments since, have justified the ringing slogan he coined at the time for Canada's youth, "Go north, young man, go north!"

Mr. Corless joined the Engineering Institute as a Student in 1903, transferring to Member in 1910. In 1947 he was granted Life Membership.

Hugh Boscawen Fergusson, M.E.I.C., senior director of G. A. Harvey and Company (London) Limited, Greenwich metals works in London, England, passed away suddenly on February 20, 1953, while holidaying in Madeira.

Mr. Fergusson was born at Shanghai, China, on March 30, 1884. He received his early schooling at Queens College, Vancouver, B.C., and in 1902 was articled to his father, a member of the Institution of Civil Engineers. He entered the Royal School of Mines in Freiberg, Germany, in 1903, graduating as a mining engineer in 1906.

Upon graduation, Mr. Fergusson became a partner in Burr and Fergusson, consulting engineers in Vancouver. From 1906 to 1908 he was assistant engineer on the construction of the Spanish Lake Dam for the Cariboo Gold Company. The following year he was engineer in charge of 25 miles of the Yukon Gold Company's ditch line at Dawson, N.Y.T. In 1910 he became assistant to Chief Engineer C. G. DuCane for Norton Griffiths and Company in Vancouver. Two years later he became a full partner in the firm of DuCane, Dutcher and Fergusson in Vancouver. He was personally in charge of the construction of Barriere River Dam and the Elbow River power and development project. Chief engineer for the Calgary and Fernie Railway, as well as the Hudson Bay and High River Railway, he was responsible for making the location plans and surveys of 400 miles of railway, and reconnaissance surveys of 900 miles of railway from Fernie, B.C., to LePas, Manitoba.

Mr. Fergusson joined the Royal Volunteer Engineers in 1914 and the next year led 750 skilled Canadian railway men to North Russia where he was in charge of construction of the Murmansk railway. In 1916 he became works manager of the Royal Ordnance Factory in Gretna which employed a staff of 60,000 At the close of the war he was recommended by Lord Moulton for appointment as chief technical advisor to the British Military Governor at Cologne where he stayed for about a year.

The next four years Mr. Fergusson spent in Spain as consulting engineer on hydro-electric plants and railway electrification projects. This was followed by five years in South America as chief agent for railway construction during which time Mr. Fergusson was in charge of the construction of the main Trans-Andine highway from Cucuta to Bogota Among a great variety of engineering projects, Mr. Fergusson was responsible for the heaviest section of Canadian Railways, that of the Canadian National system between Yale and Hope on the Fraser River.

Mr. Fergusson joined G. A. Harvey and Company (London) Limited in July, 1933 as manager of the heavy construction department and was very largely responsible for the growth and development of their activities in the oil, chemical and heavy engineering industries. He was appointed to the board of directors in May, 1938.

His wide experience, ability and foresight provided a moving force behind the development of oil refinery equipment in England, and he will be remembered for his pioneer work in this field. Outside his business activities he never spared himself in his efforts to encourage the young engineer, and his many papers read to the foremost institutes have been and will be for many years, a major source of technical information.

Mr. Fergusson was a member of the Institute of Mechanical Engineers and of the Institute of Naval Architects.

He joined the Engineering Institute of Canada as a Member in 1910 and was granted Life Membership in 1947.

Paul Moody Smith, M.E.I.C., construction engineer with Pacific Coast Terminals Company Limited in Vancouver, B.C., was drowned in a fishing accident at Harrison River, B.C., on May 24, 1952.

Mr. Smith was born at Victoria, B.C., on October 22, 1886. He received his education at Victoria High School and through private study in engineering with the Scranton School.

In 1904 he served as clerk in the division engineer's office of the Canadian Pacific Railway in Vancouver. A year later and until 1907 he held positions ranging from chairman to resident engineer of construction with the Nicola Valley railway. During the year 1907 he was instrument man during a preliminary survey of the Alberni extension of the E & N Railway. The following two years were spent as transitman and masonry inspector for the Canadian Pacific Railway at Nelson, B.C., and until 1914 he served as special engineer for the Company in both Vancouver and Port Moody, B.C. In 1914 Mr. Smith joined Hyne's Stone and Staff Company as manager and served in that capacity until 1915.

He then enlisted for overseas service in the 47th Battalion, and was drafted to the 7th Battalion in France in August of 1915. Wounded three months later, he was returned to England where he served as instructor in musketry and machine guns while on discharge from hospital until 1917 when he was transferred and drafted to the 3rd Canadian Railway Troop in France. He was promoted to the rank of lieutenant that same year and was sent to the 4th Canadian Railway Troop upon its formation. During the construction of a bridge in 1918 his arm was broken at the elbow and he was permanently disabled. He was invalided back to England for a few months, but returned to France as company officer of the 11th Canadian Railway Troop until the end of the war.

Upon his return to Canada he became assistant engineer on the Sumas reclamation project in British Columbia.

In the late 1920's Mr. Smith opened his own firm under the name of P. M Smith Construction Company in Vancouver and continued its operation until joining the Pacific Coast Terminals Company Limited as construction engineer in 1946.

Mr. Smith was a keen sportsman and was specially enthusiastic about hunting and fishing. He had always shown a particular interest in the conservation of wild life in British Columbia.

He joined the Engineering Institute as a Member in 1920.

Charles F. Draper, O.B.E., M.E.I.C., formerly construction engineer with Foundation Maritime Limited in Hali-

fax, N.S., died in Lennoxville, Que., in November, 1952.

Mr. Draper was born at Blackrock, Ireland on November 26, 1876. He received his high school training in Dublin, and entered Trinity College in 1895, graduating with an M.A. and a B.A.I. degree in civil engineering in 1899.

While studying civil engineering, Mr. Draper was associated with the late Carter Draper, a member of the Institute of Civil Engineers of Ireland. In 1900 he joined the War Department of Ireland as acting division officer in the Royal Engineers until 1904 when he became assistant to the chief engineer of the Great Southern and Western Railway in Ireland.

Mr. Draper came to Canada in 1911 and entered the Canadian Pacific Railway as assistant engineer in the bridge department.

He joined the Royal Engineers as a captain in World War I and was placed in charge of construction of light railways in Egypt, Palestine and Syria. In 1917 he was promoted to the rank of major and received the O.B.E. Upon his discharge from the Army, he returned to the Canadian Pacific Railway and continued with this Company until his retirement in 1929. During this period he was engineer in charge of the Saint John Cantilever Bridge in New Brunswick which was constructed between 1920 and 1921.

Mr. Draper was in charge of the river section of the Lake St. Louis Bridge at LaSalle, Que., constructed by the Province of Quebec between 1932 and 1934.

He was a member of the Institute of Civil Engineers of Ireland, an associate member of the Institute of Civil Engineers of Great Britain, and a member of the Association of Professional Engineers of both New Brunswick and Quebec.

Mr. Carter joined the Engineering Institute of Canada as a Member in 1922.

Harry William Rowley, M.E.I.C., consulting engineer on irrigation, layout and operation, died in hospital at Coaldale, Alta., on December 28, 1951.

Mr. Rowley was born at Byron, Michigan, on December 23, 1887. He received his B.Sc. degree from the Michigan Agriculture College in 1912.

In 1914 Mr. Rowley entered the Department of the Interior in Calgary, Alta., and was employed as district hydrometric engineer in the department of hydrometric surveys. In this capacity he also served as irrigation inspecting engineer and district waterman.

In December, 1917, he joined the Canadian Pacific Railway Company as district water master in the engineering branch of the Department of Natural Resources. For years he operated a Canadian Pacific Railway farm in the Coaldale-Readymade district and was widely known in the community.

Mr. Rowley was a pioneer in the organization of the Coaldale Mutual Telephone System, and participated in many community activities including county fairs.

He joined the Engineering Institute of Canada as a Member in 1922.

William Arthur Newman, C.B.E., M.E.I.C., of Montreal, chief of motive power, and the department of research for the Canadian Pacific Railway, died in hospital in Montreal on March 6, 1953.

Mr. Newman was born in Hamilton, Ont., on June 29, 1889. He received his

William Arthur Newman, M.E.I.C.

early education at the public school and Highfield School in Hamilton, and entered Queen's University in 1907, graduating with a B.Sc. degree in mechanical engineering in 1911.

Mr. Newman first started to work for the railway at Angus Shops in Montreal as a special machinist's apprentice in 1911. The following year he was transferred to Smith Falls, Ont., for six months, returning to Montreal as a draughtsman in 1912. The next year he lectured in mathematics at Queen's University, and from 1914 to 1916 was assistant professor in mechanical engineering at Queen's. He returned to the Canadian Pacific Railway in 1916 as superintendent of betterments. The following year he became assistant mechanical engineer and by 1928 he became successively engineer of locomotive construction, engineer of locomotive and car construction, mechanical engineer and chief mechanical engineer.

From 1940 until 1944 Mr. Newman was on loan from the C.P.R. as president and managing director of Federal Aircraft Limited, a Crown company, and for a year was in charge of the entire Canadian aircraft industry as aircraft controller in the Department of Munitions and Supply.

In 1943 he was awarded the O.B.E. in the King's Honours list. He was awarded the C.B.E. in 1946 for his part in Canada's wartime production effort.

After the war he organized the C.P.R.'s department of research and was its manager from 1945 until 1949.

In 1948 the American Society for Metals in convention at Philadelphia selected him to receive their distinguished service award, citing his "valuable contribution to the advancement and progress of alloy steel". The Engineering Foundation which provides grants from its endowments for research work that same year appointed him at its annual meeting in New York a member of its research procedure committee. His work in alloy steel went back to 1918 when he conducted the Canadian Pacific Railway's development of heat-treated alloy steel frames for locomotives and the use of alloy steel plates for pressure vessels.

Mr. Newman was a member of the executive committee of the Queen's University board of trustees and was awarded a doctor of science degree there. He was a fellow of the American Society of Mechanical Engineers, and was a member of the Joint International Council of ASME-EIC.

A past president of the Canadian Railway Club, Mr. Newman was a member of the engineering committee for the industrialization of atomic energy with the National Research Council. He was also a member of the board of the Engineers Foundation in the United States.

Mr. Newman was distinguished not only for his success in the field of engineering but as well for his services to many non-engineering organizations. Chief among these was his church—Trinity Memorial—where he served on a variety of committees and boards mostly dealing with finances and buildings. He was honorary president of the Columbus Fish and Game Club and a past president of the Royal Montreal Curling Club. He was on the board of the Trafalgar School for girls in Montreal.

A short time ago he delivered the Sir Seymour Biscoe Tritton Lecture before the Institution of Locomotive Engineers in London, England. He was the convocation speaker at Queen's University in 1952. Prominent among his hobbies was photography and gardening, in both of which he enjoyed great success.

Mr. Newman was another one of those engineers who reach great heights within the profession but who still can find time to help others. He was blessed with great numbers of friends and associates who respected him, admired him and had a great affection for him. His life full as it was with useful activity and unselfish endeavour is a splendid example to young men in the profession.

Mr. Newman joined the Engineering Institute of Canada as a Member in 1935.

Edgar Doctor Robertson, M.E.I.C., passed away in Victoria, B.C., on September 14, 1952.

Mr. Robertson was born in Ottawa in 1885. He joined the civil service four years after Alberta became a province, beginning as an assistant in the surveys department in 1909. In 1912 he was transferred to the highways branch as engineer and surveyor.

Following the outbreak of World War I he enlisted in the Royal Canadian Engineers and was on active service until the end of hostilities. He returned to Alberta and was reappointed to the highways branch of the Alberta Department of Public Works.

In 1937 Mr. Robertson was appointed superintendent of maintenance and held that post until his retirement in 1946.

Mr. Robertson was a member of the Association of Professional Engineers of Alberta.

He joined the Engineering Institute as a Member in 1941.

John Duncan MacKay, M.E.I.C., city engineer of Fredericton, N.B., for the past 27 years, passed away suddenly on February 5, 1953. He was widely known in municipal, engineering and fraternal circles in the provincial capital and in eastern Canada.

Mr MacKay was born in Fredericton in 1890. He received his early education

in the City's public schools, and graduated with a B.Sc. degree in civil engineering from the University of New Brunswick in 1913.

In 1917 he enlisted in the Royal Canadian Engineers and served overseas in England, France and Belgium. After his discharge he was associated with the lumber industry and engaged in construction engineering before accepting his appointment as city engineer of Fredericton in 1926.

Commenting on the major loss to the community caused by Mr. MacKay's death, Mayor H. S. Wright described Mr. MacKay as "the most valued employee the City has ever had."

Mr. MacKay was president of the Maritime branch of the Canadian section of the American Water Works Association, and this year he was elected president of the Association of Professional Engineers of New Brunswick.

Mr. MacKay joined the Engineering Institute of Canada in 1942.

Ambrose A. Paoli, M.E.I.C., Winnipeg branch manager of John Inglis Company Limited of Toronto, died suddenly at his residence in Winnipeg on December 16, 1952.

Mr. Paoli was born in Charlottetown, P.E.I., in 1892. He received his early education there and entered Prince of Wales College in that city in 1907. He graduated in 1910 and enrolled in Queen's University in 1911, graduating with a B.A. degree in 1915. That same year he was awarded the Rhodes Scholarship for his native province.

During the summer of 1913 he served as chairman and rodman on a city survey for Charlottetown. The following summer was spent as conduit construction foreman for the Bell Telephone Company of Canada at Peterborough, Sudbury and Sault Ste. Marie, Ont. He was employed as assistant to the chief chemist of Armstrong Whitworth Company of Canada at Longueuil, Que., during the summer of 1916, and served as testing engineer and inspector for the Imperial Munitions Boards from September 1916 until April, 1917. That same year he joined the British Forgings Limited in Toronto as smelter foreman, pit foreman, testing engineer and metallurgist.

The following year he served as night superintendent in the manufacture of French Government steel for the Charleston Alloy Steel Company in Virginia, and in December, 1917 he joined the John A. Crowley Company in Detroit, Mich., as night foreman in the manufacture of tool steel, and nickel-chrome-cobalt steel for the American Government. He next entered the Union Tool Company in Torrance, Cal., as superintendent of the open hearth and electric furnace department, and the succeeding three years were spent as superintendent of steel and iron smelting for the Moreland Motor Truck Company in Burbank, Cal., and as furnace superintendent of the California Electric Steel Company in Wilmington, Cal.

In 1921 Mr. Paoli returned to Queen's University for civil engineering study, and graduated with a B.Sc. degree in 1922.

Upon graduation Mr. Paoli entered the sales engineering field in Canada. He joined the Canadian Ingersoll-Rand Company serving as branch manager in Toronto and Sydney. He was transferred by the Company to Winnipeg in 1924, and after four years as branch manager there, he joined Kipp-Kelly Limited in that city as manager of mining and the contracting machinery sales department. He later became a director of the Company. He then joined Vulcan Iron Works Limited in Winnipeg, serving first as manager of the mining machinery department, and later as foundry consulting engineer and general sales manager. During World War II, Mr. Paoli supervised all government contracts taken by the Company.

After 12 years with the Vulcan Iron Works, Mr. Paoli became district sales manager in Winnipeg of John Inglis Company Limited, manufacturers of general engineering products. He had been with this Company for eight years.

Mr. Paoli was a member of the Association of Professional Engineers of Manitoba, the Canadian Institute of Mining and Metallurgy, the Institute of Power Engineers, Western Canadian Water and Sewage Conference, the Winnipeg Chamber of Commerce, and the Maritime Provinces Association.

He joined the Engineering Institute of Canada in 1948 as a Member.

Andrew Burt, M.E.I.C., of the Department of Transport in Montreal, died on November 29, 1952.

Mr. Burt was born at Tarbert, Argyll, Scotland, on August 5, 1891. He received his early education at Queen Anne School and Dunfermline High School at Dunfermline, Scotland, and in 1908 entered the Lauder Technical School in that city. He specialized in steam and applied mechanics, machine construction and drawing, in conjunction with five years' apprenticeship. In 1918 he received his first class board of trade certificate issued at Leith, Scotland.

He became marine engineer on various vessels of the Donaldson Line of Glasgow, Scotland, in 1914. After serving in this capacity for ten years, he was appointed chief engineer on vessels of Canadian National Steamships with the responsibility for the efficiency of the boilers and machinery.

Mr. Burt was appointed staff engineer with the controller of ship repairs in 1942, and was placed in charge of the Saint John office with control over the Bay of Fundy area.

In 1945 he became assistant superintendent and resident engineer with the Park Steamship Company at Saint John, N.B., and was in charge of repairs on Park vessels.

Two years later he joined the Saguenay Terminals Limited as resident superintendent at Port Alfred, Que., and was in charge of work on board the vessels using that port.

From 1950 until his death, Mr. Burt was associated with the Department of Transport, first in Victoria, B.C., and latterly in Montreal.

Mr. Burt was a member of the Association of Professional Engineers of New Brunswick.

He joined the Engineering Institute as a Member in 1949.

William John Kelly, Jr.E.I.C., of the Canadian Arsenals Limited at St. Paul l'Ermite, Que., died in September, 1952.

Mr. Kelly was born at Sudury, Ont., in 1926. He received his early education at Kentville, N.S. After attending Dalhousie University he entered the Nova Scotia Technical College, graduating with a B.Sc. degree in electrical engineering in 1949.

After graduation Mr. Kelly joined Cossor (Canada) Limited in Halifax, N.S., and in 1952 he entered Canadian Arsenals Limited near Montreal.

Mr. Kelly joined the Engineering Institute as a Student in 1949, transferring to Junior in 1951.

Robert Ford, S.E.I.C., of the Aluminum Company of Canada, Limited, died at Isle Maligne, Que., on May 7, 1952 at the age of 27 years.

He was born at Ladner, B.C., and received his high school education at Kitsilano High School in Vancouver.

In 1941 he entered Boeing Aircraft Limited in Vancouver where he was employed for two years before joining the Canadian Army in 1943. Upon his discharge from the Army in 1945, he entered the British Columbia School of Pharmacy from which he graduated in 1946.

He enrolled in the University of British Columbia that same year and graduated with a B.A.Sc. degree in metallurgy in 1951.

While attending university Mr. Ford was employed during the summer months by the Department of Mines and Resources, the Dominion Water and Power Bureau in Vancouver, and the Department of Transport in Vancouver.

Upon graduation he joined the Aluminum Company of Canada, Limited, at Isle Maligne, Que., in 1951.

Mr. Ford joined the Engineering Institute of Canada as a Student Member in 1948.

D. L. Phillips, D.F.M., S.E.I.C., of Halifax, N.S., died on June 6, 1952, as a result of injuries received when struck by a car while leaving work at the Imperial Oil Refinery at Dartmouth, N.S.

Mr. Phillips was born at Wentworth Creek, N.S., in 1922. He enlisted in the Royal Canadian Air Force at the outbreak of war and served with the rank of Flying Officer. He was awarded the Distinguished Flying Medal for outstanding service in combat.

Upon his return to civilian life, Mr. Phillips entered Acadia University in 1946. After three years' study there, he enrolled in the Nova Scotia Technical College in 1949, and graduated with a B.Sc. degree in chemical engineering in 1952.

During the summer holidays from 1945 until 1950, Mr. Phillips worked as laboratory technician with the Imperial Oil Limited in Dartmouth, N.S. He continued with this firm after graduation.

Mr. Phillips joined the Engineering Institute as a Student Member in 1952.

Samuel Nathan Landau, S.E.I.C., of Tel-Aviv, Israel, died as a result of an accident in August, 1952.

Mr. Landau was born in Berlin, Germany, on June 16, 1928. He went to Tel-Aviv at an early age, and received his elementary education at Hevzlia in that city.

In 1946 he came to Vancouver, B.C., and entered the University of British Columbia from which he graduated with a B.Sc. degree in electrical engineering in 1951.

After graduation Mr. Landau returned to Tel-Aviv.

He joined the Engineering Institute of Canada in 1949 as a Student Member.

GIANTS IN THE FIELD

In Canada's great allied industries, lumbering and paper, Electrical Conductors for the transmission of ever higher voltages have made feasible developments once considered impossible.

Tough, dependable Canada Wire Steel Wire Logging Ropes have proved one of this industry's most important tools.

In either Electrical Conductors of every kind or Steel Wire Rope, Canada Wire offers more than 40 years' experience in manufacturing products to meet the needs of these two great Canadian industries.

ELECTRICALLY Canada Wire *ENGINEERED*

CANADA WIRE AND CABLE COMPANY LIMITED

FACTORIES: Toronto, Montreal, Vancouver

SALES OFFICES FROM COAST TO COAST

Employment Service

EMPLOYMENT BULLETIN

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

DESIGN DRAUGHTSMAN required for designing and making layouts of piping and equipment installations in chemical engineering plant. Five years experience essential. Age 24 to 30 years. File No. 4526-V.

CHEMICAL ENGINEERING, recent graduate required by water treatment company for sales and service. Location Eastern Canada. Applicants must be free to travel. File 4550-V.

CIVIL

APPLICATIONS WILL BE received for the position of Township Engineer and road superintendent for a town in the District of Sudbury, population now 7,500. Applicants must be qualified civil engineers and should be prepared to handle all problems in connection with roads, water works, etc., in a growing municipality. We employ a work supervisor. Applicants should state age, qualifications, past experience, references and salary expected. File No. 4513-V.

CITY IN WESTERN CANADA has a permanent position open for civil engineer for valuation and assessment work in the assessment department. Several years practical experience in commercial building estimating and construction essential. Salary according to qualifications. Excellent opportunity for advancement. General pension plan. File No. 4529-V.

CIVIL ENGINEER required by the Federal District Comm. for the position of resident engineer on construction. Applicants should be under 45 and should have a broad experience in the construction field and must be capable of taking responsible charge of some new highway construction in Ottawa area. Salary will depend on qualifications and experience. Position may lead to permanent employment. File No. 4530-V.

EXPERIENCED STRUCTURAL DESIGN engineer. Must be Canadian citizen, graduate in engineering from a university of recognized standing and with a number of years of experience in the design and construction of engineering structures in both reinforced concrete and steel. Applicants should state age and qualifications and give full particulars of experience. Salary open depending on experience. File No. 4536-V.

CIVIL ENGINEER with three or four years experience since graduation required in Ontario. It is desirable that at least a portion of this time should have been on steel and concrete design work. File No. 4540-V.

ELECTRICAL

ELECTRONIC DEVELOPMENT ENGINEERS, Test Engineers, installation engineers, required by organization located in the Maritimes. Salaries commensurate with ability. Five-day week. group insurance. File No. 4515-V.

LIGHTING ENGINEER required by manufacturing company in Toronto. Applicant should be experienced in both sales and layout of interior lighting schemes in hot/cold cathode lighting. Some experience in street and flood lighting an advantage. File No. 4516-V.

COMPONENTS ENGINEER with at least 5 years experience in general electronics devices such as radar, radio and television, etc. Will probably have a design background with sound knowledge of procurement problem and supply resources on components. Familiar with military and industrial specifications. Location Ontario. File No. 4518-V.

ELECTRONICS ENGINEERS required by national research council to carry out research on electronic telecommunications equipment; to design and develop specialized electronic equipment as required; to carry out technical liaison duties. Honours degree in physics engineering physics or electrical engineering with specialized training in electronics required Must have interest and ability in circuit design, must have interest in or experience with electronic computers. Research experience in circuit work would be useful. File No. 4519-V.

ELECTRICAL ENGINEER with electric utility experience to assume post of general superintendent or to work into this position. The vacancy is with a hydroelectric utility having 40,000 customers and comprises high voltage transmission, substations, underground and overhead distribution. Location La Paz, Bolivia, population 410,000. Salary open depending on experience and qualifications. File No. 4521-V.

SERVO MECHANISMS engineer required to carry out research and development on guided missiles. Experience with electrical and electro hydraulic servo system and with navigation equipment desirable. File No. 4522-V.

ELECTRONIC INSTRUMENT engineer to carry out instrumentation work on guided missiles, telemetering and range instrumentation experience desirable. The applicant must be capable of planning and directing the work of junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER required by pulp mill located in P.Q. Applicant would be primarily in charge of all mill electrical maintenance and electrical repair installations. Prepared to consider applicants who have had a few years experience or those with many years experience in this type of work. Salary open. Good opportunity for advancement. File No. 4535-V.

MECHANICAL

MECHANICAL DRAUGHTSMAN, wanted for piping and equipment layouts for small steam plant, factory buildings, and town water supply and sewage disposal to work in our Montreal Head office. Apply in writing giving full details of experience, qualifications, age and references. File No. 4512-V.

MANUFACTURING ENGINEER required with 2-10 years experience in manufacturing design methods and tooling. Should be mechanical engineer with considerable electrical experience. Location Ontario. File No. 4518-V.

MECHANICAL ENGINEERS with six to 10 years experience to carry out design and development on armament systems. The applicants must have experience in planning and directing the work of junior scientists. File No. 4522-V.

MECHANICAL ENGINEER required to act as sales engineer for company specializing in the solution of manufacturing problems involving materials handling, dust and fume disposal, and the processing of materials. Man required must be maintaining active personal contact with industry. He should be preferably mechanical engineer with a knowledge of plant layout, and the application of materials handling equipment. Duties would be to follow up inquiries, contact prospective customers. This work could be undertaken in conjunction with present activities. File No. 4523-V.

MANUFACTURER OF STELLITE AND PRECISION CASTINGS requires a production works manager who has proven managerial capabilities. Preference will be given to a mechanical or metallurgical graduate who has experience in machine and tool manufacturing and foundry operation. Familiarity with high temperature alloys an asset. Salary commensurate with qualifications and experience. Location Ontario. File No. 4525-V.

JUNIOR DESIGN ENGINEER graduate mechanical required for designing and making layouts of piping and equipment installations in chemical engineering plant. Two years experience essential. File No. 4526-V.

RECENT MECHANICAL ENGINEER with evidence of interest in mechanical or technical problems and with experience or aptitude for sales. He should be completely bilingual and able to deal

with all levels of personnel and management. The work involves study of actual conditions related to the use and formulation of procedure and policies which must be sold at the level of top management. File No. 4527-V.

UNIVERSITY LOCATED IN Western Canada invites applications for the post of professor and chairman of the department of mechanical engineering and also for the post of assistant professor of mechanical engineering. Appropriate academic qualifications, broad experience in mechanical engineering with special interest in thermodynamics and power plant design are desirable. Starting salaries depend upon qualifications and experience. Generous retirement plan, group insurance and other benefits are available. Duties commence Sept. 1st, 1953. Applications should be accompanied by a curriculum vitae, a recent photo and submitted not later than June 1st, 1953. File No. 4531-V.

DESIGN ENGINEER a good opportunity with a sound future for a graduate mechanical engineer who has had practical experience in structural designing for commercial vehicle production. In reply state age, experience, references and salary expected. File No. 4533-V.

A YOUNG ENGINEER with experience in gas properties, flows, pressure regulation and combustion plus a knowledge of mechanical design. Work will involve the design and development of gas equipment including customer promotional work. Salary will be commensurate with experience and qualifications. File No. 4543-V.

GRADUATE MECHANICAL ENGINEER required for design of power plants; heating and ventilating; to take charge of drafting room for firm of consultants—location Ottawa. Replies should state minimum salary expected and all other pertinent information including age, marital status. File No. 4544-V.

MISCELLANEOUS

MECHANICAL OR CIVIL ENGINEER required by manufacturer of brick, tile and other ceramic products located in Ontario. Applicant must be essentially a plant man, and willing to work plant hours. He should be old enough to have had basic experience and young enough to be trained in the operations. File No. 4514-V.

APPLICATIONS ARE invited for the position of instructor in the department of engineering, Mount Allison University, Sackville, N.B. A candidate for this position must be a graduate in engineering and preferably, although not necessarily, have some teaching experience. Candidates will please submit applications, stating qualifications and salary expected, to Dean of Science, Mount Allison University, Sackville, N.B. File No. 4517-V.

DESIGN ENGINEER required with experience in radar VHF and UHF equipment, servi-mechanisms and general electronic devices for air born radar projects. Location Ontario. File No. 4518-V.

TELECOMMUNICATIONS engineer required with 2-10 years experience in the design and development of small transformers. File No. 4518-V.

SENIOR PRODUCTION control planner with 3-10 years experience in either production control planning, factory supervision, methods or time study capable of supervising small staff. Location Ontario. File No. 4518-V.

COMMUNICATIONS ENGINEER required by national research council to study and report on new and existing communications systems and on development in ancillary equipment; to act as liaison officer on radio propagation matters. Honours degree in engineering physics or electrical engineering and knowledge of multiplex and telegraphic equipment required. Post graduate training or experience desirable. File No. 4519-V.

MECHANICAL OR FORESTRY ENGINEER required by Montreal branch of well known Eastern Canada manufacturer to handle sales and installation of specialized line of machinery for pulp and saw mills. Candidate should be bilingual, ready to travel and have at least 2 years experience in either of the above industries. File No. 4520-V.

ELECTRICAL ENGINEER or engineering physicist to direct electronic design and electronic systems production engineering for guided missile development. The applicant must have experience in electronic component testing and subminiaturization techniques, and must be capable of directing the work of junior scientists. File No. 4522-V.

MICROWAVE AND ELECTRONICS engineer or physicist with six to 10 years experience to carry out research and development on guided missiles. The applicant must have experience in planning and directing the work of junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER or engineering physicist with experience in electronic computation to carry out development work on aircraft fire control computors. Basic knowledge of microwave and servo mechanism desirable. File No. 4522-V.

ENGINEERING OR SCIENCE graduates for general training designed to equip suitable persons for future responsibility. Eventual job assignment, after completion of general training course, will depend upon personal aptitude. Preference given to single applicants not over 25 years of age. File No. 4524-V.

ASSISTANT OR ASSOCIATE professor mechanical engineering required in Halifax, N.S. Duties to instruct undergraduate students and develop post graduate work. Time and facilities for research. Qualifications: university graduate preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Classification of appointee will depend upon qualifications of successful applicant. File No. 4528-V.

MECHANICAL OR CHEMICAL ENGINEER around 30 years of age to act as sales representative in Eastern Canada, from Ottawa to Halifax, with headquarters either in Montreal or Quebec City by manufacturers of water treatment equipment for all process industrial and municipal service. Applicant selected would be sent to head office and plant at Paterson, New Jersey for a number of weeks to gather first hand information. Head office of Canadian Company in Montreal with offices in Ottawa, Toronto and Calgary. File No. 4532-V.

ASSISTANT SUPERINTENDENT for open pit mine and terminal operations on St. Lawrence North Shore. Mechanical or electrical engineer preferred, with at least three years experience in maintenance work. Candidate should speak French. New 6-room house available. Salary open. File No. 4534-V.

DRAUGHTSMEN REQUIRED for work in Victoria, B.C. Structural, experienced in designing and detailing, reinforced concrete structures; bar lists, bills of material, quantities, small buildings, check engineering drawings. Electrical: general and detailed arrangement, conduit drawings, wiring diagrams and material lists for generating and transformer stations in all sizes, voltages up to 138KV. File No. 4537-V.

THE FACULTY OF ENGINEERS of the Syrian University, at Aleppo, is seeking candidates for the posts of professors and assistant professors in the following fields:

1. Mathematics, (analysis, analytical and mechanical geometry).
2. Applied Chemistry (also elements of Geology).
3. Hydraulics and hydraulic machines.
4. Mechanical Engineers (workshop tools, foundry forge).
5. Communications (bridges, highways, marine construction).
6. Civil Engineering.
7. Thermal Engines.
8. Metallic Constructions.
9. Electrical Engineering.

Teaching in the French language, age over 30 and engineer's diploma from a recognized university. Applications should be received not later than May 31, 1953. File No. 4538-V.

TIME STUDY MAN or industrial engineer required in Montreal. Must have general knowledge of foundry practice and be capable of doing time study work under direction of consulting engineer. Specialized training will be given to a man with foundry background and necessary personal qualifications. Apply with full information. File No. 4539-V.

EXPERIENCED SALES ENGINEER with at least 4 or 5 years of selling experience. This work calls for an experienced mature sales engineer with capabilities for doing direct selling of industrial instruments. File No. 4541-V.

PRODUCTION ENGINEER required in Montreal. Engineer experienced in supervisory work in production and plant organization. Capable of handling projects for shop production a well as giving assistance to plant manager on personnel work. Would also have occasion to work with the American plant and must be able to get along with people. File No. 4541-V.

CIVIL ENGINEER

Applications will be received by the Federal District Commission for the position of Resident Engineer on construction. Applicants should be under 45 and should have a broad experience in the construction field and must be capable of taking responsible charge of some new highway construction in the Ottawa area. Salary will depend on qualifications and experience. Position may lead to permanent employment. Apply by letter to the Chief Engineer, Federal District Commission, 291 Carling Avenue, Ottawa.

The University of Manitoba

Faculty of Engineering and Architecture
Winnipeg, Manitoba

PROFESSOR and CHAIRMAN

Department of Mechanical Engineering

as well as an

ASSISTANT PROFESSOR OF

Mechanical Engineering

Applications are invited for the post of

1. **Professor and Chairman of the Department of Mechanical Engineering.**
2. **Assistant Professor of Mechanical Engineering.**

Appropriate academic qualifications, broad experience in Mechanical Engineering with special interest in thermodynamics and power plant design are desirable.

Starting salaries depend upon qualifications and experience.

Generous retirement plan, group insurance and other benefits are available.

Duties commence September 1st, 1953.

Applications should be accompanied by a curriculum vitae, a recent photographic likeness and be submitted to the Dean of the Faculty of Engineering and Architecture not later than June 1st, 1953.

Further information may be obtained by writing to:

A. E. MACDONALD, *Dean.*

Works Manager Wanted

Manufacturer of Stellite and Precision Castings requires a production works manager who has proven managerial capabilities.

Preference will be given to a mechanical or metallurgical graduate who has experience in machine and tool manufacturing and foundry operations. Familiarity with high temperature alloys an asset.

Salary commensurate with qualifications and experience.

Reply to Deloro Smelting & Refining Co. Limited, Deloro, Ontario, attention R. C. Walsh, General Manager, stating age, experience and references which will be kept confidential.

JUNIOR ENGINEER required in Montreal to work in shop production. Capable of working on projects with a minimum of supervision. Work would involve occasional trips to American plant to study new equipment and to help bring them into production in Canada. Practical knowledge of machine operations gained outside of the regular university course would be helpful but not essential. File No. 4541-V.

GRADUATE ENGINEER required to act as Western salesman for large organization with head offices in Montreal. Qualifications: 25 to 35 years of age preferably single due to amount of travelling required. Candidates should have proven sales experience preferably in plumbing, electrical or building supply fields. Salary, plus travelling expenses and company car. File No. 4542-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMIST OR CHEMICAL ENGINEER experienced in compounding and laboratory testing of rubber goods, particularly along mechanical lines. Location Province of Quebec. File No. 4470-V.

TWO CANADIAN GRADUATES in Chemical Engineering required by organization in Ontario. Primarily interested in 1952 graduates with interest in process and supervisory work. Salary depends on qualifications. File No. 4501-V.

CHEMICAL SALES ENGINEER required to work in Central Ontario. Employment would be employed in marine department this season and would work from Toronto to Port Colborne and would be eventually taken into industrial department. File No. 4508-V.

GRADUATE ENGINEER required in Quebec City to be employed in air-conditioning and refrigeration department. Applicant must be bilingual and conversant with the application, selection, sales, administration and service of such equipment and to act as manager of the department. Salary is open depending on the experience and capabilities of the applicant. Age range between 27 to 40 years of age. File No. 4509-V.

CIVIL

YOUNG GRADUATE CIVIL ENGINEER for position of transitman on a railway division in P.Q. Commencement salary $205.00. Increases according to service and experience. File No. 4366-V.

CONSTRUCTION ENGINEER required as department manager for expanding construction firm in Alberta. Must have field experience in concrete work. Unlimited opportunity. Give all qualifications and remuneration expected. File No. 4467-V.

ENGINEER REQUIRED by city located in Western Canada to perform traffic studies and to design highway parking systems. Qualifications: degree in Civil engineering with considerable experience. Preferably experience in highway and traffic problems or the equivalent. Salary $357.00 to $428.00 per month. File No. 4468-V.

CIVIL SERVICE (FEDERAL) requires civil engineer (construction) and an electrical engineer (power and lighting) at salaries depending upon qualifications of applicants, for the department of National Defence at Ottawa. Many years of experience in related fields required. File No. 4477-V.

CIVIL ENGINEER required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

ELECTRICAL

A LEADING ELECTRONICS manufacturing firm, located in Montreal has an exceptional opportunity for an electrical engineer (or equivalent training) who has had several years of practical experience in the design and manufacture of small transformers and other radio receiver components. This position has unusual immediate and long-term prospects. Only fully-qualified engineers will be considered. File No. 4460-V.

ELECTRICAL SALES ENGINEER required by manufacturer located in Hamilton, Ontario, of electric motors to cover Province of Quebec. Applicant must be bilingual. File No. 4472-V.

ASSOCIATE PROFESSOR electrical engineering: duties, to instruct undergraduate students and develop post-graduate work. Time and facilities for research. Qualifications: university graduate, preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Location Halifax, N.S. File No. 4475-V.

ELECTRICAL ENGINEER required by firm of architects in Edmonton. Applicant should be qualified to handle all electrical design. Good salary offered. File No. 4481-V.

JUNIOR ELECTRICAL ENGINEERS required in the signalling department of Canadian Railway. Work is related to the entire field of railway signalling including design, installation, maintenance, repair and inspection. File No. 4485-V.

ELECTRICAL ENGINEERS required by large organization with head offices in Montreal. Applicants should be electrical engineers, who are preferably air force veterans about 30 years of age. Duties include the supervision of the installation and maintenance of specialized equipment in RCAF aircraft, and also the instruction of air crews. Candidates must be free to travel. Salary will be negotiated on the basis of experience and qualifications. File No. 4491-V.

A LARGE PUBLIC organization requires a design engineer with an electrical engineering degree, or its equivalent plus at least three years or more practical experience in electrical construction work, and preferably training with a contractor. Duties would be design and layout of electrical power and lighting circuits, equipment, substations, etc. Salary dependent on experience. Location Toronto. Applicants are requested to apply in their own handwriting. File No. 4507-V.

MECHANICAL

MECHANICAL ENGINEER required for old established concern in S.E. Ontario, within 70 miles of Toronto. Applicants must be interested in design work as applied to materials handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance profit sharing and pension plan available. Apply stating experience and remuneration. File No. 4418-V.

JUNIOR TOOL AND DIE designer required by pulp and paper industry in Province of Quebec. Applicant must also be able to do construction drawings, also entails maintenance of plant engineering records and various detailed reports. Job also covered by group insurance and pension plan. File No. 4469-V.

MECHANICAL ENGINEER required by firm of architects in Edmonton. Applicant must be able to handle all heating and plumbing design. Good salary offered to applicant with experience. File No. 4481-V.

STEAM PLANT ENGINEER required for large Newfoundland paper mill. Essential requirements: 1st class British Board of Trade Marine Engineers Certificate, sound mechanical training, preferably with experience in paper or pulp mill, experience with high pressure boilers and turbines. Age limit 45 years. Attractive salary and good working conditions. Other detailed information available on application. File No. 4483-V.

MECHANICAL ENGINEER required for the position of service supervisor. Applicant must have at least 5 years experience on or associated with steam power house equipment particularly boilers have a good personality and be capable of meeting people and possess the ability to organize and operate a service department. The work will be chiefly in the Head Office in Ontario, but will entail travelling. Salary open. File No. 4497-V.

MECHANICAL ENGINEER for plant engineering department in Montreal. Candidates should be recent graduates with approximately two years experience in mechanical maintenance field. Initiative and mature judgment are, of course, requisites. Duties would involve design, planning and estimating. File No. 4499-V.

MISCELLANEOUS

A LARGE MULTIPLANT company has an important administrative position open for a graduate engineer. The scope of the position embraces the design, upkeep and improvement of manufacturing units engaged in the casting and machining of brass, iron and steel components with mass production foundry equipment and machine tools. The responsibilities of the position includes the direction and efficient operation of the engineering forces at the various plants located across Canada. Salary open. File No. 4459-V.

ESTIMATOR REQUIRED for all types of construction in the commercial institutional and industrial field. Location, Hamilton area, medium size construction company. Applicant must have had experience in these fields. File No. 4461-V.

MECHANICAL AND CIVIL ENGINEERS wanted for a large pulp and paper or-

DESIGN ENGINEER

●

A good opportunity, with a sound future, for a graduate mechanical engineer who has had practical experience in structural design for commercial vehicle production. In reply state age, experience, references and salary expected. File No. 4533-V.

ganization located in Quebec city. Applicants should have one to three years experience in pulp and paper mills or allied industry. File No. 4466-V.

SALES ENGINEER required in Toronto. Applicant must be personable engineer with about 10 years paper mill experience to take charge of paper machinery sales. In addition to administration of sales office routine, duties would include maintaining contact with Canadian mills in promoting sales of paper machines manufactured to designs of Pusey and Jones, and acting as liaison between customer and company's engineering department. Please supply photograph and full details of personal, educational and experience background. File No. 4478-V.

SALES POSITION AVAILABLE at head office, Hamilton. Machinery tools and supplies of British and Canadian manufacture in metal and woodworking. Salary overall commission, in exclusive territory including expenses. File No. 4482-V.

SUPERINTENDENT REQUIRED for natural gas department by Western Canadian Power Corporation to assist in setting up a provincial gas utility. Experience in actual operation of collection, transmission and distribution systems, with particular reference to rates and customer acquisition and relations important. Excellent superannuation plan, sick leave with pay and other fringe benefits. Salary $5,000 to $8,000 per year commensurate with experience and responsibility. File No. 4484-V.

SALES ENGINEER WANTED preferably with some experience in structural steel and tank and plate work, for organization located in Montreal. File No. 4488-V.

ESTIMATOR FOR SPECIAL machine tools fixtures, dies, etc. Position requires a knowledge of design and modern production methods. Location Western Ontario. File No. 4490-V.

THE RESEARCH COUNCIL of Alberta requires an industrial engineer, preferably with mechanical or metallurgical experience, to assist in making industrial surveys, to prepare reports on processes and developments and to provide liaison between science and industry. Position available immediately. The salary will depend on academic attainments and experience. File No. 4492-V.

ELECTRICAL ENGINEERS or physicists with an interest or experience in radar or electronics required by leading electronic organization located in Southern California. After successful training period applicants would become Canadian representatives with Canadian companies where equipment is being installed. Applicants should be under thirty-five years of age, a Canadian citizen. Write giving full resume of experience, etc. File No. 4493-V.

RUBBER CHEMIST required by progressive manufacturer of rubber footwear has an opening for a rubber chemist experienced in compounding development and process control. Must have complete knowledge of formulating compounds, factory processing and laboratory control. Should be able to express himself in French. Salary commensurate with experience. File No. 4494-V.

Openings Exist for Experienced

Mechanical Engineer i/c mechanical design
Electranic Develapment Engineers
Test Engineers
Installatian Engineers

at: Cassar (Canada) Limited
301-303 Windsar Street,
Halifax, N.S.

Salary Cammensurate with ability.
5-day wark week. Group Insurance.
Please send resume to the Chief Engineer

JUNIOR ENGINEER required in Montreal by manufacturer of plumbing and heating materials to work in the estimating department. File No. 4495-V.

ENGINEER REQUIRED for intermediate position in Ontario by organization with head offices in Montreal. Applicant should have some experience in time study and have good engineering background. File No. 4495-V.

AIR CONDITIONING AND refrigeration engineer required by Canadian representative for outstanding line of American equipment, to carry out engineering sales work in Ontario and Quebec. Applicant must have several years experience in this or related field and have successful sales record. File No. 4496-V.

ENGINEER REQUIRED by manufacturer located in Ontario for estimating and scheduling department. Applicant must have experience in the field of mechanical assembly and/or architectural drawing, practical shop and some general contracting experience, estimating experience is very desirable. Age 30 to 40. The starting salary would be commensurate with the man's experience. File No. 4498-V.

SUPERVISOR REQUIRED for a large Western Canadian Warehouse containing varied types of merchandise as well as workshop and assembly areas. Qualifications: age preferably 30 to 40, education, university degree with emphasis on engineering. Must have had at least five years of supervisory experience and must know how to deal with people. Prefer someone with experience in bulk handling methods. Salary will be in accordance with qualifications. File No. 4500-V.

SURVEYOR WANTED for Labrador — Ungava area with experience in transmission line surveying and knowledge of spans and structural location spotting. Applications should give full details including age, education, experience, marital status and salary requirement. File No. 4502-V.

CHIEF ENGINEER required by a well established Western Canadian organization, engaged in both the repair of R.C.A.F. aircraft and industrial manufacturing wishes to enlarge its operation in the sheet metal, plate work, and mechanical fields, particularly with regard to fabricating equipment for the petroleum and petro-chemical industry. A chief engineer with proven record of extensive experience in one of the following fields is required to head the industrial engineering department: structural steel, sheet metal, plate work, pressure vessels, boilers, heat exchangers or mechanical equipment. File No. 4503-V.

INSTRUMENT ENGINEERS required with university degree in engineering. Experience in instrument work a requirement. Preference given to engineers with refinery experience. This is an excellent opportunity with a progressive and expanding oil company located in Western Ontario. Reply giving details of education, experience and background. File No. 4505-V.

INSTRUMENT ENGINEER REQUIRED by large firm of consulting engineers in Montreal. Must have several years experience on interpretation of flow sheets, flaw calculations, industrial measuring and control instruments. File No. 4511-V.

Situations Wanted

CIVIL AND SANITARY ENGINEER Jr.E.I.C., P.Eng., B.Sc., civil, Queen's 1948; M.A.Sc., Toronto 1949. Age 28, single. Presently employed as municipal engineer in charge of engineering and public works department. Have 4½ years experience on design and construction of watermain system, sewer systems, sewage disposal plant, reinforced concrete structures, road construction, pavements and various other municipal projects. Also experienced in estimating, planning and administration. Desires responsible position as design engineer with a firm of consultants or as assistant design engineer with an organization where initiative and ability would lead to advancement. Locate anywhere if position suitable. File No. 250-W.

CIVIL ENGINEER AND LAND SURVEYOR, M.E.I.C., 26 years of varied experience abroad and in Canada, in: Railroad, airport, road, dam, water-supply, irrigation, building, factory construction and related survey of layouts

SALES ENGINEER

TRANSMISSION EQUIPMENT

Man with good technical qualifications and with high voltage transmission line design and operating experience required to advise on the use and sell insulators and transmission line equipment to power supply companies.

This is a senior position with a well-known firm. Salary $4,500 per annum. Apply by letter only, File No. 4545-V.

and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

PLANT ENGINEER with civil and mechanical background, 1936 granduate, M.E.I.C., P.Eng., (Ont.), 17 years experience in design, construction, maintenance, supervision, purchasing and operations in leading Canadian paper mills desires change. Interested in engineering, purchasing, or engineering sales. Picture, details of experience, references on request. File 619-W.

PROFESSIONAL ENGINEER, qualifications grade VI. Experience heavy machine shop manufacturing, field erection of machinery and general industrial construction. Available immediately, on full time, part-time or job basis. File No. 2526-W.

MECHANICAL ENGINEER, Sask. '46, Jr.E.I.C., P.Eng. (Que.), with some experience in design of steel and reinforced concrete structures desires a position with consulting engineers. Experience since graduation includes 18 months drafting in plant expansion programme, 3½ years on project work for plant expansion and modernization and 18 months on plant maintenance and new equipment installation. The last two positions are with the same firm. File No. 2909-W.

MECHANICAL ENGINEER P.Eng., 9 years industrial experience in staff and supervisory positions in production, maintenance, and plant engineering. Wage incentives contract estimating and control for manufacture of heavy equipment, methods study, production eng., purchasing, for volume production. Sound business background. Desire plant or production management or technical sales. Presently employed. File No. 2920-W.

CIVIL ENGINEER, M.E.I.C., professional engineer, age 48, 10 years experience railway and highway construction, 10 years as sales and service manager large eastern electric, gas and transportation utility. 5 years experience ship construction. Presently employed but available on two weeks notice. Seeking permanent position where technical skill, knowledge of handling men and public relations experience would be of value. File No. 3057-W.

PRODUCTION EXECUTIVE — P.Eng., M.E.I.C., B.A.Sc., age 43, family. Extensive production and manufacturing experience in Canada and United Kingdom in variety of industries in senior management positions. Proven administrator and organizer with outstanding drive and energy. Interested in establishing connection with medium to large sized concern in which ability to organize and produce can be utilized. Montreal area preferred but will locate anywhere depending upon proposition. File No. 3138-W.

CIVIL ENGINEER M.E.I.C., P.Eng. N.S., graduate of U.N.B. 49, age 36, married, 53 car. Experienced in construction work, estimating, field engineer, concrete inspection, and etc., on wharf and building construction. Interested in a change to sales engineering. Willing

to travel one month's notice or less. File No. 3182-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., McGill University graduate, age 30, married, without children, desires position with prospects of advancement in Montreal. One year with large paper company on design and construction of electrical power installations. Also some experience on instrumentation and control. For the last two years and at present with leading electrical manufacturer. Available on reasonable notice. File No. 3310-W.

WORKS MANAGER, 19 years diversified experience in heavy industry including maintenance, inspection, design, production, administration and over five years as works manager of large mechanical plant. Graduate mechanical engineer presently employed, but interested in more responsible position offering scope to introduce improvements, including cost reduction and the promotion of sound employer-employee relations. Location preferably Quebec Province, but would go elsewhere in Canada dependent on nature of position offered. File No. 3355-W.

CONSTRUCTION ENGINEER seeks an administrative position with a construction firm. P.Eng., M.E.I.C., B.Sc. in civil engineering from U.N.B. in 1949. Age 33, married. Six years experience in construction as labourer, tradesman, field engineer, office engineer, and cost engineer on large projects Experienced in office procedures, estimating, scheduling, job control, material control, cost accounting, field layout and supervision of all trades on construction of industrial, housing and petro-chemical processing plants. File No. 3386-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field, or in instrumentation and control. File No. 3460-W.

CIVIL ENGINEER, M.Eng., Jr.E.I.C., P.Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement. Montreal area preferred. File No. 3466-W.

COMBUSTION Engineer and Fuel Technologist, M.E.I.C., M.Inst. Fuel, (Eng.), twenty years experience construction, operation and maintenance coke ovens, manufacured and synthetic gas plants, industrial refractory settings, kilns, furnaces, boiler settings, waste heat recovery units, etc., can assume complete charge for all phases of works from foundations to performance tests and reports. Married, free to travel, locate anywhere. File No. 3505-W.

1949 GRADUATE Jr.E.I.C., P.Eng., desires part-time work in Montreal and vicinity doing design work, drafting, checking, etc. File No. 3699-W.

ENGINEER CIVIL/STRUCTURAL, 15 years experience design and construction of buildings, industrial and chemical plant structures and foundations. Trained in England, field and office. Sound theoretical background. Four years senior design engineer with large Canadian Company engaged on hydro-electric development work. Member E.I.C., A.S.C.E., etc. Interested in senior positions only. File No. 3702-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I.Mech.E., (G.B.), M.E.I.C., P.Eng. 20 years experience in development various types high speed I.C. engines, (carburettor, diesel, petrol-injection, supercharged, etc., from 20-1,000 H.P.). At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. File No. 3863-W.

MECHANICAL ENGINEER Jr.E.I.C., B.Eng. N.S.T.C., 1951, age 24, single. Presently employed in propane gas, nave had six months experience in building construction. Desire permanent position with good opportunities for the right man, no preference to job location availab'e at reasonably short notice. File 3903-W.

LAND SURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of a land-surveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. File No. 3908-W.

CIVIL ENGINEER, age 28, 1st class honours B.E. degree, National University of Ireland (1950), D.I.C. for post graduate course in the theory and design of structures at the Imperial College, London, England. P.Eng. (Ontario). Some experience in surveying. Presently employed (since July 1951) at the design of buildings and other structures required for mining plants. Desires position which would give some experience in reinforced concrete or steel design or construction. Location preferably Southern Ontario or Montreal, but will also consider others. File No. 3927-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as. automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

EXECUTIVE AVAILABLE P.Eng. M.E.I.C., B.A.Sc., age 38, family, offers direct administrative experience at a high level of responsibility in a large chain-retail merchandising operation, combined with teaching experience, university administration, and background of electrical engineering followed up by technical experience in the electronic instrument field. Present location southern Ontario but willing to move. Interested in management of a medium-sized industry with growth possibilities dependent on capable administration and promotion; or employee relations and personnel administration, production-sales liaison, or cost control in a large organization which also provides opportunity for advancement. File No. 4075-W.

MECHANICAL ENGINEER, P.Eng., Jr.E.I.C., B.E., 1949, M.Sc. 1951, University of Saskatchewan, married, age 25. Experience includes two years conducting research on heat and moisture transfer through building materials, and two years design work on heating, piping, air conditioning, steam plant and paper mill equipment. Desire responsible position in plant engineering, design or development work where initiative is required. Would prefer to be located in small city or town. File No. 4107-W.

POST-GRADUATE CIVIL engineering, McGill student, who is also honours graduate in mathematics, seeks part time work. Available for full time work from June 1st. File No. 4108-W.

MECHANICAL ENGINEER Jr.E.I.C., married, age 28. Nearly three years experience in pulp and paper industry. Desires position with control or production department of paper company which will eventually lead to a position of responsibility. File No. 4109-W.

METALLURGICAL PHYSICIST AND physico-chemist, graduate, 16 years experience, married, desires position with initiative and responsibility. Experience consists mainly in the development for technique of procedures, especially in thermo-chemistry and measuring technique. File No. 4110-W.

CIVIL AND STRUCTURAL ENGINEER arriving in Canada April, seeks responsible position. Age 26, B.Sc. (Eng.), A.M.I.Struct.E., graduate I.C.E. Experience includes field survey; site investigation; design of general and reinforced concrete structures, sewerage and sewage disposal schemes and water supply; supervision of construction. Presently employed as resident engineer on the construction of new sewerage schemes. Will consider any location in Canada. File No. 4111-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., (Ont.) B.A.Sc., Tor. 1951, M.Sc. Illinois, 1952, age 24, married, one child. Presently employed, one year's experience in soil mechanics. Desires work in structural engineering or with consulting engineer engaged in such or in construction. Available on one month's notice to work anywhere in Canada. File No. 4112-W.

CIVIL ENGINEER, P.Eng. Jr.E.I.C., age 28. married, graduated 1949. Experience includes design, specifications, and field work in ground services, some reinforced concrete design; past 2½ years as resident engineer on multimillion dollar townsite project. Desire responsible position with real opportunity for advancement. Available upon month's notice to present employer. File No. 4119-W.

FIELD ENGINEER, S.E.I.C., 28, married, family. Presently employed as administrative engineer on general building Studying civil engineering and road design under C.I.S.T. Wishes position with responsibility under contractor or consultant. Future promotion on ability. Administrative abilities proven. 1 year on N.H.A. housing; 2½ years on highway location surveys, draughtman, instrument, etc.; 2½ years on subway underpinning, instrumentman yard layouts, assistant project engineer. Familiar with office procedure and field take-offs for quantities. References. Prefer Ontario to start. Working Brockville area now. Available on reasonable notice to present employer. Open for interviews. File No. 4121-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Que.) 1949 graduate, age 31, married, one child. Four years varied experience in electronics, inspection of steam and hydro power plant machinery hydro power plant layout and design. Three years wartime aviation electronics experience. Desire change of location, preferably Ontario or Western Canada. File No. 4124-W.

CHEMICAL ENGINEER, Jr.E.I.C., B,A,Sc. (Toronto 1950), master's degree in Business Administration, age 24, single, 2 years' experience in electrical manufacturing company. Desires position in production supervision with medium-sized company anywhere in Canada where recognition is given for ability and initiative. File No. 4126-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A,Sc. (Chemical, Toronto 1946), Dr. Sc.nat. Swiss Federal Institute of Technilogy, Zurich 1950). Canadian, married, age 28, abroad last six years, residing in Switzerland, France, Indonesia. Just completed three years with a United Nations Specialized agency in scientific liaison work. Travelled extensively. Desirous of organization and management work—policy formulation, planning and administration, leading to increased responsibility and independent action; definite possibilities for advancement dependent on competence in a situation where initiative, imagination and resourcefulness are assets. An organization with foreign interests would be of most interest. File No. 4129-W.

CIVIL ENGINEER, S.E.I.C., Nova Scotia Technical College, 1953. Age 29, married. Overseas with R.C.A.F. Summer experience includes assistant resident engineer department of highways. Seeking employment in structural engineering and steel erection. File No. 4130-W.

1951 GRADUATE IN CIVIL ENGINEERING National University of Ireland, with one year's experience as designer with consultant and at present engaged on construction with railway company, desires employment with consulting engineers in Montreal or Toronto. File No. 4131-W.

ELECTRICAL ENGINEER, M.E.I.C., age 43, married, no children, desires responsible position, 17 years experience in design and construction of electrical lighting and power installation, and electric hydro and thermo electric power stations. At present with leading consulting engineering firm. Available on reasonable notice to present employer. File No. 4132-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., Sask. 1949, age 25, single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting, design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

FULLY QUALIFIED ELECTRICAL, mechanical and patent engineer and lecturer, 22 years experience in power stations, transmission and distribution, installation of electrical and mechanical plant. Energetic, reliable and can undertake variety of responsible positions. File No. 4139-W.

JUNIOR E.I.C., 1947 graduate, offers 5 years of quality control and production

supervision experience in non-metallic processing industry. Desires supervisory or administrative position in industrial minerals, pulp and paper or chemical industry, preferably located in Western Canada. Age 27, married, 1 child. Available on reasonable notice to present employer. File No. 4142-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.E. (Sask.) 1949, D.L.S., age 29, married. 4 years experience electronic surveying. Army veteran with radar technical training. Desires position in field of engineering or surveying. File No. 4146-W.

METALLURGICAL ENGINEER — 1951 McGill graduate, S.E.I.C., age 29, married, bilingual. R.C.A.F. commissioned service. Desires employment leading to the production and supervision fields. Summer experience in copper and nickel production. 2 years experience in steel plant operations. Wish location in southern Ontario, but preferably in Quebec (Montreal area). File No. 4148-W.

ENGLISHMAN DESIRES post in Canada. B.Sc. (Eng., Lond.), M.E.I.C., A.M.Inst., C.E. At present employed in hydroelectric projecting department of world-renowned European Continental electrical firm. Specialist in traction from tramcars to diesel and gas turbine locomotives, long operational experience. Practically bilingual (French mother). 52 but healthy and active. File No. 4149-W.

JR.E.I.C., P.Eng., B.Sc. in civil engineering U.N.B. '48, desires responsible position with construction firm. Age 29, veteran, married, two children, five years experience in construction in estimating, purchasing materials and job supervision on building projects. Desires position in Ontario or Western Canada with progressive company having good opportunity for advancement. Available on two weeks notice. File No. 4150-W.

ELECTRICAL ENGINEER, B.A.Sc., U.B.C. 1950, age 28, married, 2 children. Completed Westinghouse's 2 year graduate training course. Desires position in plant engineering, manufacturing engineering,, or electrical design, File No. 4153-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., University Graduate, over 20 years diversified plant engineering experience in process industries and steam power plants seeks responsible position in pulp and paper industry or allied fields. Experience includes design, construction, maintenance, planning and administration. File No. 4155-W.

GRADUATE METALLURGICAL ENGINEER, age 41, seeks a progressive and responsible post. Intimate knowledge of the steel industry fits him for an operating or research post. Married with children, homeowner and financially solvent. Presently employed. Willing to consider anywhere in Canada. File No. 4156-W.

CIVIL ENGINEER, A.M.I.C.E. (qualified 1949), aged 31, married (2 children); at present Deputy Engineer of a town (population 11,000) in England; seeks any appointment in Canada offering scope for his capabilities. Particularly experienced—roads and sewers, house design, housing layouts and planning. Used to writing specifications; taking-off quantities, preparing estimates, drawing up of contracts and supervising construction. 4½ years war service RAF. File No. 4157-W.

GRADUATE MECHANICAL ENGINEER, age 39, (15 years diversified experience in heavy industry, including maintenance, plant layout, erection, production and administration. Special knowledge of steel plant machinery, operation and production of rolling mills, electric welded pipe plants, pipe galvanizing and steam power plants. Knowledge of technical correspondence in English, French, German and Portuguese. Presently employed and interested in more responsible position with a company that can offer incentive and advancement to an ambitious engineer. Willing to locate anywhere if position suitable. Available on reasonable notice. File No. 4158-W.

DESIGN ENGINEER, M.E.I.C., fully experienced in reinforced concrete design and water works engineering available for part time work in Montreal. Designing drafting or detailing. File No. 4159-W.

ENGINEERING PHYSICIST, B.Sc. 1948, M.Sc. 1950, P.Eng. Two years university teaching in physics, two years research in X-Ray deffraction and electron microscopy in government laboratory. Age 31, married. Seeks position in industry offering opportunity for advancement. Willing to take training course. File No. 4160-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 31, bilingual with some teaching experience at leading university and production experience in a nationally known sewing machine company, etc., seeks position in a well established peace time mass production industry, (automotive, chemical, oil. etc.), interested in working on development of new processes or machines or preferably an extensive period of training leading eventually to an executive opening. Services available May 15, or possibly before if employer offers an attractive long term future. File No. 4161-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 32, veteran, 1949 graduate. Experience consisting of production supervision, process development and control work including supervision of engineering graduates in this work. Desire position providing experience in another manufacturing field. File No. 4166-W.

CIVIL ENGINEER, unmarried, 28, bachelor's degree Cornell University, master of science degree Cornel University in engineering materials and highway engineering. Interested in research or teaching position in soil mechanics, concrete, highway materials, highway engineering; or working with a well established engineering firm. Available July 1, 1953. File No. 4167-W.

CHEMICAL ENGINEER, P.Eng. Ont. Jr.E.I.C. 1949 graduate, (Queens), age 25, single. One and a half years experience in production supervision in chemical extraction plant and two years experience in process development and production supervision in chemical plant producing cellulose and thermoplastic films. Interested in a position in supervision, process development or technical service offering a good opportunity for advancement. Location, Ontario or Western Canada preferred. Presently employed but available on reasonable notice. File No. 4168-W.

CIVIL ENGINEER, B.Sc. (Hons.), Edinburgh, A.M.I.C.E., A.M.I.E. (Aust.), veteran R.E. officer, aged, 32, married with two children, recently district engineer, Colonial Engineering Service, seeks employment with contractor, consultant or municipality, perferable in B.C., or Ontario. Arriving in Canada late April 1953. Experienced in construction and maintenance of roads, bridges, airfields, light buildings, waterworks. Accustomed to executive responsibility, office administration, preparation of plans and specifications and supervision of contracts. Experience administration of small town boards. Prepared to work hard to establish himself firmly in Canada. File No. 4169-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in industrial planning of major expansions, and plant improvements including investigation, reports, estimates, and design (civil and some mechanical). During 4 years in pulp and paper industry, reaching supervisory capacity, have obtained broad field and office experience in diversified structural design and plant engineering. Spent 1 year structural design of power plants with consulting engineer. Seek responsible position with industrial organization. Locate anywhere in Canada. File No. 4171-W.

SHELL STRUCTURE SPECIALIST available. M.Sc., M.E.I.C., graduated 1947. File No. 4173-W.

MECHANICAL ENGINEER, married, with three years experience in production supervision, quality improvement, cost reduction, and maintenance in a large basic industry. Worked as an undergraduate with the Dominion Government in charge of a field crew. Will consider a position with any organization that presents opportunity and challenge. Will work anywhere in Canada including the N.W.T. and will consider a foreign assignment. File No. 4174-W.

GRADUATE IN BOTH mechanical and electrical engineering (B.Sc. Queen's Belfast, 1946) P.Eng. M.E.I.C., age 29, single. Experience comprises two years manufacture of marine and land diesel engines, diesel alterations, steam turbines, six months manufacture and repair of electrical machinery, eight months diesel drawing office work, and two years steam power station operations. Canadian experience—ten months electrical distribution, four months electrical protection. Seeks position in Alberta, British Columbia, or Western U.S.A. File No. 4175-W.

GRADUATE CHEMICAL ENGINEER M.E.I.C., honours, family multilingual, high invention record, imaginative, resourceful, 20 years diversified experience in heavy chemicals and management (pilot plant experiments, research, production, economic studies, estimation, plant design). Conversant with fluid mechanics, thermodynamics, fluidization, heat exchange, drying, air conditioning. Extensively travelled. Presently employed but interested in more responsible position offering scope to introduce improvements, consultant or assistant to senior executive. Location preferably Montreal area, but would consider going elsewhere depending on nature of position offered. File No. 4176-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc. (mathematics and chemistry), B.E. from Nova Scotia Technical College 1952, desires a position offering more scope for learning and advancement. Presently employed in transmission and distribution department of utility. Interested in learning design. Age 25. File No. 4177-W.

STATISTICAL ENGINEER, graduate engineer J.E.I.C., qualified in mathematical statistics and quality control, desires position in the applied statistics, engineering research, or quality control fields. File No. 4178-W.

CIVIL ENGINEER and architect, graduated in Germany, Danzig and Munich Universities, seeks position anywhere in Canada. Polish immigrant, fluent in English and French, age 39, married, no children. 17 years varied experience in Europe and Near East, in design of residential, industrial and hospital buildings, supervising and directing construction (concrete), town planning (receiving 2nd place in the town planning competition for lower part of the town Haifa), municipal work. Willing to start in junior position with the possibility of advancement. File No. 4182-W.

MECHANICAL - CHEMICAL ENGINEER (M.Eng. Dresden, Karlruhe), M.E.I.C., P.Eng. At present lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. Available end of April. File No. 4183-W.

BRITISH ELECTRICAL ENGINEER, Whitworth Schoiar, First class honours degree (1949) emigrating in September wants job in computing, servo-mechanisims or process control. Four year apprenticeship in naval dockyard, one year test course in Metropolitan Vickers, one year on design of electrical computers, eight months on liaison work with U.S.N. in Washington, D.C., one year on machinery control. File No. 4186-W.

1950 U. of A. E.E., P.Eng., M.E.I.C., veteran of R.C.N.V.R., married, requires employment, preferably in Western Canada, commencing around July 1st. Experience includes heating, ventilating and electrical design, limited well head production equipment sales, and field supervision of construction of

Mechanical, Civil, Electrical Engineers

for Mining Plant Design
minimum of
3 - 5 years experience

2 for Structural design
2 for Mechanical layout and design
1 for Electrical layout and design

Please state full details of qualifications and experience in first letter to—

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MECHANICAL ENGINEER

For internationally known metal fabrication plant in the Niagara District, employing approximately 350 people. Must be experienced in plant layout, modern foundry and machine shop practice, tool design and industrial engineering.

After a brief training period, will be appointed to senior engineering position. Age limit approximately 35 years.

Reply stating age, qualifications, complete history of experience, marital status and salary expected.

All replies confidential.

File No. 4553-V.

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power plant equipment and steam distribution system. Desires employment on sales or construction supervision of heavy machinery or power plant equipment. File No. 4187-W.

ELECTRICAL ENGINEER (BRITISH) visiting Canada in May, view to emigration. Graduate London University. Member of Institution of Electrical Engineers. Age 43, married. 23 years experience electrical manufacturing and distribution industries. Last 14 years managing district containing 60,000 consumers, mainly urban: responsible for planning, construction and maintenance of networks and provision of supply to industrial, commercial and domestic premises. File No. 4188-W.

METALLURGICAL ENGINEER; Jr.E.I.C., B.Eng., McGill 1951, age 31. Married, one child; two years experience as project engineer in steel industry and milling experience in mining industry. Desires responsible position which offers interesting and diversified work with definite possibilities for advancement to executive position. Willing to travel. Available on reasonable notice to present employer. File No. 4189-W.

CIVIL ENGINEER, Jr.E.I.C., 4 years experience, desires part time employment, reinforced concrete or steel designing and detailing in Montreal. File No. 4190-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.A.Sc. (honours), Toronto 1949, Post-graduate training and knowledge of prestressed concrete. Age 25, single. Presently employed as design engineer in mechanical field. Experience includes harbour work planning, design, maintenance, and administration; structural steel and concrete design, and construction supervision. Seeking position with either consulting civil engineer or contractor where capabilities and training will be used. Available on reasonable notice. File No. 4191-W.

GRADUATE ELECTRICAL ENGINEER, age 28, single, presently employed as electrical draughtsman in Montreal. Seeks position as junior engineer preferably in Ontario. File No. 4192-W.

AVAILABLE OCTOBER 15, 1953, young Dutch civil engineer graduate Delft Technological University, Holland. Age 25, married, no children. In full command of the English language. Special interests and some experience in concrete and prestressed concrete structures. Wanted: work in a first class construction company, with possibilities for advancement. Location anywhere in Canada with preference for Ontario or British Columbia. File No. 4193-W.

MECHANICAL ENGINEER, British, A.M.I. Mech.E., A.M.I. Prod.E., seeks executive position or position with prospects. Wide experience in production methods, production control, tooling, etc., several years experience in development projects. Structural experience gained during service with H. M. Forces. Age 37. File No. 4194-W.

MECHANICAL ENGINEER, under 35, 8 years diversified industrial experience in production control, layout, development, design, purchasing, maintenance and machine shop practice. Extensive supervisory experience and sound business training. Cost and production minded Presently employed. Seeks production or plant management. Will also consider technical sales. Location, preferably Ontario or Montreal area. File 4204-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., Ass. Mem. A.I.E.E., B.A.Sc., University of Toronto, 1951, age 28. Test Course graduate of a prominent electrical firm with experience in design and related production problems. Previous experience in maintenance of electronic equipment. Interested in servo-mechanisms. Desires position of increased responsibility with progressive organization. Married, one small child. File No. 4210-W.

WANTED CIVIL ENGINEER

Permanent position with good prospects of advancement for Civil Engineer with experience in the design and construction of sewers and other municipal works. Salary range $400.00 to $480.00 per month, plus cost of living bonus of approximately Thirty Dollars ($30.00) per month. Apply giving full particulars of education and experience to Commissioner of Works, Room 703, Transportation Building, City Hall, Ottawa, Ontario.

N. R. OGILVIE, City Clerk

Attention, Members

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned.

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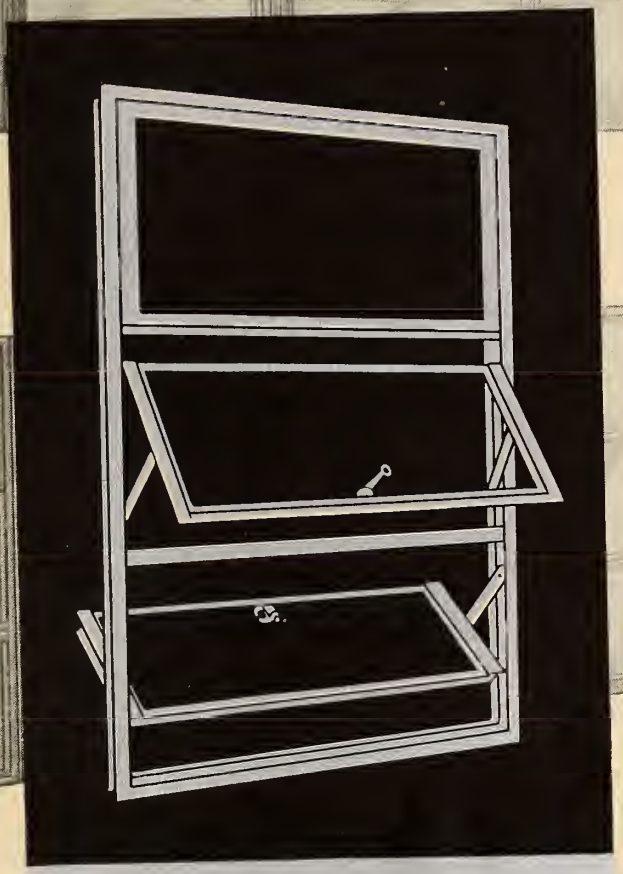

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News of the Branches

Activities of the Forty-four Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. Lusk, Jr.E.I.C.
Secretary-Treasurer

March Meeting

The Belleville Branch held its regular monthly meeting at the Masonic Temple on March 9 with 75 members and guests present.

Mr. G. A. Bradford, chairman of the Branch, presided. Mr. Bradford extended a welcome to the guests, especially those who were there from the R.C.A.F Station at Trenton.

The members were advised that a general invitation had been issued by the committee in charge of the Junior Engineers' Training Course to attend its meeting on March 23, when there would be a panel discussion on the subject, "What Management Expects of the Junior Engineer".

The minutes of a special executive meeting held on February 23 were read by the secretary-treasurer. These minutes outlined the basis by which a prize of $25.00 would be given by the Branch to a deserving high school student who intends to register in a recognized school of engineering.

The chairman also advised the members regarding the Bennett Memorial Fund. It was felt that this fund had not received sufficient publicity.

The members were advised that several copies of a booklet prepared by the Canadian Management Council were available.

Councillor S. Sillitoe then introduced Dr. G. N. Patterson, who addressed the Branch on "Shock Waves and Supersonic Flight". Dr. Patterson is director of the Institute of Aero-Physics at the University of Toronto. He outlined the various characteristics of shock waves and described how it was essential to know the characteristics of these waves before any airfoil could be designed.

Dr. Patterson's address was well illustrated with slides and a film. The characteristics of these waves are too complex to be adequately outlined in this report.

Mr. C. R. Whittemore expressed the appreciation of the Branch to the speaker.

Border Cities

D. A. Sinclair, M.E.I.C.
Secretary-Treasurer

Border Cities Branch Auxiliary Celebrates First Anniversary

The Engineering Institute of Canada Auxiliary, Border Cities Branch was formed on January 31, 1952, with the first meeting being held at the home of Mrs. A. D. Harris on Riverside Drive. The purpose of the auxiliary is for the wives of the members to become better acquainted and to introduce new members to the organization. Another reason for getting together is to be of assistance to the men when social events take place, such as, the President's visit. It is not to be a money making organization and it is to have three meetings a year.

Several active groups have been formed and keen interest has been shown in all of them. All that joined the smocking and leathercraft groups have done some beautiful work and more are joining as time goes on. A bowling league of 24 members meets every Wednesday evening and great enthusiasm is shown in this sport.

At the first meeting Miss Eleanor Cruickshank gave a very interesting talk on her trip to Europe and her impressions of conditions there in 1951.

On May 14, a group meeting in the Red Cross Headquarters on Ouellette Avenue was taken on a tour of the building.

The first fall meeting was on October 7 at the Jeanne Mance Nurses' Residence on Ouellette Avenue. On the program was a movie on the life of an American Cowboy, provided by Mr. Mackie and Mr. Dearling of the Ford Motor Company of Canada.

The occasion of the President's visit was the highlight of the year's social events. A very delightful dinner-dance was arranged at the Essex Golf and Country Club.

In December the Christmas Tea was held at Mrs. G. W. Lusby's home on Esdras Place.

At the first meeting there were registered 54 members. There is now a membership list of 94, with approximately 60 members out at each meeting.

On January 29, 1953, the first annual meeting took place and the slate of officers for 1953 was presented — president, Mrs. J. G. Hoba; 1st vice-president, Mrs. D. A. Sinclair; 2nd vice-president, Mrs. R. T. Waddington; recording secretary, Mrs. J. M. Wyllie; corresponding secretary, Mrs. D. G. Jamieson; treasurer, Mrs. Joseph Brown; publicity convenor, Mrs. A. G. Ackerman; program convenor, Mrs. J. VanWinckle; groups convenor, Mrs. F. J. Ryder; counsellors, Mrs. G. W. Lusby, Mrs. J. C. Aitkens, and Mrs. G. G. Henderson.

The retiring president, Mrs. G. W. Lusby, was presented with a gift from the auxiliary by Mrs. G. G. Henderson.

A very informative and interesting talk on "Civic Affairs" by Alderman Mrs. Cameron Montrose was enjoyed by all. Refreshments and a social hour followed.

Eastern Townships

R. H. Blackmore, Jr.E.I.C.
Secretary-Treasurer

Gaston Masse, M.E.I.C.
Branch News Editor

Edward Evans, district manager of Steel Company of Canada, Limited, was the guest speaker at the meeting of the Eastern Townships Branch which was held at Club Social on Friday, March 20.

Mr. Evans gave interesting figures on the production of steel in the various countries of the world.

For instance, the production of steel in Canada in 1952 was 3,660,000 tons; in 1953, the production is expected to reach 5,000,000 tons. The steel consumption in Canada in 1952 was 6,500,000 tons. The production of the United States in 1952, was 117,000,000 tons.

The production of steel in the European countries west of the Iron Curtain was 72,000,000 tons while the production of Russia and its satellites countries was 55,000,000 tons.

Therefore the yearly production of steel in America and Western Europe is about 200,000,000 tons compared with 55,000,000 tons by the communist countries.

Mr. Evans gave also some peliminary explanations on the film "Steel in Canada" that was shown following his talk. This film is very interesting, and shows very clearly the various phases of steel production.

The speaker received the thanks of the gathering from Mr. Barnacle, who also thanked Messrs. Stephens and St-Jean, of J. S. Mitchell and Co., through whose courtesy the film was shown.

Chairman G. M. Dick added his thanks and advised that the next meeting would be held on April 20 or 21, and would be attended by Dr. Stirling, president of the Institute and Dr. Wright, secretary, and other members of the Montreal Branch.

Mr. Dick called on W. A. Smyth for a report on the junior engineering lecture course. Mr. Smyth reported that there had been three meetings during the last month, the speakers being as follows: A. W. Walton, chief economical writer, Bank of Montreal; A. Noël, of Maheu & Noël, chartered accountants;

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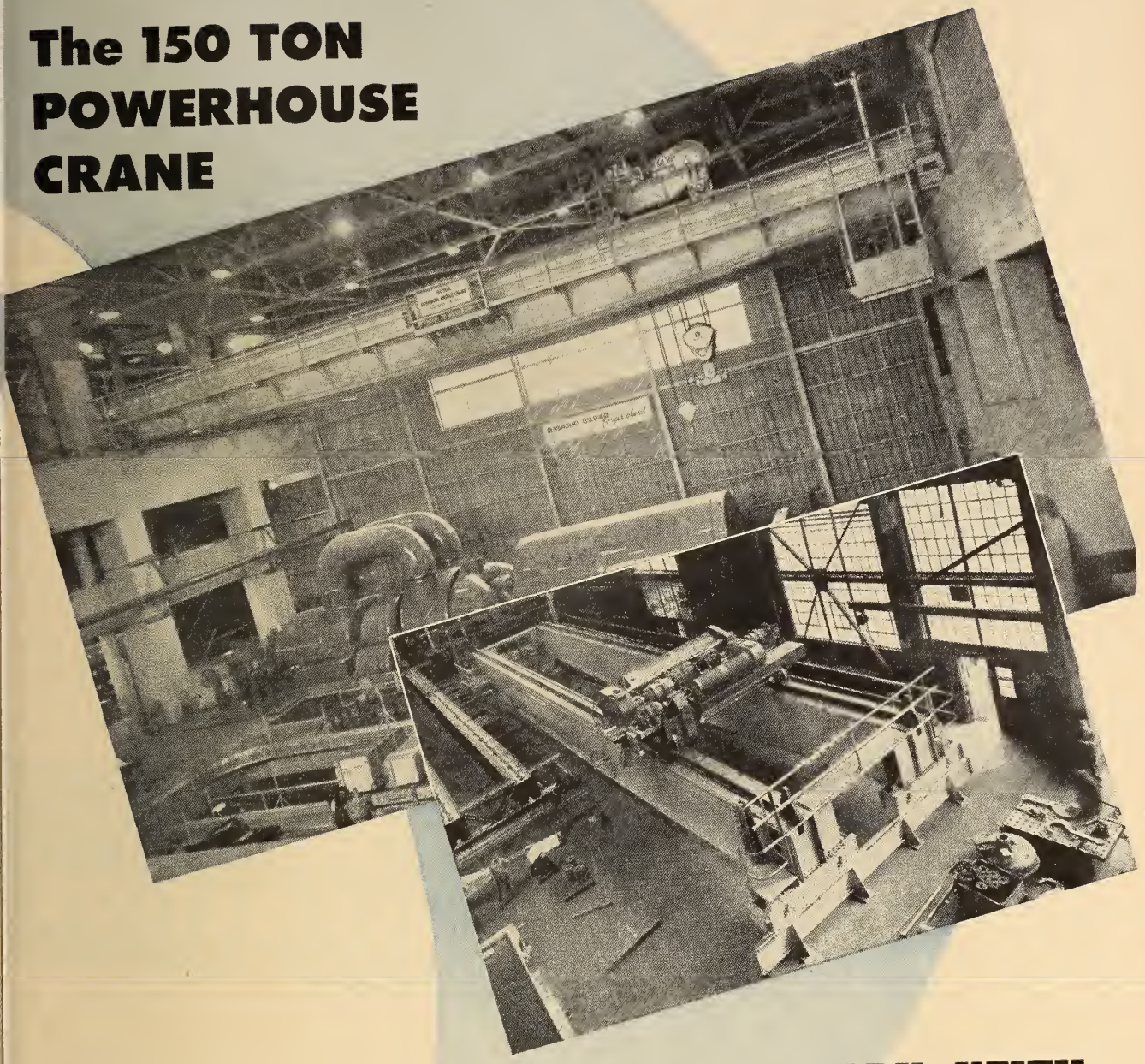

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and A. Gregory, mill manager, St. Lawrence Corporation, East Angus.

The meeting ended with the serving of a very enjoyable buffet lunch through the courtesy of the firm Codère, Limited, which was represented by Roland Codère.

Hamilton

J. A. Reid, Jr.E.I.C.
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.
Branch News Editor

February Meeting

On February 19, the Branch was fortunate in hearing Capt. H. Ross Smyth, M.B.E., of the National Research Council, who spoke on "Electronic and Radar Aids to Inland Navigation."

With a varied and colourful background as a seafarer on technical assignments, which have taken him from the Arctic to the South Pacific seas, Capt. Smyth was able to cover his subject in an authoritative and interesting manner. Techniques discussed included the use of underwater robot TV cameras, microwave lighthouses, responder beacons, and harbour radar installations.

Papers Competition

At an executive meeting February 12, Mr. J. A. Michell, Jr.E.I.C., stated that five Branch members would be entering papers in the March Students' and Juniors' Paper Competition, including two of last year's competitors.

Fredericton

R. E. Tweeddale, M.E.I.C.
Secretary-Treasurer

R. S. Myles, M.E.I.C.
Branch News Editor

Branch Smoker, March 16

The guest speaker at the March meeting, a smoker at Colwell's Inn, was William Ketchen, chief chemist for Fraser Companies, Ltd., in Edmundston. Mr. Ketchen told of his travels in various parts of Canada and Europe and compared the various methods of manufacturing paper in the countries that he visited recently. He cited many interesting incidents that took place on his visit to Sweden. He also spoke generally on the pulp and paper industry and its role in present day economy.

Mr. Ketchen was introduced by F. O. White, retired chief engineer of Fraser Companies and was thanked on behalf of the Branch by J. L. Feeney, chief engineer of the New Brunswick Electric Power Commission.

After Mr. Ketchen's address, moving pictures were shown dealing with the pulp and paper industry and other subjects. Vice-Chairman C. E. Weyman presided at the meeting in the absence of the chairman, and R. H. B. McLaughlin handled the refreshments.

The list of nominees for offices for the new year as submitted by the nominating committee was read at the commencement of the meeting.

President's Visit

The president's annual visit took the form of a dinner party at the Lord Beaverbrook Hotel on March 2. President Stirling was introduced by Dr. E. O. Turner, dean of engineering at U.N.B,. who commented on the president's ability to speak, due, no doubt, to the fact that Dr. Stirling took an Arts course before he took his engineering degree.

The president spoke of his tour of the Maritime Provinces and mentioned that three new branches at Amherst, Bathurst and New Glasgow were to be inaugurated on this tour. He pointed out that the size of a branch was no measure of the work or accomplishments of that branch. He mentioned the mineral discoveries in Northern New Brunswick and pointed out that they would benefit all of Canada.

Engineers in Canada, he said, are constantly gaining more recognition both by the public and from various organizations in the United States, Great Britain and Europe. The recent war hastened this recognition and placed engineers in many prominent positions in management and politics. Engineers have a great responsibility in public life right from the community level up to the national level. He said that he was baffled to understand how many young engineers thought that they could be legislated to prominence.

Honourable Hugh John Flemming, Premier of New Brunswick, spoke a few words of welcome to the president

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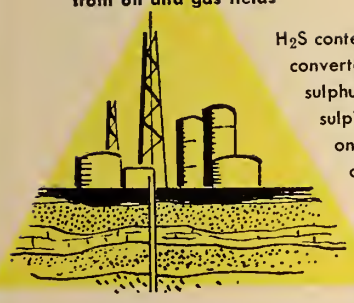
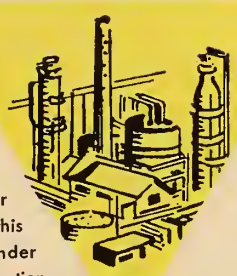


H_2S content of sour gas converted to elemental sulphur. A Foster Wheeler sulphur recovery plant in one location is producing over 300 tons/day of elemental sulphur.

petroleum refineries



H_2S gases previously "flared" and the sulphur wasted, now recovered. Two Foster Wheeler sulphur recovery plants for this service now under construction.

coke ovens

Removal of H_2S from coke oven gas not only enhances the value of the gas but provides a source of elemental sulphur. A Foster Wheeler sulphur recovery plant is in operation on this service.

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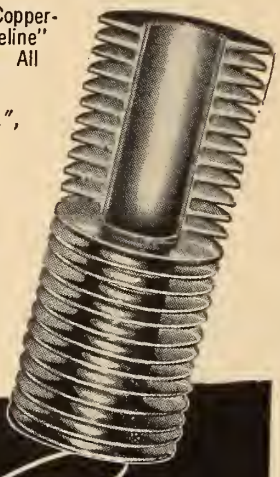

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and his wife on behalf of the Province, and Mayor H. S. Wright welcomed them on behalf of the City. Austin Wright also spoke a few words and gave some interesting information about the Institute.

Vice-Chairman C. E. Weyman conducted the meeting very skilfully in the absence of Chairman D. J. Brewer. Mr. Horace Hughson thanked Dr. Stirling for his interesting and informative address.

Dr. Stirling had addressed the engineering students of the University of New Brunswick at the Memorial Hall earlier in the afternoon. He also presented the Engineering Institute Undergraduate Prize for highest standing in the 4th year to Robert J. Cavanaugh. This address to the Branch in the evening was recorded earlier and broadcast over CFNB at 11.15 that evening.

Dr. Stirling and his party were entertained at a luncheon at the home of Dr. and Mrs. E. O. Turner.

Kingston

H. D. Forbes, M.E.I.C.
Secretary-Treasurer

Waterway Discussed by G. A. Lindsay

After all these years of talk and argument it now appears that the St. Lawrence Deep Waterway Project is to become a reality, at least it seems more assured now than at any other period in its history. This was the opening remark of Guy A. Lindsay, special adviser to the minister of transport, Ottawa. Mr. Lindsay spoke on "The St. Lawrence Deep Waterway Project" to a meeting of the Queen's University Engineering Society, on March 3, in which the Kingston Branch was invited to participate.

He defined the requirements of the waterway as "those necessary for adequate provision for navigation requiring a controlling channel depth of 27 feet with locks 80 feet wide, a depth of water 30 feet on the lock sills and with a usable lock length of 760 feet."

"At present Canada's capital investment on the present waterway amounts to nearly $300,000,000. The United States has spent $93,000,000.

"Although the importance of cheap transportation to the national economy has been appreciated ever since settlement on the continent progressed inland from the sea, the realization of the value of the power potentialities of our large rivers is something relatively new. As a source of hydro-electric power our Great Lakes system is unsurpassed," Mr. Lindsay said.

"The idea of a connecting waterway is not new. It has been discussed for over 50 years but the present plan may be said to date from just prior to World War I. Since that time, agreements have been drafted, treaties have been written but all these have failed of ratification in the United States Congress.

"In December, 1951, Canada and Ontario took steps which it is now expected will result in the construction of what has become known as an "all Canadian project."

The waterway was to be divided into five sections for purposes of description and definition. They are the St. Lawrence section, Lachine section, Soulanges section, Lake St. Francis section and the International Rapids section.

Mr. Lindsay detailed the condition in each of these sections and outlined the

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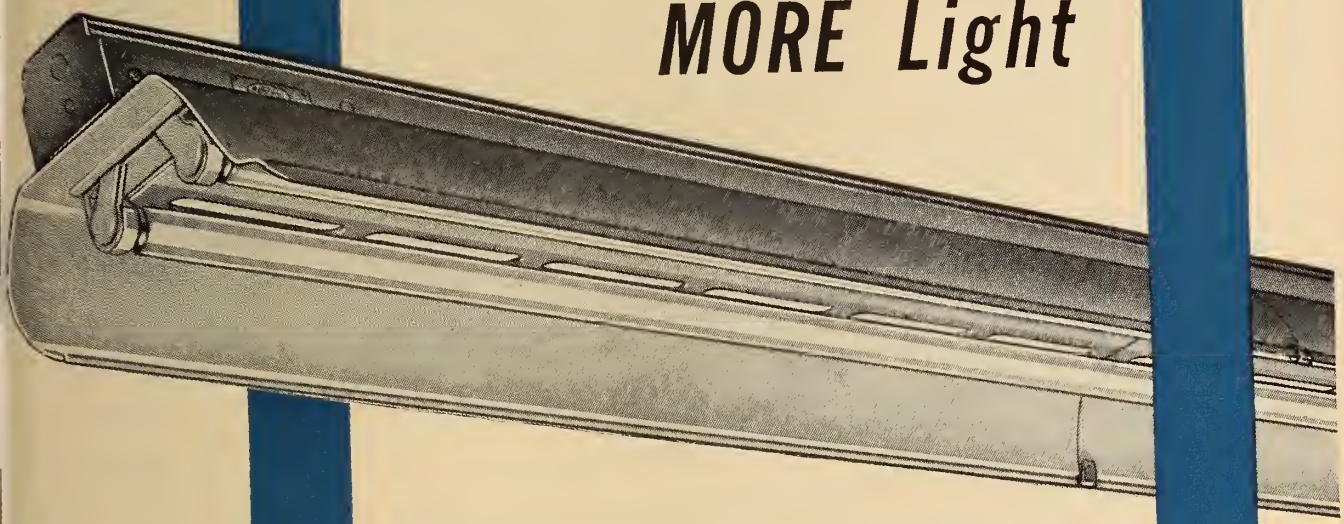

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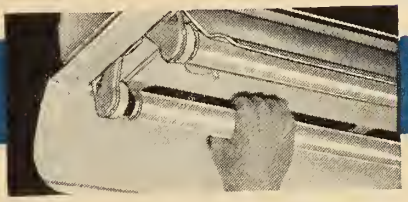

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requirements of each for purposes of the proposed seaway.

"The effect the waterway will have on the economy of Canada is something I don't believe can be determined accurately," he said. "Cost estimates, as made by different people have varied greatly but not as much as the estimates of the benefits that will accrue. The actual costs will be determined on the day the project is completed. The effect on the economy of Canada will certainly not be known for many years to come."

Montreal

R. J. Harvey, M.E.I.C.
Secretary-Treasurer

Students Present Papers

James Desloover and Jim Ripley, both students at McGill University, won first and second prizes, respectively, in a contest sponsored by the Engineering Institute of Canada, Montreal Branch.

At the recommendation of their professors, the students had been selected to present papers on technical subjects. Desloover spoke on electric house-heating while Ripley discussed the Rideau canal.

Representing L'Ecole Polytechnique were George Laferriere and Rene Hamel. Their subjects were internal combustion engines, and heat transfer of copper tubing.

All four students were presented with free membership in the Engineering Institute for one year.

The contest was held during the annual students' night, sponsored by the junior section of the Institute. Judging the submissions were R. L. Dunsmore, vice-chairman of the Branch; Pierre Bournival, registrar of the Corporation of Professional Engineers; and Professor Jacques Laurence, of L'Ecole Polytechnique. Harvey Goodwin, of McGill, presided.

Participants in Montreal Branch papers contest. Left to right: Rene Hamel, G. H. Laferriere, Harvey Goodwin, chairman, J. J. Desloover, J. G. Ripley.

Kootenay

N. H. Booth, Jr.E.I.C.
Secretary-Treasurer

W. E. Lawrie, Jr.E.I.C.
Branch News Editor

Annual Meeting

Officers of the Kootenay Branch for the coming year were installed at the annual meeting of the Branch held on February 17, 1953. The following officers were all elected by acclamation: chairman, E. B. Broadhurst; vice-chairman, W. K. Gwyer; secretary-treasurer, N. H. Booth; executive members, A. A. Lambert, T. W. Lazenby, W. G. Small, H. T. Miard, C. G. Rogers, A. F. Brooks; ex-officio, S. L. Baird, A. H. W. Busby; councillor, E. Mason.

Future Prospects for the Columbia Basin

A. A. Lambert, chief hydraulic engineer for the West Kootenay Power and Light Company, presented a talk entitled "Future Prospects for the Columbia Basin" at the annual meeting of the Kootenay Branch. Mr. Lambert described the fourth largest river system on the North American continent, showing the contribution of each of the tributaries to the main stream.

The speaker made reference to the International Joint Commission and to duties relative to the Columbia Basin, in particular, to determine future developments.

T. H. Higginson, managing director of the Automatic Sprinkler Co. of Canada Ltd., addressing a group of Montreal Branch engineers during their plant visit in February. The tour to the Automatic Sprinkler plant was sponsored by the Junior Section.

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The section of the basin in the United States contains 3 per cent of the nation's population, yet has 37 per cent of the potential hydro-electric power. Future developments, multi-purpose projects to provide flood control and power, will be determined by the expansion in industry and population.

In British Columbia the power generated is used mostly for metal production, with the remainder used for public utility loads.

The Columbia Basin in Canada is the source of all the necessary raw materials, and a supply of hydro-electric power available will be essential for future expansion. If expansion continues as it has in the past, the Columbia Basin will be important in the economies of the Province and of Canada.

Professional Development Course

The Professional Development Course, sponsored by junior members of the Kootenay Branch, has presented 17 of 18 lectures scheduled for the series. The lectures have been marked by the high calibre of the speakers, and by the lively discussion periods following the talks. Average attendance has been about 23.

The success of the lectures has been due to the support of senior business and professional men in the district.

The course has filled a definite need in the district, and plans are being formulated to have the course continued in future years.

Nipissing and Upper Ottawa

D. KEITH CAMPBELL, JR.E.I.C.,
Secretary-Treasurer

Dinner Meeting, March

Members and guests of the Branch gathered in Temiskaming on March 4 for a dinner meeting at White Oaks Inn. Speaking on the subject of "Safety" at this meeting was H. H. Watson, safety supervisor of the Canadian International Paper Company at Temiskaming. Mr. Watson said the present day safety supervisor stays in the background and gets all the employees of the company to help him put his safety program over. The high cost of accidents makes it well worth while for everyone to be safety conscious. A good safety record in a factory is of benefit to both the company and the employees because it increases profits and take-home pay. Mr. Watson went on to list the basic requirements of a good safety program as follows: management leadership; assignment of responsibility; maintenance program to keep safe working conditions; safety training program — special stress for foreman's training.

Mr. Watson concluded his talk with this safety tip, "Keep records of accident frequency and post them for all to see. When the employees see how good or how bad their safety record is, it naturally follows that the bad ones tend to improve".

R. H. Foy of the Canadian Westinghouse Company, the second speaker of the evening, spoke on "Electronic Trends". Mr. Dobbie of C.G.E.'s North Bay branch operated the lantern to show slides illustrating the talk.

In Mr. Foy's opinion, it is difficult to say when electronics had its beginning. The first practical applications in industry are recent. In 1919 the first radio station KDKA began broadcasting. The listeners had crystal receivers and one tube radio battery sets. In 1930 electronic TV was demonstrated and the first black and white TV was broadcast in 1936.

Colour TV was first broadcast in 1945 although both mechanical and electronic colour TV were demonstrated in 1940. Future TV sets may have three dimension screens and there is a possibility that they will provide scenes appropriate to the broadcast.

Electronics play an important part in the present day world — communications with telegraph, telephone, wireless; weapons of war with pilotless aircraft, radar, proximity fuses; A-bombs, mines, torpedoes; computing tools with analogue and digital computers; semi-automatic factories with servo controls, automatic machine tools; navigation with electronic altimeters, radio compasses; medicine with X-ray machines, automatic anaesthetic control, electronic diagnosis of nervous system.

The electronic manufacturing field has expanded rapidly until now it is a large scale industry employing some 50,000 engineers and scientists in the United States and Canada.

A sample transistor which Mr. Foy brought along drew considerable interest from the Gateway Amateur Radio Club members present. The transistor is one of the most recent inventions in the electronics field. It performs much the same function as a small tube in a radio, but requires much less power.

Mr. R. Dye said a few words of appreciation to the two guest speakers and adjourned the meeting.

Saint John

J. A. B. BRENAN, JR.E.I.C.,
Secretary-Treasurer

H. S. MCCLEAVE, M.E.I.C.,
Branch News Editor

President Stirling Visits Saint John

Members of the Saint John Branch and their wives turned out March 3 to meet the president Dr. John B. Stirling and his party who were making their Maritime tour.

On behalf of the local members Mr. Watt extended greetings to the party from Montreal, which consisted of Dr. and Mrs. Stirling and Dr. L. Austin Wright. R. M. Richardson, president of the Dominion Council of Professional Engineers welcomed the party on behalf of the N.B. Association.

Dr. Austin Wright reported on the annual meeting of the Institute which is to be held at Halifax this summer, and at which certain by-law changes are to be made.

Dr. Stirling who is no stranger to Saint John, having supervised the construction of many of the docks and grain elevators, spoke about various features of the tour across Canada. He also mentioned, in passing that the hotel in which the meeting was being held was another of the many projects on which he had supervised construction.

In closing his report Dr. Stirling stressed the importance of the engineer taking an active interest in affairs of the community and government. "Many engineers are now in positions of importance in these activities and we hope that more will be," said Dr. Stirling in closing his talk.

John Flood, president of the Canadian Construction Association thanked Dr. Stirling.

A sing-song, led by Jean Haycock was followed by colour movies shown by H. P. Lingley, both items of entertainment being much enjoyed.

Saskatchewan

REGINALD BING-WO, M.E.I.C.
Secretary-Treasurer

Saskatoon Section

J. A. WEDGWOOD, M.E.I.C.
Secretary-Treasurer

Course on Gas Appliances

A short course has been given for the benefit of those to be engaged in the natural gas industry in Saskatoon. The following subjects were covered: Composition and properties of gas, combustion characteristics of hydrocarbons and burner design, methods of analysis of combustion products, furnace types and characteristics, installation of gas appliances, automatic gas controls and their operation.

A demonstration unit operating on propane gas was used to help clarify the points being discussed.

T. R. Copeland, head of the Heating and Service Division, Inter Products Limited, Calgary, covered installation of gas appliances. Prior to joining this firm Mr. Copeland was chief heating inspector for the City of Calgary and was for a number of years a member of the Calgary Gas Committee.

A. Maleczek, in charge of research and development, Inter Products Limited, lectured on combustion, burner and furnace design and efficiency. Mr. Maleczek, before moving to Calgary, was senior chemist with a large British gas appliance manufacturing firm.

The third lecturer, whose name was not available when this item was prepared, is with the Minneapolis-Honeywell Regulator Company. His subject was automatic gas controls and their operations.

Admission to this course was restricted to members, and employees of members, of the sponsoring groups: Saskatoon Contractors Association; Saskatoon Heating Contractors Association; National Association, Master Plumbers and Heating Contractors Association, Saskatoon Section; Saskatoon Section, Engineering Institute of Canada.

The course was held in the Tractor Laboratory, Engineering Building, University of Saskatchewan. The lectures, given on Wednesday, Thursday, and Friday, March 4, 5, and 6, were followed by discussion periods. There was no charge for the course. However, a charge to cover the cost of refreshments was made each evening.

Sudbury

G. W. FLEMING, M.E.I.C.,
Secretary-Treasurer

H. M. WHITTLES, JR.E.I.C.,
Branch News Editor

Dinner Meeting, March 12

At a dinner meeting of the Sudbury Branch at the Sudbury Granite Club H. R. Graham, regional manager of the Hydro Electric Power Commission was guest speaker.

Introduced by Percy McAdam, Mr. Graham, a graduate of the University of Toronto and now residing at North Bay, gave an interesting address on the Sir Adam Beck — Niagara Generating

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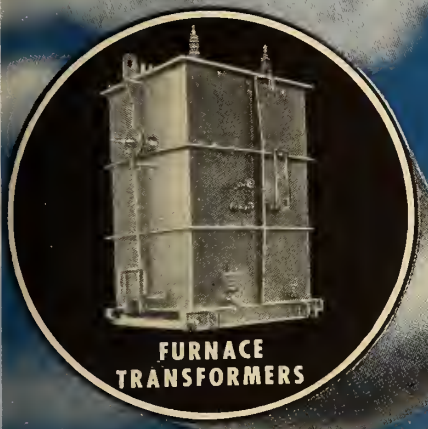

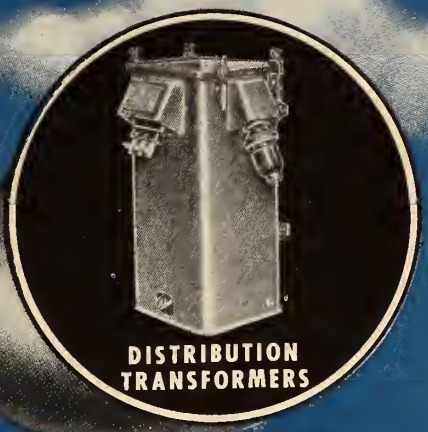

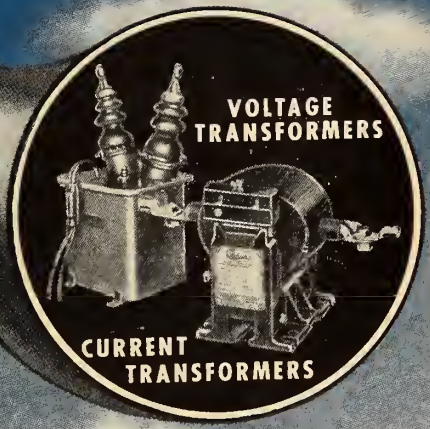

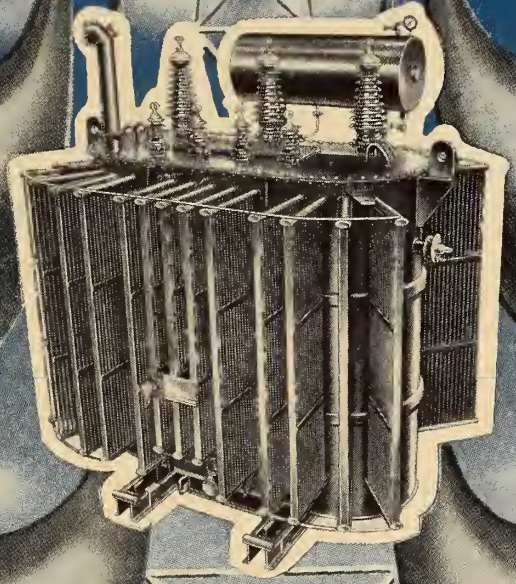

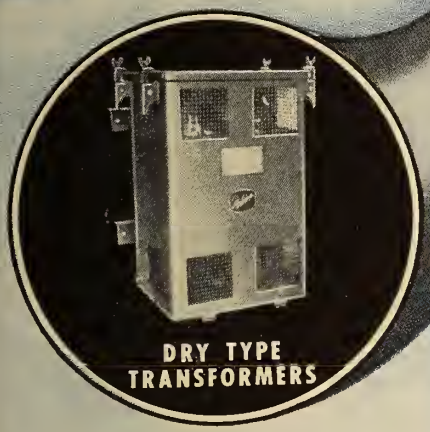

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Station No. 2. His address was augmented by coloured slides.

Mr. Graham said that this power project was a huge development undertaking, costing approximately $300,000,000 for the 12 generating units situated six miles below the falls on the Niagara River, where it will be possible to generate 50 per cent more power than if it were located just below the falls.

Construction of this power plant began in January 1951, and when completed in 1956 will have a capacity of 1,200,000 horsepower or 900,000 kilowatts, which will be available to meet the needs of industrial expansion in the southern part of the province.

The water diverted from the Upper Niagara River will be conveyed beneath the city of Niagara Falls by two parallel tunnels, 5½ miles long and 45 feet in diameter. These tunnels are serviced by five vertical shafts situated uniformally along its length, and drilling of the rock is carried out by large jumbos, mounting 17 machines. Fresh air is brought to the working faces at the rate of 60,000 cubic feet per minute through eight-foot diameter wooden pipes. The twin intakes, situated two miles above the falls, will each divert 20,000 cubic feet of water per second from the Niagara River.

The twin tunnels re-emerge below the city and empty into a canal 200 feet wide and 70 feet deep, and which is capable of handling 40,000 cubic feet of water per second. The water flows through this canal to the forebay of the generating station situated on the cliff-side of the lower Niagara River.

The Hydro Electric Commission operate their own cafeteria, where 600 men can be fed at one sitting. They have also built living quarters for the workmen and a 30-bed hospital to care for the sick and injured.

In closing, Mr. Graham stated that Sir Adam Beck — Niagara Generating Station No. 2 was the largest of more than a dozen power development projects undertaken by Ontario Hydro since 1945.

The speaker was thanked by Jim Smith for a very informative address which was enjoyed by the Institute members and guests.

Announcement was made by John Quance of the meeting to be held April 9, 1953, with Walter Giles of the Ontario Lands and Forests as the guest speaker.

Toronto

H. M. Kolesar, Jr.E.I.C.
Secretary-Treasurer

Dugald Cameron, M.E.I.C.
Branch News Editor

Branch Meets with Architects

A panel discussion on the question "Are Specifications Properly Written and/or Correctly Read?" was a feature of a joint meeting of the Toronto Branch with the Toronto Chapter of the Ontario Association of Architects, on March 5, 1953. More than 200 were present.

The panel, consisting of Messrs. Craig and J. B. Parkin, architects; R. W. Teagle and P. D. Dalton, contractors; C. D. Carruthers and D. L. Angus, consulting engineers; and under the chairmanship of Mr. C. E. Potter—developed a lively and interesting discussion in which the whole meeting participated enthusiastically.

Among the questions discussed were: need for more adjectives when required, to eliminate uncertainty as to intent; need for extended standardization, and references to accepted Canadian and other accepted Standards where applicable, to reduce the volume of reading required; more consistent classification of trades to simplify the calling of tenders for sub-trades and reduce the time required to take off and estimate jobs; pros and cons of having the specification govern in event of discrepancies with plans; clarification of responsibility for conforming to local and other by-laws and regulations where such requirements are inadequately or incorrectly shown on plans; desirability of developing separate agencies for taking off quantities along the lines followed in Britain, and the effect of this practice on specification writing; problems and objections arising from the use of trade names with the qualification "or equal", "or equal approved" and other equivalent phrases.

The meeting ran considerably over the usual times, and following closure by Mr. Cox there was a noticeable tendency for the discussions to continue around the speakers' platform and on out to the street.

It is also interesting to note that the meeting was referred to in a talk delivered to a joint meeting of the Toronto Builders Exchange and the C.C.A. Management Committee by Mr. John Flood, president of the C.C.A.

It has been noted that since the meeting a small private committee of architects and engineers has been formed to study the subject with a view to revised procedure in writing specifications.

Vancouver Island

P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer

Ronald E. Dyson, Jr.E.I.C.,
Branch News Editor

First Voyage of "Yellowknife Expeditor"

The colourful story of how Victoria and Yellowknife, N.W.T., were linked for the first time by water in the fall of 1949 by the voyage of the converted wartime U.S. Navy LCI "Yellowknife Expeditor," proved a unique topic at the February joint meeting of the Vancouver Island Branch of the Engineering Institute and the Victoria Branch of the Association of Professional Engineers.

The voyage of the 160-foot craft was described by Jim McKeachie, public relations director of the B.C. Power Commission, who was aboard her for the trip across the North Pacific, Bering Sea, Arctic Ocean and up the Mackenzie River to Yellowknife.

Mr. McKeachie, a reporter on the Victoria Daily Times at the time, interjected several occurrences which proved humorous in retrospect, but which were taken in a more serious light as the ship churned its way north, its crew of 13 uncertain if it would be able to "beat" the great Arctic ice pack.

Being a flat-bottomed landing craft, the "Yellowknife Expeditor" was able to carry out the rough ocean voyage and also navigate the 1,200-mile Mackenzie River. Purpose of the 5,300 mile voyage was to deliver the ship, which had been converted at Victoria Machinery Depot, to Great Slave Lake, where she has operated as a passenger-freighter for the Yellowknife Transportation Co. Ltd.

The speaker told of the practical nature of things in the far north — things which sound strange on the surface, to many, but when analyzed, proved sound.

He noted the genuineness of the people in Canada's north — where a person is taken for what he actually is rather than because he can "keep up with the Joneses" as is often the case in what we call the more "civilized" part of the nation.

"The type of people you find — genuine, meeting a challenge with a pioneer-like spirit — that, to me was the meaning of the 'lure of the north'," Mr. McKeachie concluded.

Winnipeg

C. S. Landon, M.E.I.C.
Secretary-Treasurer

Electrical Section

L. E. Marrin, Jr.E.I.C.
Branch News Editor

Annual Meeting

The annual meeting of the Electrical Section, Winnipeg Branch, was held recently in the new United College Building. Retiring chairman E. M. Scott presided over the meeting in the absence of the new chairman, C. E. Osterlant. Mr. Scott reviewed the activities of the Section during the past year and complimented the members for their enthusiasm and increased attendance at the Section functions. He also expressed his thanks to the council and members at large, for the co-operation and assistance tended him during his term of office.

Besides the new chairman, Mr. Osterlant, the Section officers for 1953 include: executive member, R. T. Harland; past chairman, E. M. Scott; secretary, R. J. Crawley; papers chairman, S. Barkwell.

Originally elected to the office of chairman, R. H. Tivy has left the city to take up his new position in the east.

The guest speaker, Prof. J. P. C. McMath was introduced by Prof. A. E. Macdonald, dean of engineering and architecture of the University of Manitoba.

Prof. McMath described the evolution of various types of EHT underground cables from their origin to the present. The earliest underground cables were bare conductors laid in wooden troughs and filled with compounds, and it was not until about the turn of the 20th century that PILC cables began to make their appearance. Even at this seeming late date lead sheath extrusion was rather primitive, with little control of sheath thickness and concentricity. Vacuum drying was unheard of; drying consisted merely of heating the cable in an oven prior to immersion in the hot impregnating compound. The rosin impregnants had very high dielectric losses which rapidly became intolerable as operating temperatures and voltages were increased. Some of the early rosin-oil compounds had a tendency to set with age so that old cables could not be moved or bent safely. Using well illustrated slides, Prof. McMath discussed the development of these and other construction and material features which were necessary before the present highly engineered power cables became a reality.

Following a vote of thanks to the professor, delivered by Jack Young on behalf of the members, Mr. Scott brought the meeting to a close.

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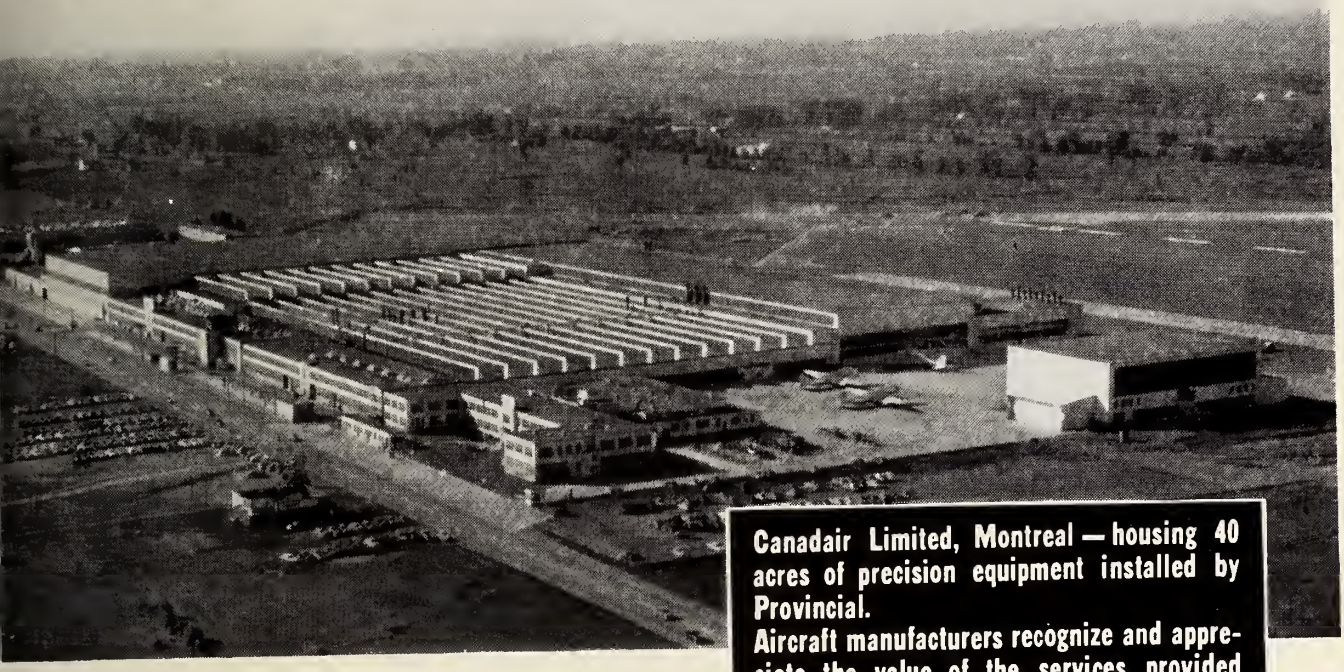

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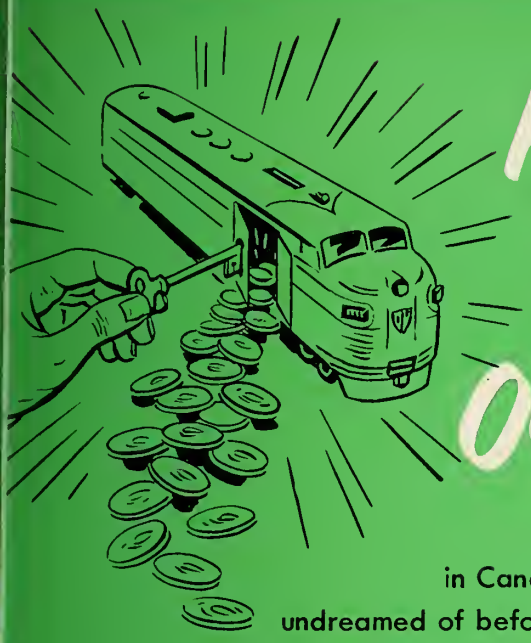

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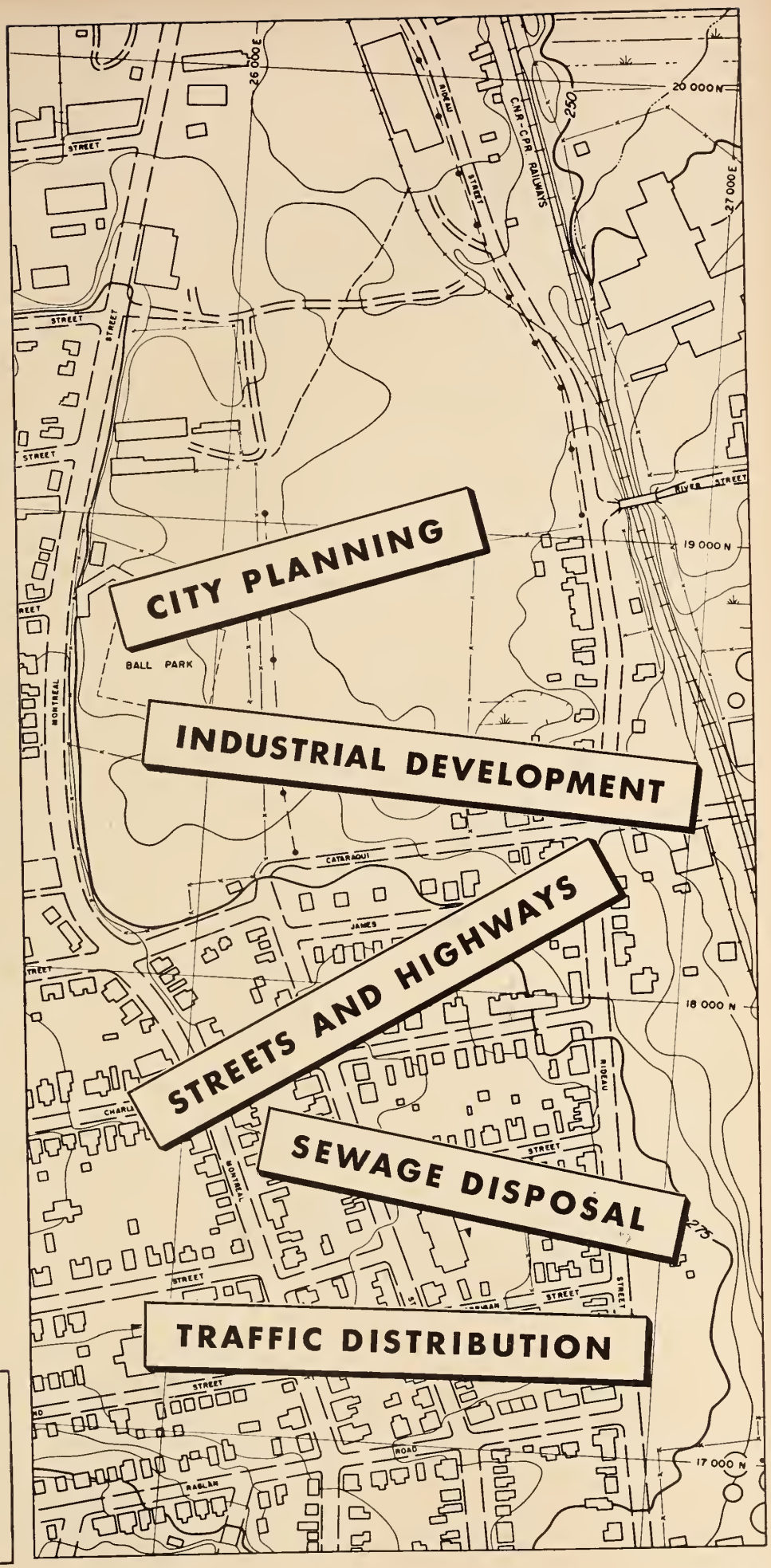

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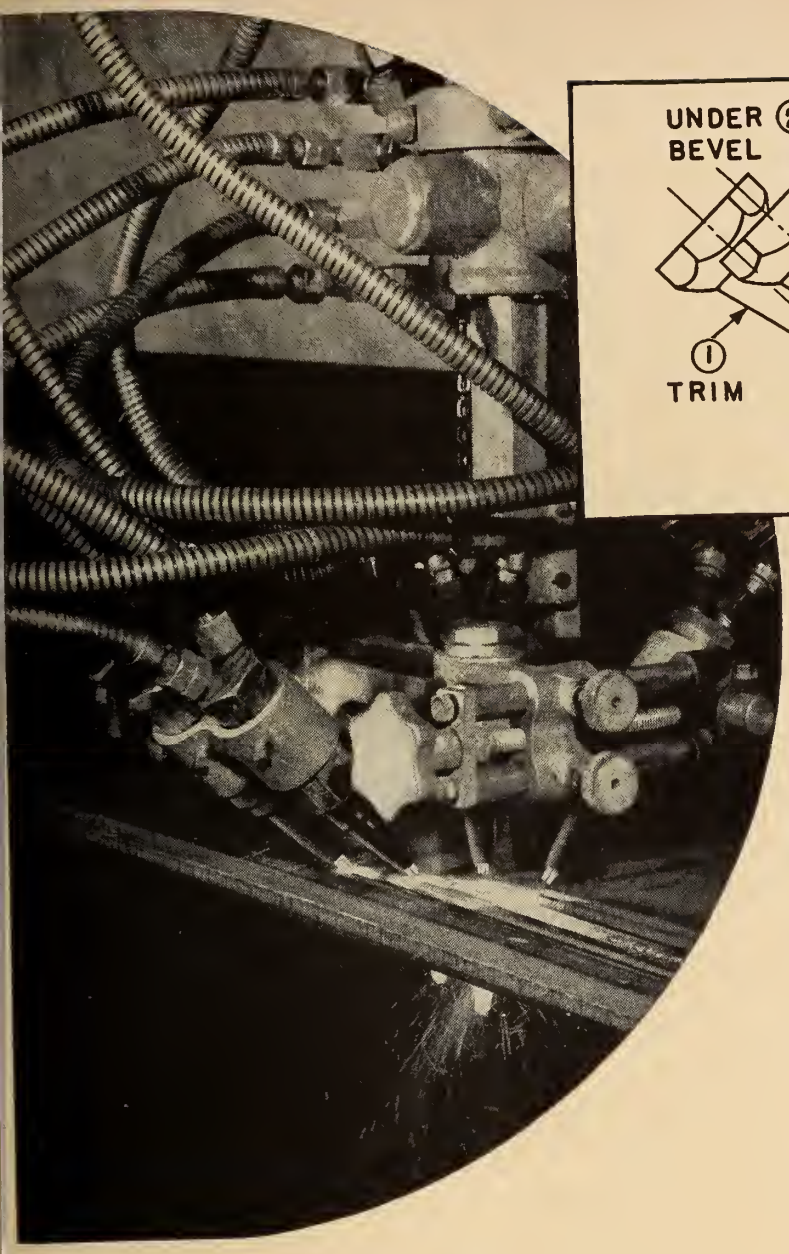

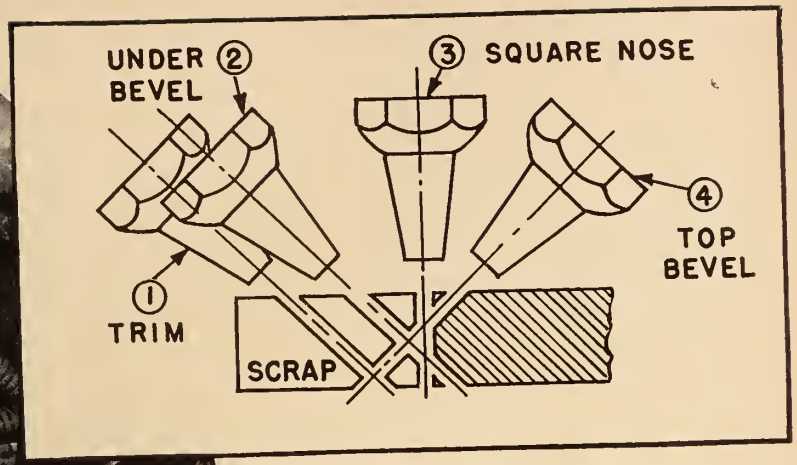

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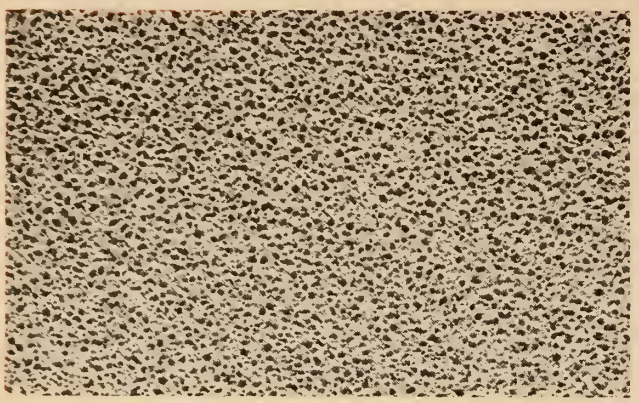

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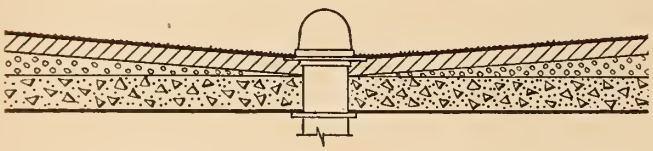
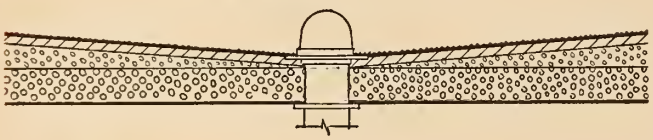


4″ Concrete Roof — Standard Aerocrete Fill at 70 lbs. per cu. foot, 0″ at drains, rising to 4″ on all sides, average thickness of fill 2⅔″; 2″ Insulation Board; Tar and Gravel Roofing.

Heat Transmissian U = 0.13



4″ Aerocrete Roof—Standard Aerocrete Fill at 70 lbs. per cu foot, 0″ at drains, rising to 4″ on all sides, average thickness of fill 2⅔″; 1″ Insulation Board; Tar and Gravel Roofing.

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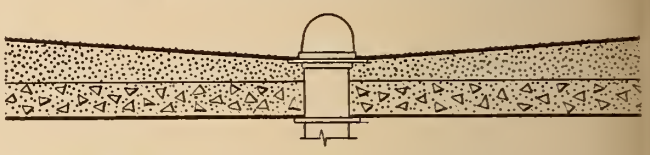

4″ Concrete Roof—FEATHERCRETE FILL at 30 lbs. per cu. foot, 2″ at drains, rising to 6″ on all sides, average thickness of fill 4⅔″; Tar and Gravel Roofing.

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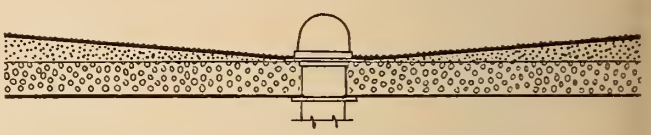

4″ Aerocrete Roof — FEATHERCRETE FILL at 30 lbs. per cu. foot, 0″ at drains, rising to 4″ on all sides, average thickness of fill 2⅔″; Tar and Gravel Roofing.

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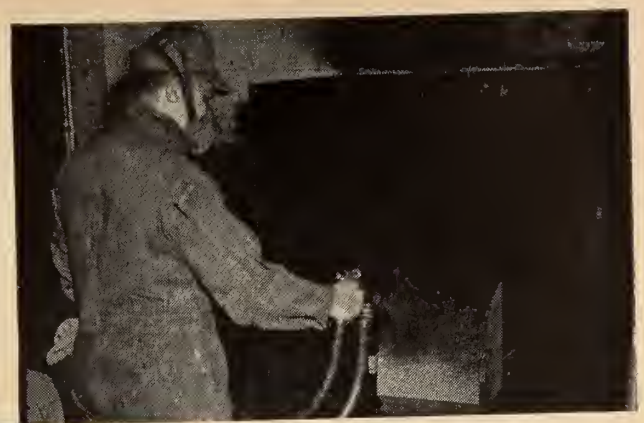

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Wood's register of Canadian manufacturers; 1952 ed. Montreal, W. R. Woods Ltd. Loose leaf. Volume 1, $75.00.

Formerly known as REGISTER OF MANUFACTURERS, and published by Grant-McCart Publishing Company, the nineteen hundred and fifty-two edition of this directory now comes to us under both a new title, and a new publisher.

Volume one of the set, which is in the library now, covers the provinces of Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Volume two, which we expect shortly, will cover Ontario and the western provinces. The format is loose leaf, and the publishers maintain that it will be kept up-to-date with monthly Change Bulletins. However, all we can say on that subject at the moment is that at the time of our going to press, February tenth, the last bulletin in our volume one is dated November thirty-first (?)

Also, a spot checking shows a well-known firm in Quebec province with its name change of fourteen-month standing still unrecorded.

To the former of these statements, the publishers state that the Change Bulletin at the beginning of the year is always delayed due to the number of staff changes in companies at that time of the year.

To the second of these, they reply that the company concerned did not report their change of name.

The arrangement throughout is alphabetical and geographical and the names of executives are listed with their offices. The first one hundred and thirty pages list firms with head offices in Montreal, and the following twenty-five those with Montreal branch offices.

An alphabetical list covering cities and towns between Quebec and the east coast takes eighty-five more pages, and the volume is completed with five concluding pages listing branch offices in these same cities and towns.

Tables of contents list all place names concerned with the page number of their appearance.

The periodically published Change Bulletin, which service is included with the price of the set, lists New Listings, and Change in listing, and in some cases, the number of employees.

Provided the publishers keep abreast of accurate information on the relevant data, this will be an invaluable publication to all of you interested in personnel, advertising, or the compilation of mailing lists.

E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Designing by photoelasticity. R. B. Heywood. London, Chapman, Toronto, British book service, 1952. 414 pp., illus., $13.00.

This book draws attention to the powerful photoelastic method of stress analysis which, by recent simplifications in technique, has progressed from the field of pure research to that of applied research. The remarkable "freezing" method of stress analysis is described, which permits the analysis of such complicated three-dimensional parts as crankshafts. Stress concentration factors and values of these factors are correlated and presented in a form convenient for reference purposes. A chapter has been devoted to methods whereby stress concentrations can be lessened by suitable design, so increasing strength without the penalty of increased weight. A fairly extensive list of references, classified in order of subject and chronologically, is given. A large number of illustrations supplement the text, and name and subject indices are included.

Electricity meters and instrument transformers. S. James. London, Chapman, Toronto, British book service, 1952. 467 pp., illus., $10.00.

This volume deals with many matters in greater detail than is customary in books on meter practice. For the benefit of readers outside of Great Britain the subject of two-phase metering has been included. The two chapters devoted to the diverse variety of prepayment meters in use are barely sufficient to cover the fringe of this very large subject. Separate chapters are devoted to these classes of instrument: polyphase kilowatt-hour meters, reactive meters, kilovolt-ampere meters, and maximum-demand indicators. The section describing summation metering provides an elementary introduction to a method having possibilities for extensive

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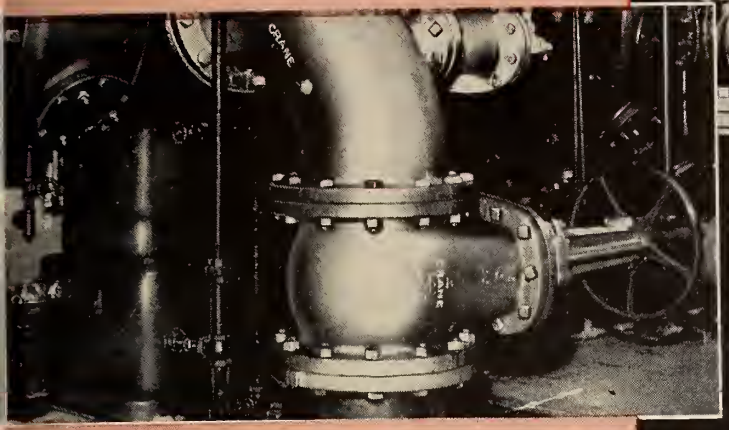
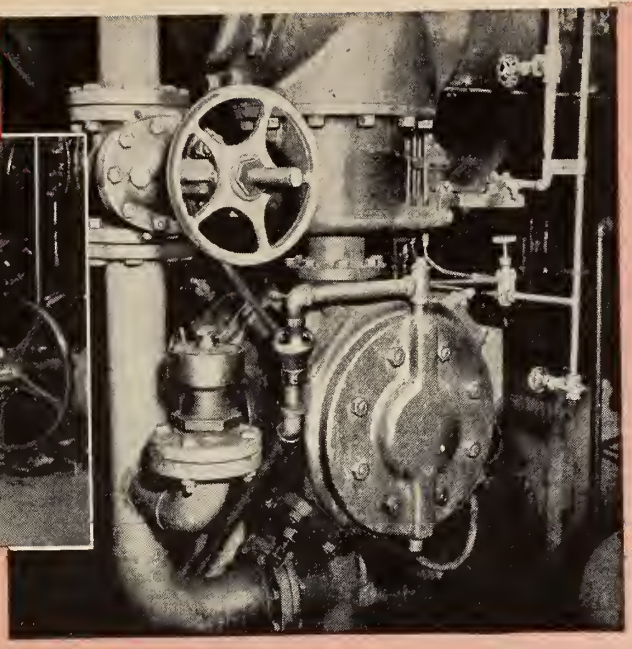
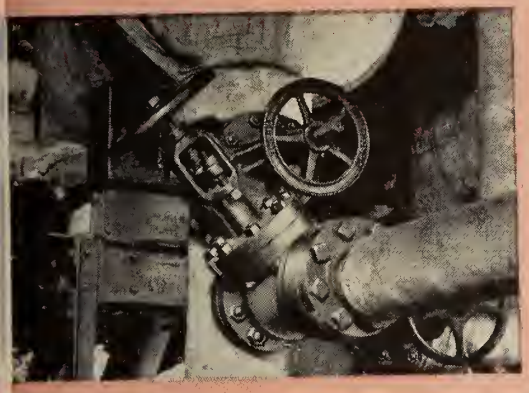




LINES TO CLOSED FEED hot water heater showing Crane 4-in. steel gate valves.



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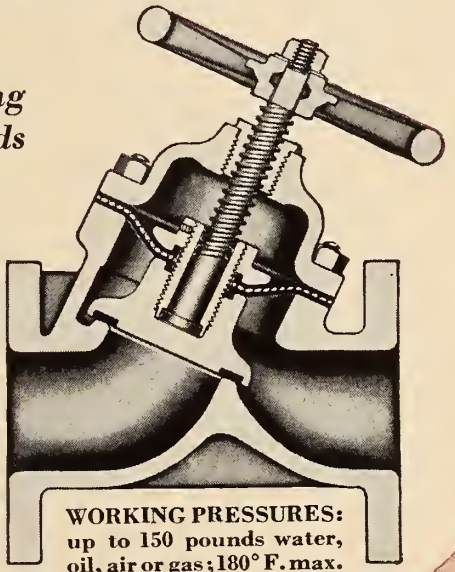

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use in the future. Current and voltage transformers are dealt with in separate chapters. The book is adequately illustrated and contains a comprehensive index.

F.B.I. register of British manufacturers, 25th ed., 1952-1953. London, Iliffe, c1952. 922 pp., illus., 42/-.

This edition comprises seven sections, including PRODUCTS & SERVICES which is a classified Buyers' Guide listing over 6,000 F.B.I. member firms under more than 5,000 alphabetical trade headings. Other sections on addresses of firms, addresses and activities of trade associations, trade marks, and brands and trade names, are extremely useful. The introductory information and detailed instructions on the use of the Register are translated into French and Spanish, and all sections have reinforced guide cards for easy reference.

A geology for engineers, 3rd ed. F. G. H. Blyth. Toronto, Longmans, Green, c1952. 336 pp., illus., $4.50.

In writing this book the author has attempted to produce a concise account of geological science at the present time and some of its applications to engineering although no claim is made to an exhaustive treatment of this latter subject. Because of the value of the petrological microscope in certain branches of engineering practice, brief descriptions of the optical properties of the commoner rock-forming minerals have been included. In this new edition three sections relating to dams, and a somewhat fuller discussion of geological factors in connection with tunnelling have been added. The section on coals and on igneous intrusions have also been largely re-written. The photographic illustrations form an outstanding feature of the book. A detailed index and references at the end of each chapter are included.

Heat transfer and fluid mechanics institute. Preprints of papers 1952. Stanford, University press, 1952. 186 pp., illus., $4.00 (U.S.).

These twelve papers, representing fundamental contributions to this branch of the engineering sciences, include such titles as: Heat transfer to molten lead-bismuth eutectic in turbulent pipe flow; Stability of gas flow in a tube as related to vertical annular gas-liquid flow; Invariants in the turbulence in compressible viscous fluids; Boundary-layer stability and transition in subsonic and supersonic flow; Anemometry of a heated flat plate; Laminar flow forced convection in long rectangular tubes; Temperature distribution in the walls of heat exchangers with non-circular flow passages. Detailed diagrams and tables, and bibliographies increase the usefulness of each paper. There is no general index.

Laboratory manual of materials testing. R. T. Liddicoat and P. O. Potts. Toronto, Macmillan, c1952. 239 pp., illus., $4.00.

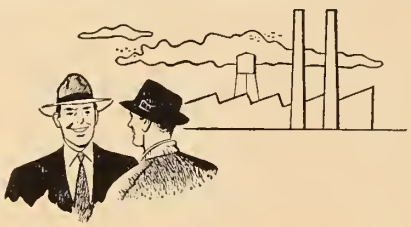
The tests in this manual are selected not only to supplement the various phases of textbook study in strength of materials but also to emphasize the possibilities and limitations of the materials of engineering. Specific instructions and a list of material required in each test are included. Some of the tests described concern hardness; strain gages; metal grain structures; strain hardening; shear and torsion testing; photoelastic, fatigue and impact testing. The book is indexed and illustrations are adequate.

Parachutes. W. D. Brown. Toronto, Pitman, c1951. 322 pp., illus., $7.20.

The author here traces the history of the parachute from the first descent in the late 18th century to the most modern developments. He describes the factors which influence the design and choice of materials; the aerodynamics of a parachute which include the opening characteristics, drag and stability. Separate chapters are devoted to such special types of parachutes as clusters, ribbon and paper parachutes, and drogues. Various types of pack and methods of deployment are explained, followed by the many uses which the parachute can have. Methods of repairing and testing parachutes are also covered. Fully illustrated, the book includes a glossary of parachute terms, a list of symbols used, and an index.

Proceedings of the American power conference, March 26-28, 1952, Volume 14. Chicago, The conference, 1952. 483 pp., illus., $6.00.

These papers, on widely diversified topics dealing with the technical, economic and social aspects of electrical power production, transmission and utilization, were presented by leading manufacturing and electric utility executives and engineers. The conference was divided into general interest, mechanical, electrical and water technology sessions, and within each of these several papers were devoted to a number of pertinent subjects. A full table of contents partially compensates for the lack of a general index. The detailed diagrams are an essential part of the technical papers.



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Report of the committee on national policy for the use of fuel and power resources (Ridley report). London, H.M.S.O., Ottawa, United Kingdom information office, 1952. 242 pp., $1.50.

This report covers all use of fuel and power resources, both by the ultimate consumers—householders, manufacturers, traders and others—and by the industries which convert primary fuels (chiefly coal and oil) into secondary forms (mainly gas, coke and electricity), but omits problems of primary fuel production. Incentives to both domestic and industrial coal users for installing fuel-saving equipment are recommended. Among the more important of the committee's forty suggestions is the remodelling of electricity tariffs to allow for higher prices for current supplied during peak hours. Equivalents and definitions are given in the appendices, followed by a list of references and an index.

Soil mechanics for road engineers. Great Britain, Road research laboratory. London, H.M.S.O., 1952. 541 pp., illus., 30/-.

This book is an account of the present state of knowledge of rock and soil in relation to their behaviour both as foundation materials and as construction materials. It is essentially practical in detail but some mathematical treatment of the underlying theoretical aspects of the subject has been included. Dealing with structural and construction problems, the chapters are divided into the chemical and mechanical aspects of soil engineering. Sections on compaction and on soil stabilization are of particular value to those concerned with the construction of low-cost roads in under-developed areas. Special features of road engineering dealing with settlement of embankments, swampy ground and the stability of clay slopes are covered. The text is supplemented by numerous illustrations and tables and the index is a valuable part of the book.

Standard metal directory, 13th ed. 1952. New York, The directory, c1952. 926 pp., $15.00 (U.S.).

The directory is divided into four sections: iron and steel plants; ferrous and non-ferrous metal foundries; metal rolling mills; smelters of non-ferrous metals. It contains more than 10,000 detailed reports on these plants located in the United States and in Canada. The reports give the name of the company, its capitalization, plant equipment, products manufactured, primary and secondary raw materials consumed, names of company officials, purchasing agent and sales manager. Some of the special lists included are: distributors of metals; metal stamping plants; forging manufacturers; galvanizing plants; aircraft manufacturers; automotive vehicle manufacturers; scrap metal dealers; importers and exporters of ferrous and non-ferrous metals; railway purchasing agents and manufacturers of equipment and supplies. The table of contents lists these special branches alphabetically.

Statistical yearbook of the World power conference, No. 6, Annual statistics for 1948-1950. Frederick Brown, ed. London, World power conference, Montreal, Engineering Institute of Canada, 1952. 163 pp., $6.50.

This volume is devoted principally to annual statistics of fuel and power production, distribution, and consumption; but it also contains a considerable number

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METADYNE STATICS
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SEWERAGE AND SEWAGE TREATMENT, 7th Edition
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ELECTRIC CONTROL SYSTEMS, 3rd Edition
By RICHARD W. JONES, *Northwestern Technological Institute*

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of estimates of resources. Most statistics were specially reported on standard forms and in conformity with standard definitions established by the World power conference. Statistics extracted from other publications do not necessarily conform with these standards but they are, in the main, approximately comparable. Continents and countries are arranged alphabetically in the tables. The World power conference tries to establish continental and world totals of fuel and power resources, but has recently found this impossible in certain areas of Eastern Europe where statistics have not been provided. Sources of the statistics are found at the end of the book.

Timber drying and the behaviour of seasoned timber in use, 3rd ed. R. G. Bateson. London, Crosby Lockwood, c1952. 143 pp., illus., 15/-.

This book covers the whole subject of timber drying, including developments in the post-war years during which greatly increased prices of timber and the appearance of new species have provided added difficulties for the operator and technician. Old established methods such as air-drying are described, followed by the newer practices: kiln and chemical seasoning, drying with superheated steam and electrical drying. The behaviour of dry timber after it is put into service is covered in several chapters, and solutions are suggested for several seasoning problems. The book is indexed but there are few illustrations.

Underpinning and strengthening of structures. L. E. Hunter. London, Contractor's record ltd., 1952. 162 pp., illus., 25/-.

This book deals with underpinning problems connected with buildings and bridges. Simple methods of underpinning and shoring have been described with an eye to strict control on expenditure and materials. A chapter has been devoted to the strengthening of each of these structures: bridge foundations; reinforced, steel and masonry structures; bridge superstructures. The last chapters deal with foundations in subsoil subjected to heat and with settlement of supporting ground. The book is well illustrated but, unfortunately, there is no index.

Welded highway bridge design. J. G. Clark, ed. Cleveland, James F. Lincoln arc welding foundation, 1952. 240 pp., illus., $2.50 (U.S.).

This book was compiled from the designs and details of welded bridges submitted in the Lincoln foundation's award program for welded through highway bridges. It is divided into chapters covering structural types, floor systems, new sections, connections and details, and quantities and costs, thus facilitating comparison between similar features of different designs. Arches, trusses and other types of designs are represented in many variations, and floor systems include concrete, steel grid and steel plate. New sections suggested are for plates, tees, beams, channels and angles. Over one hundred original drawings are clearly reproduced. The book lacks an index but there is a fairly detailed table of contents.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Atmospheric Pollution: its origins and prevention. A. R. Meetham. London, Pergamon, 1952. 268 pp., illus., 35/-.

This book treats the whole subject of fuel pollution in Great Britain—principally in the forms of sulphur dioxide, smoke, and ash. It goes into the subjects of fuels, fuel-burning appliances and industrial processes, besides giving information on the measurement, distribution and effects of atmospheric pollution. Remedial measures are also considered, together with some legislative measures in England and the anti-smoke laws in the U.S. The non-technical approach of this book renders it useful to a variety of interested groups.

Control of electric motors, 3rd ed. R. B. Harwood. New York, Wiley, c1952. 538 pp., illus., $7.50 (U.S.).

In this book the characteristics of various types of motors are described briefly, and the ways in which these characteristics are used to control them are explained. The design, construction, and operating characteristics of a number of controllers and control devices are discussed, and methods of combining these devices to secure a desired effect are des-

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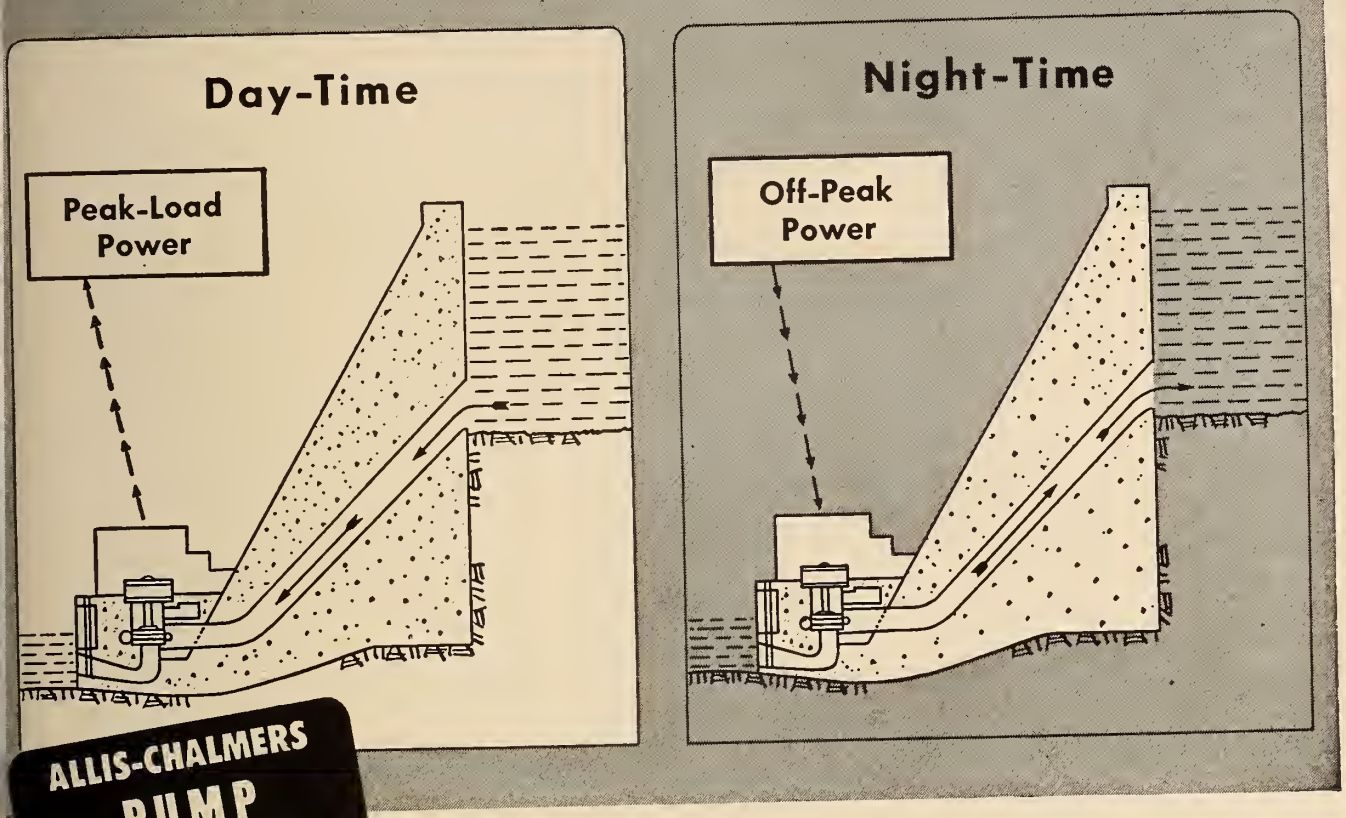

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cribed. Owing to the rapid expansion of electronic control and the number of books on that particular aspect the topic is omitted from the new edition.

Handbook of aerial mapping and photogrammetry, 2nd ed. L. G. Trorey. Toronto, Macmillan, 1952, 180 pp., illus., $5.75.

This manual, intended for the drawing office, describes a variety of techniques for making maps from air photographs. The methods described are mainly the newer ones developed during and since the war. Procedures, calculations, and instruments are covered in logical order in a step-by-step manner. Appendices contain a detailed presentation of the standard mapping procedure of the Royal Canadian Engineers, additional notes on the multiplex and stereoplanigraph, and a brief account of the Kelsh plotter.

Heat transfer phenomena, R. C. L. Bosworth. New York, Wiley, c1952, 211 pp., illus., $7.20.

Heat flow is described as a type of transport process in which physical characteristics are transferred through the movement of certain "carriers". It is in this light that the conduction of heat in gases, liquids and solids, radiative transfer, forced and natural convection, and heat flow with simultaneous phase change are explained. An analogy of heat flow to other transport phenomena completes this monograph which should prove useful both to advanced students and technologists.

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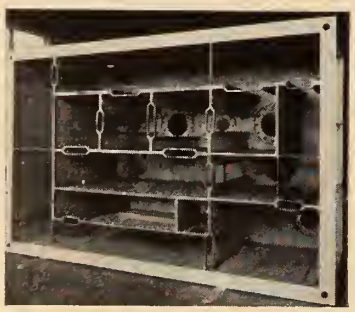

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Métallurgie, 65th ed., R. Cazaud. Paris, Dunod, 1953. 372 pp., illus., $1.50.

This condensed pocket-book of metallurgical information covers some thirty metals, chiefly those of the greatest commercial importance, giving briefly their properties, basic qualities, and metallurgical characteristics. Separate sections are devoted to metal corrosion, to heat treatment methods, and to test methods for metals. Data tables and some common formulas are included at the back of the book.

BOOKS RECEIVED

Atomic theory for students of metallurgy, 2nd rev. ed. William Hume-Rothery. London, Institute of metals, 1952. 331 pp., diagrs., $4.25. (Monograph and report series, No. 3).

Dairy engineering, 2nd ed. A. W. Farrall. New York, Wiley, c1953. 477 pp., illus., $7.20.

Foundation engineering. R. B. Peck, W. E. Hanson and T. H. Thornburn. New York, Wiley, c1953. 410 pp., illus., $8.10.

High-speed photography, its principles and applications. G. A. Jones. London, Chapman, Toronto, British book service, 1952, 311 pp., illus., $8.50.

Industrial science — present and future. A. T. Bonnell, comp., R. C. Christman, ed. Washington, American association for the advancement of science, c1952. 152 pp. (paper), $2.00 (U.S.).

Interim rules for the evaluation of restriking voltage severity. Association of short-circuit testing authorities. London, The association, 1952. 16 pp., diagrs. 5/-.

Marine refrigeration. R. Munton. London, Modern refrigeration, 1952. 90 pp., diagrs., 7s. 6d.

Metadyne statics. J. M. Pestarini. New York, Technology press, Massachusetts institute of technology, and Wiley, c1952. 415 pp., illus., $10.80.

Polarized light in metallography. G. K. T. Conn and F. J. Bradshaw, eds. Toronto, Butterworth, 1952. 130 pp., illus., $3.80.

Prestressed concrete. Kurt Billig. Toronto, Macmillan, 1952. 470 pp., figs., tables, $6.85.

Proceedings of the joint engineering conference, 1951. Institution of civil engineers, Institution of mechanical engineers, and Institution of electrical engineers. London, The institutions, 1952. 529 pp., illus.

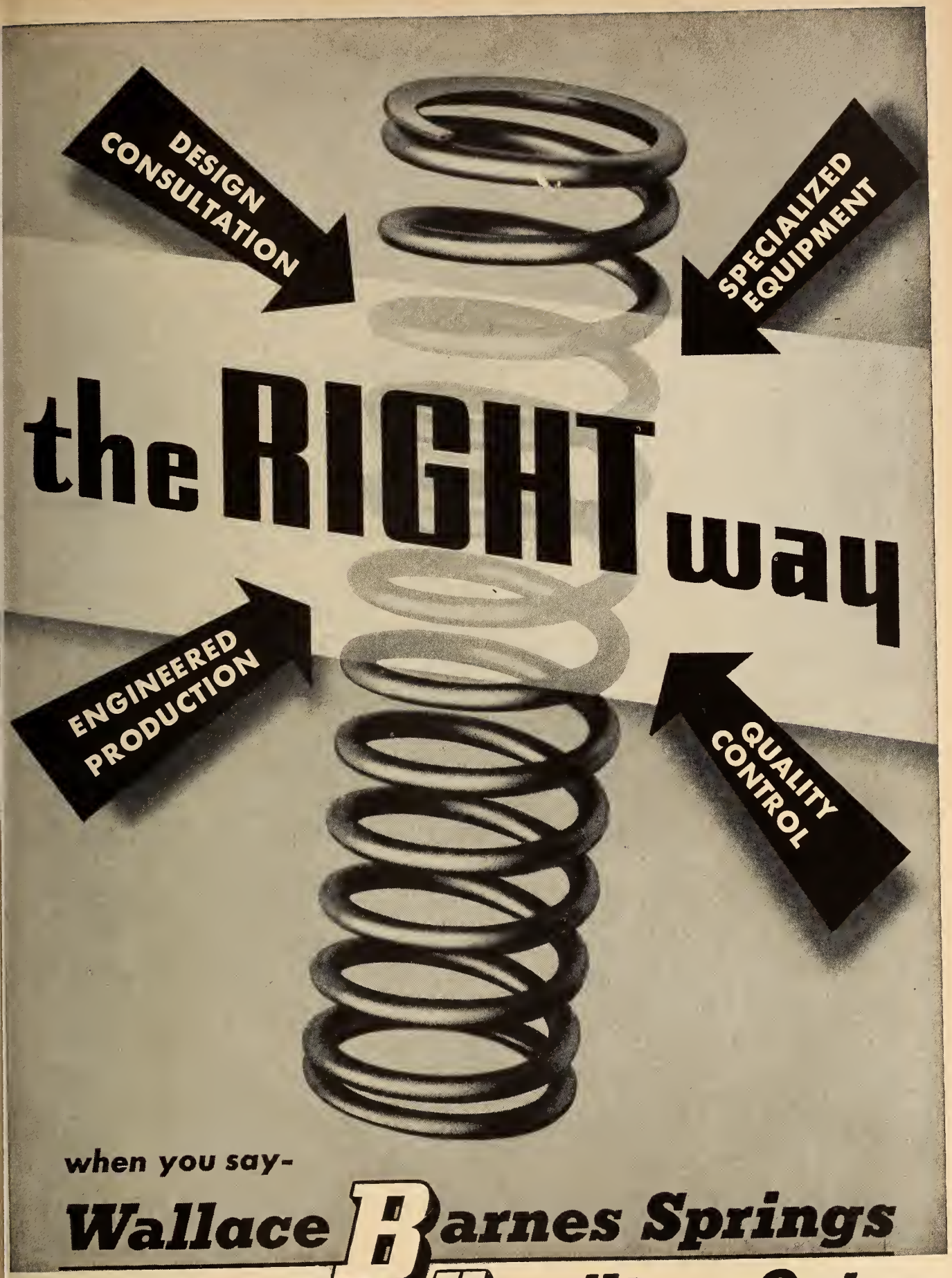
The world almanac and book of facts for 1953. Harry Hansen, ed. New York, New York World-Telegram and The Sun, c1953. 896 pp., $1.10 (U.S.).

STANDARDS REVIEWED

British standards. British standards institution, 24/28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 116: 1952—Oil circuit-breakers for alternating current systems. 15/-.

In this new edition service conditions are defined and standard ratings are listed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for rated service voltages up to 275 kv. Requirements are specified for construction, test and performance. Appendices cover: information to be given with enquiries, orders and tenders; calculation of fault currents; selection and maintenance of circuit-breakers; details of test methods, and information to be included in test reports.

B.S. 1098: 1953—Jig bushes. 3/-.

In this standard the problem of 'closing-in' has been very carefully investigated. One rather surprising result of the experiments carried out is that under ordinary industrial conditions of research, the amount of 'closing-in' is unpredictable, a finding which has had a certain amount of repercussion on the limits of tolerance in the specification.

B.S. 1133: section 6: 1953—Temporary prevention of corrosion of metal surfaces (during transportation and storage) Packaging code. 10/6.

This section 6 of B.S. 1133 refers to ordinary commercial practice. Not only are temporary corrosion preventives and their uses described in detail, but the essential preliminary conditions are catered for by an extensive section on cleaning (covering all the well-established methods of dealing with oil grease and dirt and including the removal of rust and scale) and a short section on drying.

B.S. 1453: 1952—Filler rods for gas welding. 3/-.

This issue covers thirty-one types of filler rods under the headings of steel, cast iron, copper and copper alloys, magnesium alloys and aluminium and aluminium alloys. Each type is defined in terms of chemical composition.

B.S. 1894: 1952—Electrode boilers of riveted, seamless, welded and cast iron construction for water heating and steam generating. 12/6.

The standard applies to boilers to design temperatures not exceeding 650°F. It deals with materials, construction and workmanship, scantlings, inspection and testing of electrode boilers of riveted, seamless, welded, and cast iron construction. Safety valves have been dealt with at length and electrical safety devices are also specified.

B.S. 1919: 1953—Hacksaw blades. 3/6.

This represents the fruits of co-operation between the British Standards Institution and the British Hacksaw Makers' Association and has the further advantage for many sections of industry that its provisions for the ranges of sizes, teeth and dimensions are identical with those accepted by American and Canadian manufacturers through agreements between the respective trade organizations.

B.S. 1935: 1953—Adjustable adaptors for multiple spindle drilling heads. 2/6.

This standard meets the need for these adaptors to be interchangeable not only between the various makes of spindle manufactured in this country, but also between British and American spindles. It provides dimensions for fine adjustment by two nuts in addition to the coarser adjustment by a single nut and also lays down requirements for material and various manufacturing items. The adaptors specified are for Morse taper shank tools and are not intended for use with tools having parallel shanks.

Canadian standards, Canadian standards association, National research building, Ottawa, Canada.

CSA G111-1952—Specification for wire nails, spikes and staples. $1.50.

This specification covers recommended sizes and other dimensional data for various kinds of wire nails, spikes and staples commonly used by the building trades and others. The greater part of the book consists of tables covering twenty-three types of these articles.

TECHNICAL BULLETINS—RECEIVED

American iron and steel institute. Committee on reinforced concrete research. Reprints.

No. 48-11—Diagonal tension in reinforced concrete beams, by A. P. Clark.

No. 48-17—Measurement of the distribution of tensile and bond stresses along reinforcing bars, by R. M. Mains.

No 49-8—Effect of compressive reinforcement on the plastic flow of reinforced concrete beams, by G. W. Washa and P. G. Fluck.

American society for testing materials. Special technical publications:

No. 129—Symposium on determination of elastic constants.

American Water Works Association. Tentative standard specifications:

AWWA C207-52T—Steel pipe flanges.

Bell telephone system. Technical publications. Monographs:

No. 2015—Automatic switching for nation-wide telephone service, by A. B. Clark and others.

No. 2016—Effective sum of multiple echoes in television, by A. D. Fowler and H. M. Christopher.

No. 2017—Energy of a Bloch wall on the band picture, by Conyers Herring.

No. 2021—An improved electrolysis switch, by V. B. Pike.

No. 2023—On the motion of gaseous ions in a strong electric field, by G. H. Wannier.

No. 2024—Stress relaxation in plastics and insulating materials, by E. E. Wright.

Canada. National research council. Canadian government specifications board. Specifications:

1-GP-78—Paint remover, non-flammable, emulsion type, water rinsable.

3-GP-12A—Oil; boiler fuel, naval.

4-GP-2—Methods of testing textiles.

4-GP-34—Felt; ammunition filling.

4-GP-35—Felt; hair and/or wool.

27-GP-1—Methods of sampling and testing electrical insulating varnishes.

27-GP-2—Varnish; electrical insulating impregnating for radio frequency applications.

27-GP-3—Varnish; electrical insulating baking.

27-GP-4—Varnish electrical insulating air-drying for stationary parts of rotating electrical equipment.

27-GP-5—Varnish; electrical insulating; flexible, impregnating for rotating electrical equipment.

27-GP-6—Varnish; electrical insulating baking, non-pigmented, polymerizing for rotating electrical equipment.

32-GP-1B—Bread; white, enriched white, and whole wheat.

32-GP-2A—Bread; fruit and raisin.

37-GP-16—Asphalt cutback; filled; for dampproofing and waterproofing.

Edison electric institute. Industrial development subcommittee. Area development suggestions:

Vol. 1, No. 1—How to encourage industries to direct their plant location enquiries to electric companies.

Vol. 1, No. 2—Check list for handling industrial prospects and locating new industries.

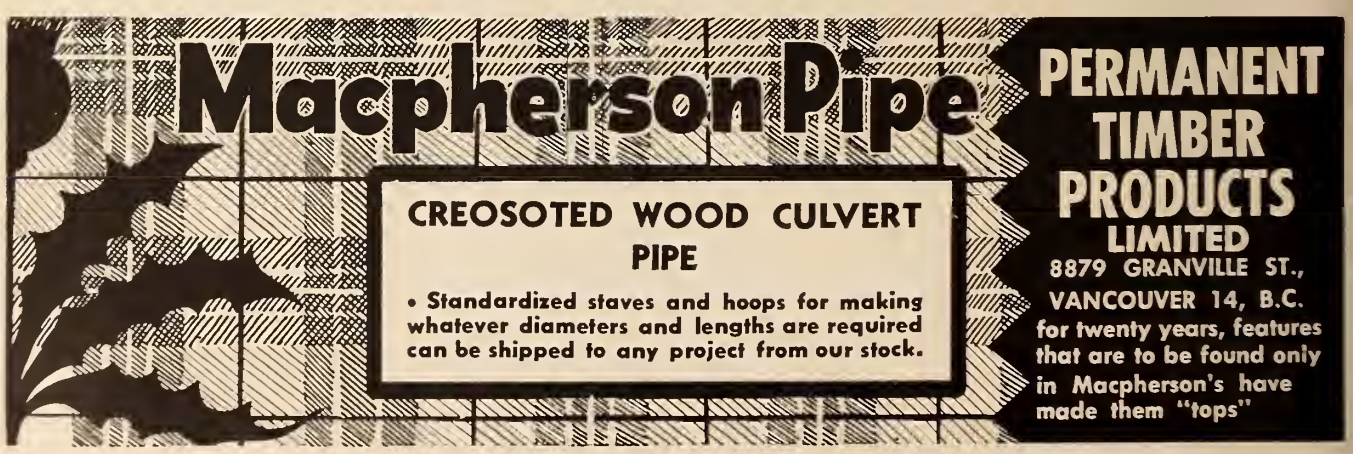
McGill University. Extension department. Transportation course. Papers:

The role of roads in Canada's development, by C. W. Gilchrist.

United States. Highway research board. Bulletins:

No. 56—Night visibility.

No. 57—Pavement-marking materials.



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TANKS — All Smooth-a-Surge Transformer Tanks are fabricated from rust resisting steel sheets, electrically welded in construction. The cover is suitably bolted to the case. The base is electrically welded to the case with suitable cross members welded thereto for maximum strength. Four jack-steps are provided, which have unrestricted vertical clearance. Shipping skids may be attached parallel to either axis.

BUSHINGS — H.V. and L.V. Bushings conform with the CEMA standards for Power Transformers.

OIL — All oil supplied with S.P.S. O.N.S. Power Transformers conforms with C.S.A. Spec. No. C50T-1938.

FINISHES — All tanks are thoroughly cleaned. The outer surface is then coated with a special primer and two coats of finishing enamel. The entire tank finish is tough, oil proof, and flexible to the expansion and contraction of the tank metal under temperature changes.

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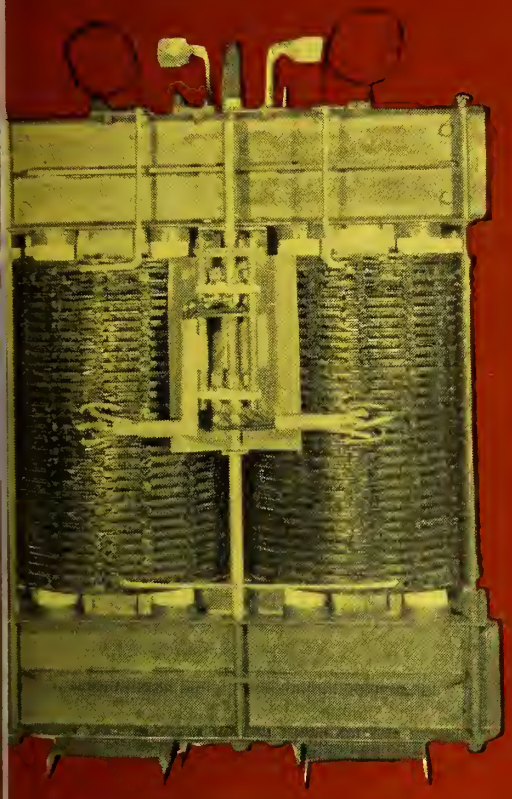
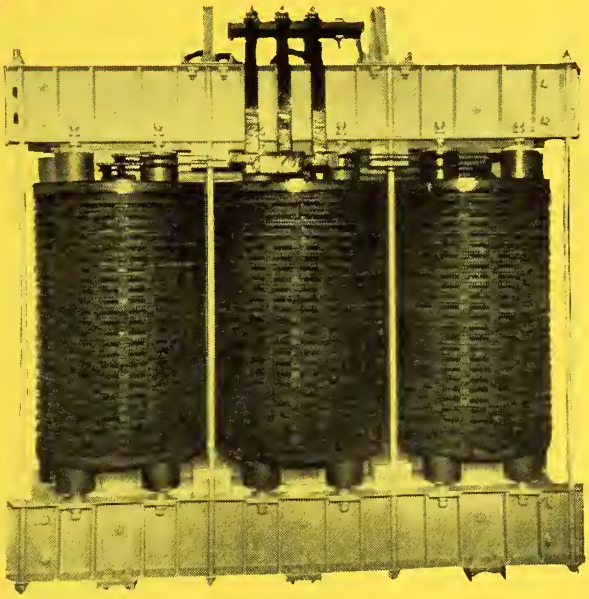


INTERNAL VIEW OF THE TRANSFORMER SHOWN ON THE OPPOSITE PAGE.



1,000 KVA 3 PHASE CORE AND COIL ASSEMBLY

OIL AND CORE ELEMENTS

ORE CONSTRUCTION—All Smooth-a-Surge Power ansformer cores are assembled from lamina- of the best grade of none-aging, low loss ilicon alloy sheets annealed to relieve rolling nd shearing strains.

OILS — All Smooth-a-Surge Power Transformer oils are either cylindrical or disc type. Conductors re divided and transposed at proper points of e windings to reduce copper eddy-current losses. l coils are specially impregnated and rigidly ured to give a maximum of trouble-free rvice.

TESTS — Complete electrical tests are given to all mooth-a-Surge Power Transformers before they are shipped. To insure that the prescribed standards of the Canadian Standards Association C-88 are met, the following tests are made:

(1) core loss (no-load)
(2) Copper loss (load)
(3) exciting current
(4) impedance
(5) ratio
(6) resistance
(7) induced voltage
(8) high potential
(9) temperature rise
(10) phase sequence

GUARANTEE — All parts and workmanship are guaranteed. This is furnished in writing at the time of shipment.

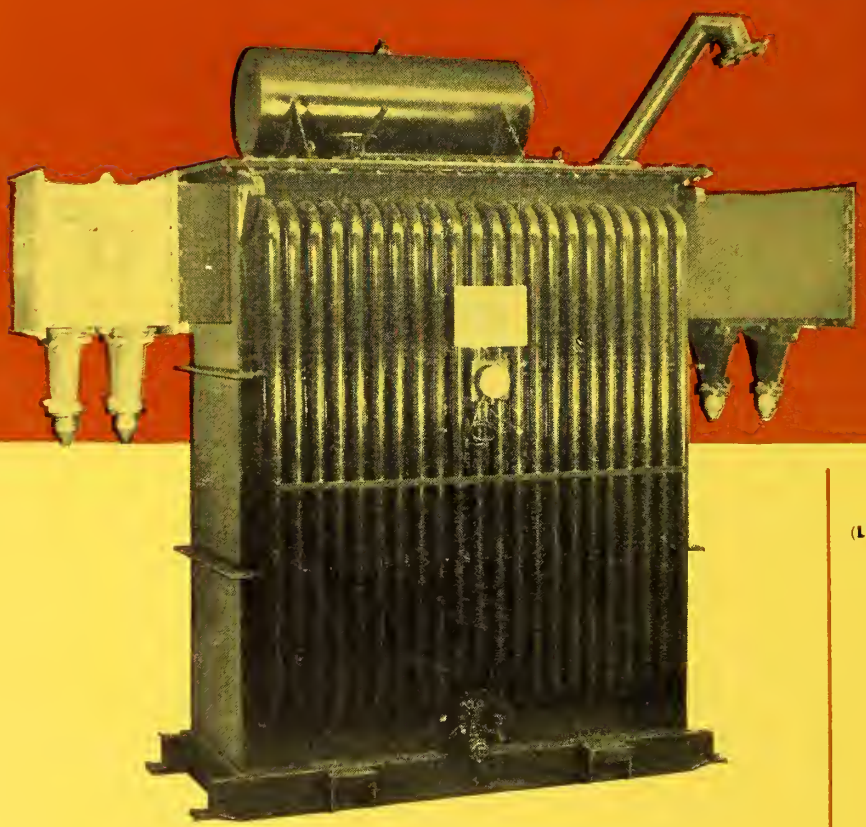
CAPACITIES — Supreme Smooth-a-Surge Power Transformers are manufactured in a range up to 5,000 KVA and in voltages up to 69,000.

Smooth-a-Surge

TRANSFORMERS

FOR CONTINUOUS SERVICE, LOWER LOSSES, HIGHER EFFICIENCIES

(Right)—667/1,200 KVA, 27,600/13,800 H.V., 2,400/4,800 L.V., 25/60 CYCLE O.N.S. POWER TRANSFORMER DESIGNED AND BUILT FOR A LARGE PUBLIC UTILITY.



(Left)—600 KVA 4,000/575 VOLTS 25 CYCLES WITH THROAT CONNECTIONS FOR A PUMPING STATION

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New $2,000,000 East River Pedestrian Bridge provides access from East 103rd Street, Manhattan, to Wards Island, New York.

From this modern Westinghouse Control Desk, the operator has complete finger-tip control of all operations.

World's longest girder lift span operates from finger-tip control

A finger-tip speed control system plays a vital role on the Department of Public Works' new East River Pedestrian Bridge. Connecting East 103rd Street, Manhattan, to Wards Island, New York, this installation features a 312-ft. girder lift span—longest in the world.

Level raising and lowering of the lift span is done by four 40-hp Westinghouse wound-rotor induction motors, paired off in the two towers. Each pair includes a drive motor and a leveling motor. Drive motors raise and lower the span. The other two are connected in a power synchro-tie arrangement to keep the span level.

Centralized operation and control are provided by a Westinghouse Control Desk. Mounted in the desk are main drum controllers, toggle switches, pushbuttons, height and level indicators, instruments and indicating lights. These give the operator complete and centralized control of all operating functions.

Two alternate control methods, in the control desk, have been provided for emergency operation. One system is automatic—utilizing Westinghouse synchro-tie transmitters and a differential receiver. The other permits manual operation.

This is another instance of Westinghouse participation in movable traffic bridge projects—ranging from application engineering service to supplying electrical apparatus, matched to a specific need.

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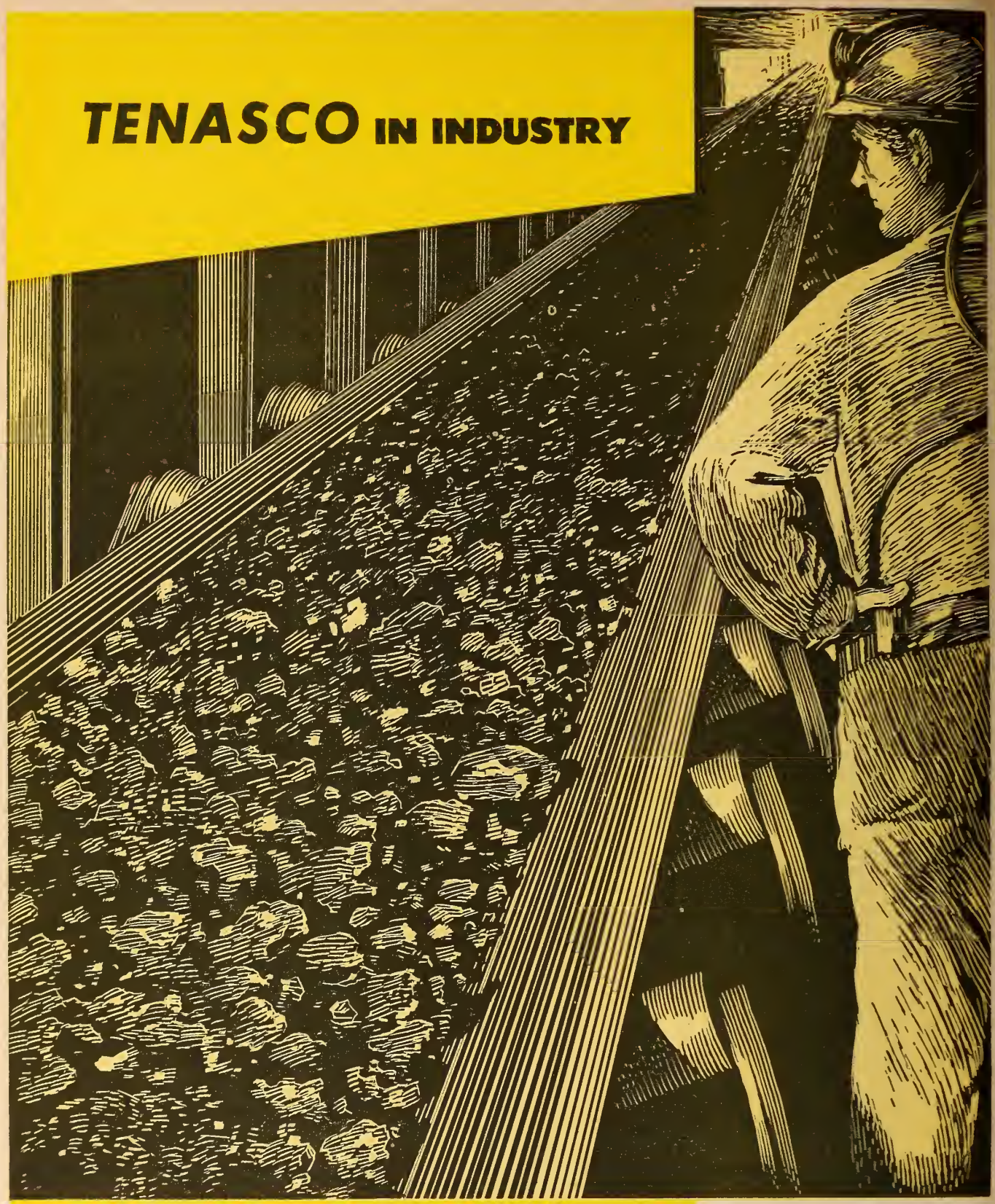
Unusual girder lift span, powered by four 40-hp Westinghouse wound-rotor induction motors, has a lift of 80 ft. to provide 135-ft. clearance above water.

TENASCO IN INDUSTRY



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TENASCO*
makes stronger, lighter more flexible conveyor belts

**Regd. trade name for Courtaulds high tenacity viscose rayon yarn*

The outstanding qualities of High Tenacity Viscose Rayon are being used to increase the efficiency of conveyor belts. Here are some of the advantages which this man-made fibre provides in conveyor installations:

1. MORE TENSILE STRENGTH PER DOLLAR

2. BETTER TROUGHABILITY

Due to Viscose Rayon's natural flexibility, stronger belts with better troughability can now be built. Belts made with TENASCO* trough more readily than standard duck belts which have 25% less tensile strength. This means less belt wander, less edge wear, longer belt life.

3. BETTER FASTENER-HOLDING ABILITY

Belts made with TENASCO* have 20 to 60% more fastener-holding strength than other belt constructions which offer improved troughability.

4. LONG FLEX LIFE

Distortion of the carcass is held to a minimum in bending around small pulleys because a carcass made of TENASCO* yarn is 30% thinner than standard ducks of equal strength.

5. LIGHT WEIGHT

Belt fabric made of TENASCO* weighs 37% less than standard fabric of equal strength. This makes it easier to handle belts in limited space, such as in underground installations.

6. HIGH TEAR RESISTANCE

The strong TENASCO* threads resist lengthwise tears more effectively than heavy, stiff, standard ducks of equal weight.

Conveyor belts made with TENASCO* are just one example of how High Tenacity Viscose Rayon yarn is used to increase efficiency and cut costs in industrial equipment. We are always glad to discuss the possible advantages of TENASCO* in any specific application you may have in mind.

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4 BABCOCK BOILERS
are now providing
the "steam for power"
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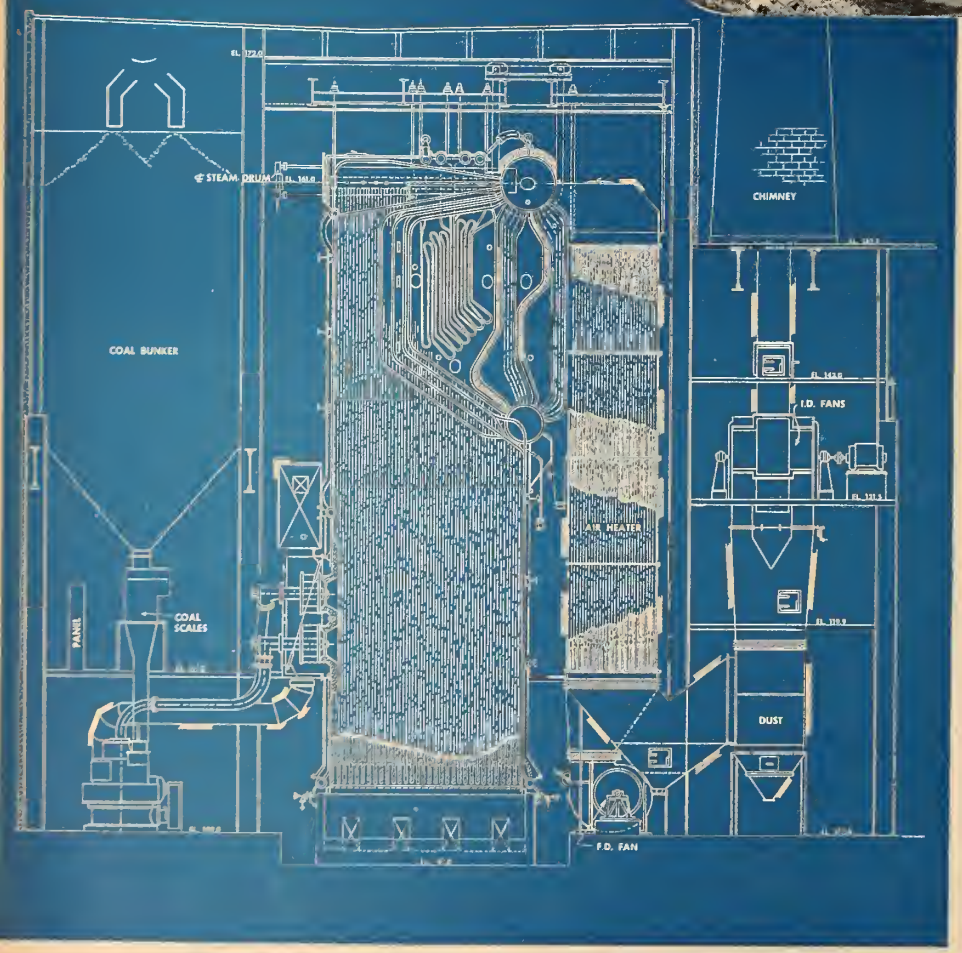

The four Babcock boilers installed this plant have a total steaming capacity of more than 700,000 pounds per hour. The operating pressure is 61 lbs. and superheated to give a total temperature of 815°F.

Each boiler unit is fitted with one tubular type Air Heater and one has a Vertical Type Economizer.

Two type "E" Pulverizers supply the powdered fuel for each unit.

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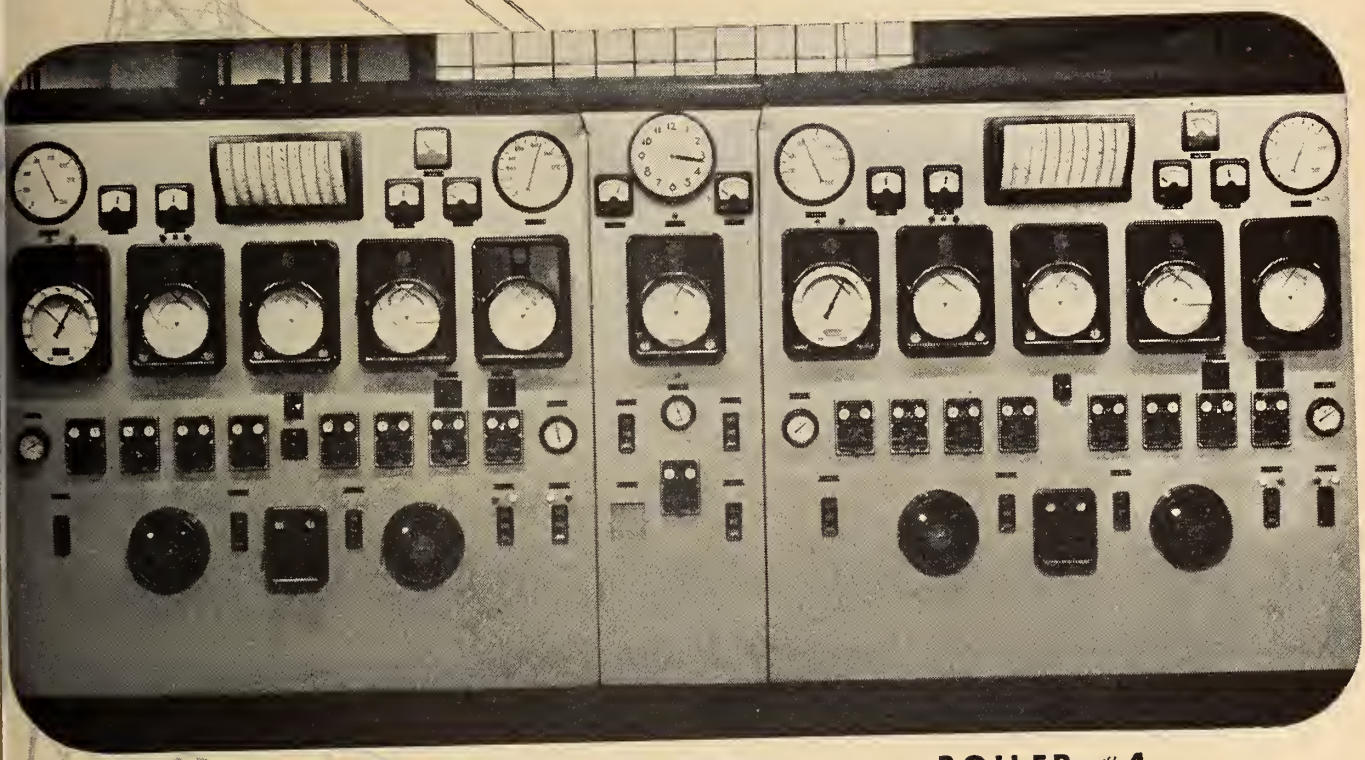

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Bailey 3-element Feed Water Control holds drum water level.

Bailey 2-element Steam Temperature Control provides uniform steam temperatures at turbine.

Bailey Combustion Control co-ordinates pulverizers, forced draft, and induced draft fans, to maintain uniform steam pressure and maximum boiler efficiency.

Bailey Controls also ordered for boiler No. 5

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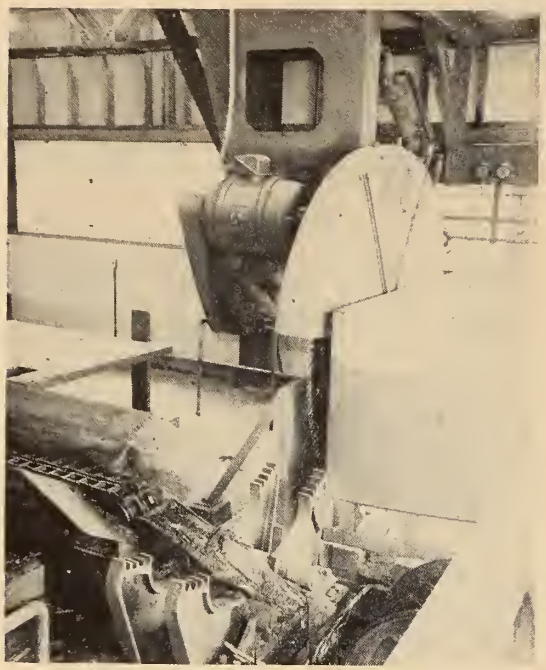

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2-102" Swing Saws
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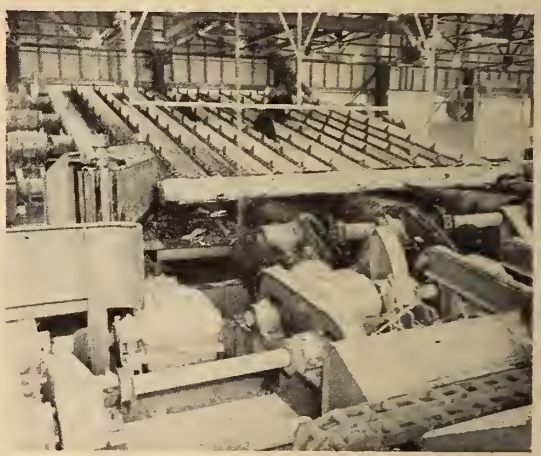
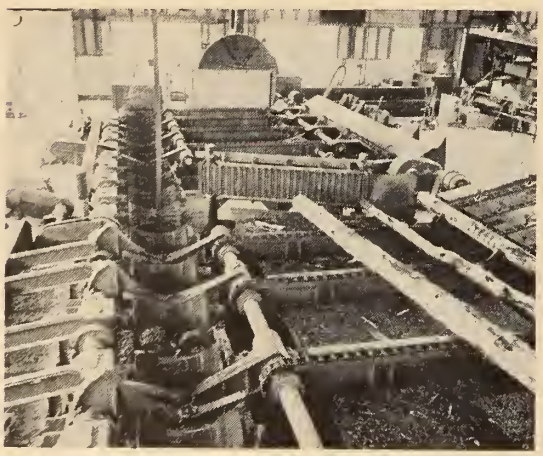


● 5-Saw Slasher



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Pumps
AT WORK AT ELK FALLS

Located in the pump house on the Campbell River approximately 3¼ miles away from the mill site, three two-stage Fairbanks-Morse vertical Pomona pumps supply all of the water required in the production of pulp and paper at the Elk Falls plant in British Columbia. Each pump is complete with a 250 HP 1750 RPM Fairbanks-Morse Vertical hollow shaft motor and has a capacity of 4,000 GPM against a total operating head of 200′.

Two pumps are in operation all the time with the third unit as a standby. The pumps discharge into a common header which in turn delivers the water through 3¼ miles of 36″ Wood Stave Pipe to an elevated storage tank of 355,000 Gallons capacity. And in addition to the storage tank for mill use, the same pumps deliver water to a storage tank of 112,000 Gallons capacity, used for fire protection.

Indicative of the vital and important function which this pumping equipment performs in keeping the mill in operation, is the fact that the combined hourly pumping capacity of the two units on the line is 480,000 Gallons and the storage capacity of 355,000 Gallons is only sufficient to run the mill for approximately forty minutes.

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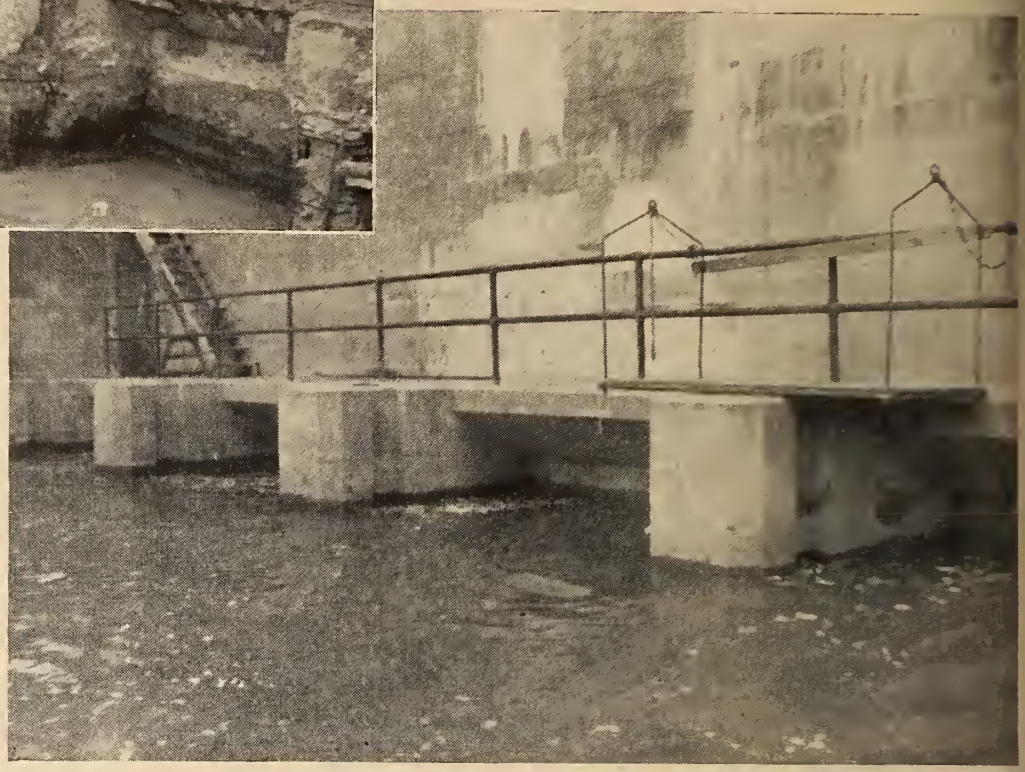
FM52-33T

Left: Deteriorated cancrete and expased reinfarcing steel in piers af tailrace befare making Prepakt-cancrete repairs.

Below: Tailrace piers restored ta better-than-ariginal candition by Intrusion-Prepakt methads. This work was done withaut unwatering the tailrace ar stopping the electric generating units.



THERE'S ONE *Best* WAY TO DO EVERY JOB . . .

Whether it's in new construction or concrete repair, there is always one *best* way to accomplish the best results. In an ever-increasing number of projects, Prepakt is being chosen as the *best* method to do the job.

Repair of badly eroded piers in the tailrace structure at the power plant of a leading Ontario pulp-and-paper company is typical. Deterioration and spalling of the old concrete had brought the whole structure to the point of incipient failure.

Prepakt methods and materials provided exceptional advantages in this repair project. First, Prepakt methods *completely* filled the repair openings with high-strength concrete having a superior bond to the old concrete. Second, the low drying shrinkage and high weather resistance of Prepakt concrete provided the structure with additional strength for long, trouble-free service. Third, the use of Prepakt concrete did not involve dewatering and did not interrupt power generation . . . all that was required was a 50% shut-down of one wheel.

Full information on this and other outstanding Prepakt installations may be had by writing the main office of Intrusion-Prepakt Ltd., 159 Bay St., Toronto, Ont.

CONTRACTORS · ENGINEERS — PREPAKT — SPECIAL SERVICES

INTRUSION-PREPAKT LIMITED **THE PREPAKT CONCRETE CO. LIMITED**

159 BAY STREET, TORONTO, ONT.—Phone EMpire 3-5694

UNION COMMERCE BUILDING, CLEVELAND 14, OHIO

Chicago · Seattle · Philadelphia · Zurich · Paris · Madrid · Stockholm · Helsinki · Berlin
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The Touch Of The Master

Operator becomes master at the touch of a switch. Power surges at his will to drive the machines that are the backbone of industry.

But if power is to flow, a vast network of wires and cables must function reliably day after day.

The Northern Electric Company supplies to industry the wires and cables needed for continuous, efficient service. They are designed by engineers and made on modern machinery with a craftsmanship sprung from sixty years of experience.

Northern Electric wires and cables meet industry's every electrical need.

Consult your nearest Northern representative for all your wire and cable requirements.

Northern Electric

COMPANY LIMITED

HALIFAX MONCTON SAINT JOHN QUEBEC CHICOUTIMI THREE RIVERS SHERBROOKE MONTREAL L'ABORD À PLOUFFE OTTAWA VAL D'OR KINGSTON TORONTO HAMILTON LONDON SARNIA KIRKLAND LAKE WINDSOR TIMMINS SUDBURY FORT WILLIAM WINNIPEG BRANDON REGINA SASKATOON LETHBRIDGE CALGARY EDMONTON CRANBROOK TRAIL PENTICTON VERNON NEW WESTMINSTER VANCOUVER VICTORIA NANAIMO

3052-1

The Challenge of a New Era

WE CONGRATULATE THE ENGINEERING INSTITUTE OF CANADA on its sixty-seven years of service to our nation. We are proud of our fifty-nine years of association with members of the profession.

To-day Canada stands on the threshold of an era that demands the utmost in ingenuity and courage. Greater problems must be faced—new methods and higher standards must be adopted—by all who compete for good will.

We share with the members of the Institute a background of experience vitally necessary as a guide through the unexplored paths of to-morrow.

ANGUS ROBERTSON LIMITED

MONTREAL • TORONTO

Continuous service to Canada since 1895

CANADIAN CONSTRUCTION ASSOCIATION

Our best advertisement- a satisfied customer!

...one Turbo Generator installed, another ordered at WINNIPEG HYDRO

The confidence of the City of Winnipeg Hydro Electric System in the 15,000 kw Brown Boveri turbo generator shown below has resulted in the placing of an order for another complete installation—this time a 25,000 kw unit, with feed water heaters, evaporator, condenser and condensate pumps. Thus, Winnipeg Hydro is added to the constantly growing list of satisfied users of Brown Boveri steam turbines.*

Such concrete examples of satisfaction are any company's best advertisement. They result from the recognition of those outstanding qualities which have gained world-wide renown for Brown Boveri equipment used in the generation, distribution and utilization of power.

*Users of Brown Boveri steam turbines

Canada Electric Company Limited • Ontario & Minnesota Pulp & Paper Company Limited • New Brunswick Electric Power Commission • Dominion Coal Company Limited • Dominion Steel & Coal Corporation Limited • Bathurst Power & Paper Company Limited • Canadian Cottons Limited • Noranda Mines Limited • Stanfields Limited • Fraser Companies Limited • Powell River Company Limited

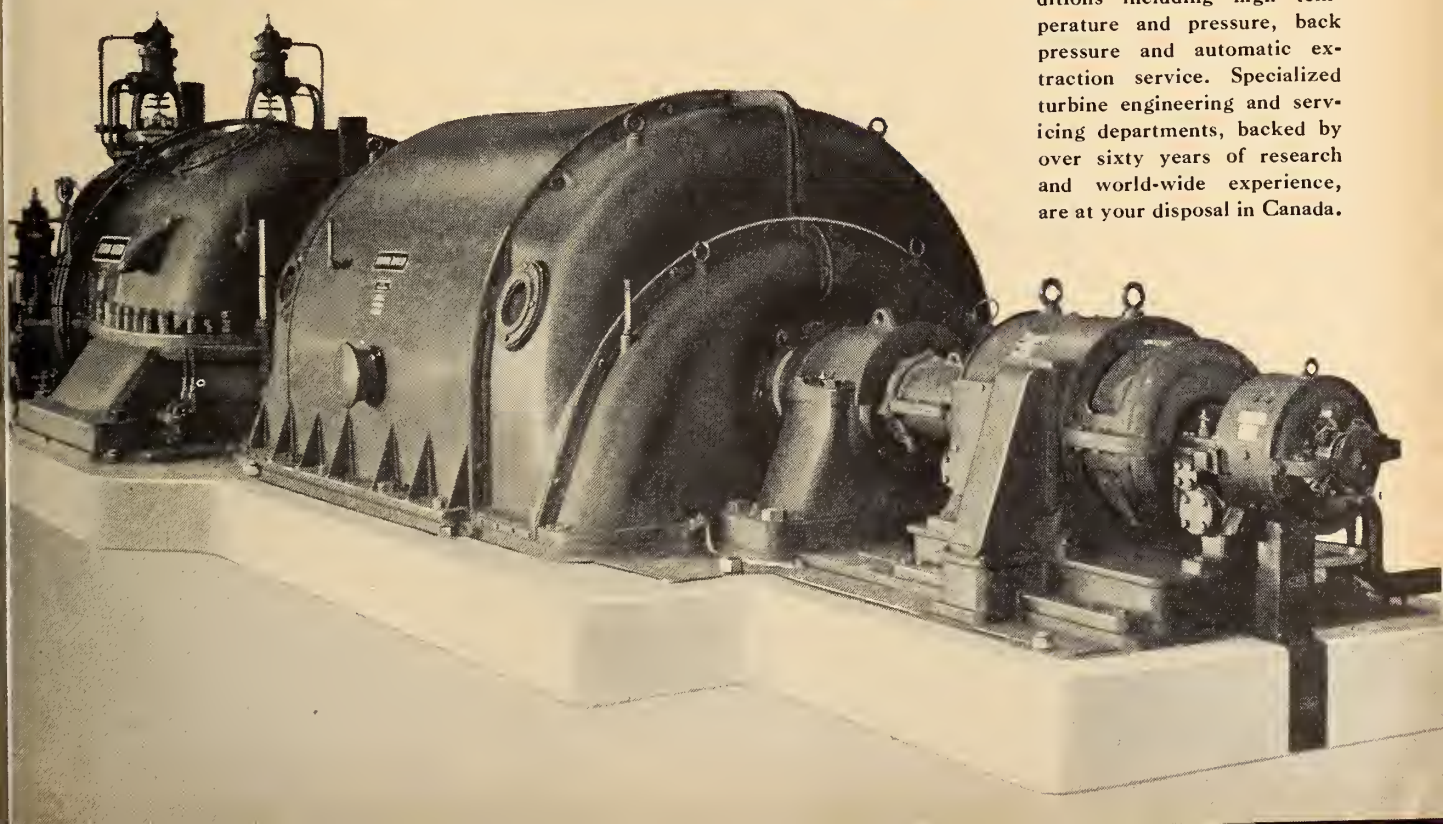
BROWN BOVERI (CANADA) LIMITED

Head Office: 1111 Beaver Hall Hill, Montreal—*Plant:* St. Johns, Que.

WORLD RENOWNED POWER EQUIPMENT

BROWN BOVERI

Brown Boveri turbines are designed for modern steam conditions including high temperature and pressure, back pressure and automatic extraction service. Specialized turbine engineering and servicing departments, backed by over sixty years of research and world-wide experience, are at your disposal in Canada.



THE SPECIALISED PROPERTIES OF ALUMINOUS CEMENT

Ciment Fondu aluminous cement is acknowledged to be unquestionably the best cement in the world. It is, of course, more expensive than ordinary constructional cements but, where conditions warrant its use, its higher initial cost is more than justified. Indeed, in some circumstances, only aluminous cement can be used — there is no alternative. For example: —

NO OTHER type of cement ever produces concrete having such great strength in so short a time.

NO OTHER type of cement ever produces concrete so resistant to chemical attack by sulphates.

NO OTHER type of cement ever produces concrete which hardens without protection at such low temperatures.

NO OTHER type of cement ever produces a refractory concrete capable of withstanding white heat.

CIMENT FONDU
Regd Trade Mark
ALUMINOUS CEMENT

The words Ciment Fondu are the registered Trade Mark of Lafarge Aluminous Cement Co. Ltd., London, England

Write for further information and literature. Please specify exact use intended.

CIMENT FONDU LAFARGE (CANADA) LIMITED

1405 Peel Street, Montreal, Telephone PLateau 6651

Associated Companies

U.S.A. Ciment Fondu Lafarge Corporation, 141 East 44th St., New York 17, N.Y.

FRANCE Société Anonyme des Chaux et Ciments de Lafarge et du Teil, 32 avenue New York, Paris.

Head Office

Lafarge Aluminous Cement Co. Ltd., 73 Brook St., London W1.

Note to E.I.C. delegates to Halifax:— Pier "B", Halifax, built in 1930 using 20,000 tons of Ciment Fondu, is the largest Ciment Fondu installation in the world. In 23 years no repairs have been required & it is in perfect condition today — go down to the harbour & see it!

Choose

CARTER CONSTRUCTION

for reasonable costs

CARTER CONSTRUCTION

for on-time completion

CARTER CONSTRUCTION

for major projects

For 50 years, the name CARTER has
meant dependable heavy industrial construction.
Whatever your construction plans, see CARTER.

CARTER THE CARTER CONSTRUCTION COMPANY LIMITED

Contractors for 50 years

TORONTO — 419 Cherry Street Tel: EMpire 3-9348
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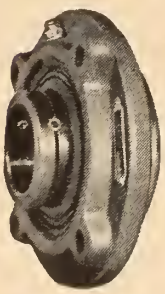
Specify

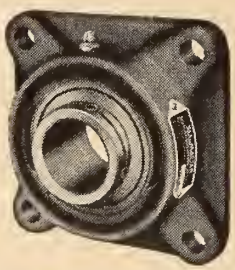
SEALMASTER
BALL BEARING UNITS

QUIET IN OPERATION • PRE-LUBRICATED

PERMANENTLY SEALED • SELF-ALIGNING and NO HOUSING WEAR



Flange Cartridge Unit



Flange Unit

Write for Catalog No. 845 for essential engineering data on the complete SealMaster line of units.

SealMaster's exclusive combination of features insures long bearing life on all types of equipment. Outstanding qualities are smooth, dependable operation and minimum maintenance requirements.

Permanent Seal—Dust and dirt are effectively sealed out by SealMaster's patented sealing principle. Lubricant stays in.

Self-Aligning—SealMasters are self-aligning. Misalignment of shaft in any direction cannot distort the seal.

Pre-Lubrication—Each SealMaster is shipped with lubricant sealed in—ready for use.

No Housing Wear—Patented locking pin prevents rotation of outer race in housing, and positions unit for relubrication.

STEPHEN S-ADAMSON MFG. CO. OF CANADA LIMITED

Conveying • Elevating • Screening and Transmission Equipment

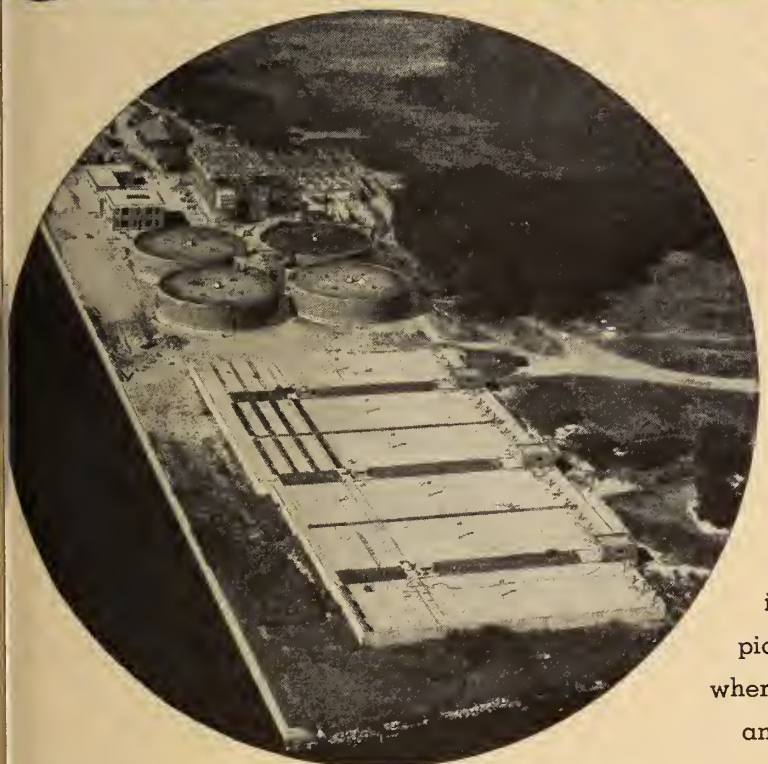
HEAD OFFICE — BELLEVILLE, ONTARIO

BRANCH OFFICES: MONTREAL, TORONTO, VANCOUVER

Carlington Heights Reservoir, Ottawa, Ont., in caurse of construction.
Owner: City of Ottawo. Cantractar: Ross-Meogher Ltd., Ottowo. *Designers:* Gore and Storrie, Toronto.

Sewage Disposal Plants Call for Durable CONCRETE

Concrete pipes used in Lovol Union's two mile long Utilities tunnel, Quebec. Contractar: Komo Canstructian Co. Ltd., Quebec. *Cansulting Engineer:* Maurice Royer, Quebec.



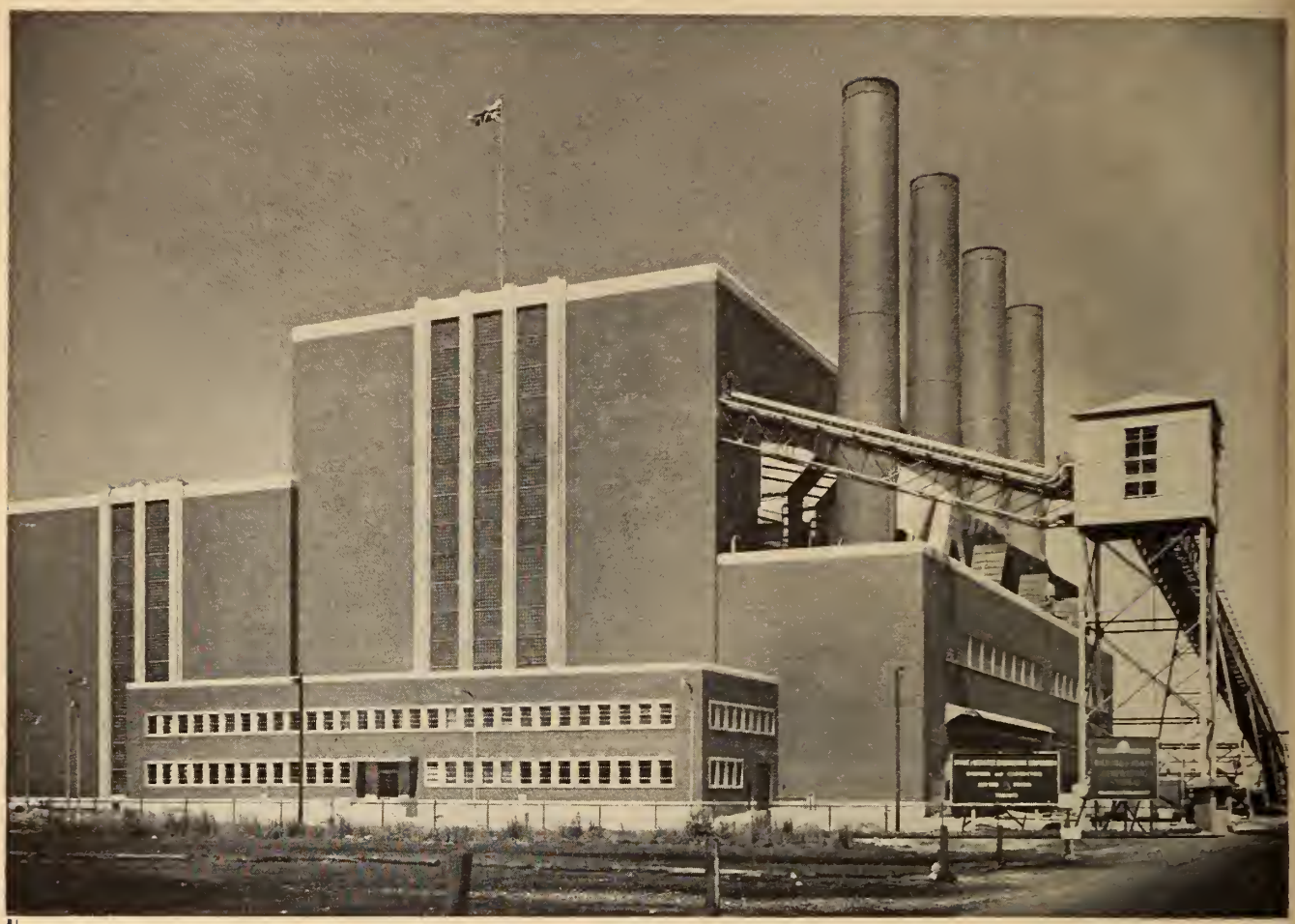
Ashbridge's Boy Sewage Treatment Plant, Toronto. Owner: Corporation of the City of Toronto. Cantractar: Foundation Company of Ontorio. *Cansulting Engineers:* Gore and Storrie, Toronto.

In the building and remodelling of sewage disposal plants, over-the-years dependability of the construction material is of vital importance. This is why concrete plays such an important role in municipal projects like those pictured here. Whatever the field of service, wherever used, concrete assures long life and low annual cost. Copies of two new brochures "Sewer Treatment Works" and "Concrete Sewers" will be sent free on request.

CANADA CEMENT COMPANY LIMITED

CANADA CEMENT COMPANY BLDG., PHILLIPS SQUARE, MONTREAL

SALES OFFICES: MONCTON QUEBEC MONTREAL TORONTO WINNIPEG CALGARY



ANOTHER "COOKSVILLE" JOB

THE RICHARD L. HEARN GENERATING STATION—TORONTO

Cooksville Precast Haydite Roof Deck, Red Radial Chimney Brick, Red Everhard Face Brick, Sand Lime Brick Back-Up, Speedtile & Partition Tile, Ceramic Glazed Tile for Locker Rooms, Washrooms, etc., Heatherbrown Quarry Tile for Floors.

GOOD BUILDING PRODUCTS

- Light Weight Precast Roof, Floor & Wall Slabs
- Haydite Building Blocks
- Haydite Concrete Aggregate
- Sealbond Mortar Mix
- Face & Common Brick
- Sand Lime Brick
- Acid Resisting Floor & Paving Brick
- Hollow Building Tile & Fireproofing
- Ceramic Glazed Tile — Red Quarry Tile

THE COOKSVILLE COMPANY LIMITED

1055 Yonge Street TORONTO MI. 8466

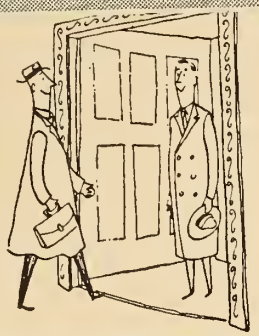
waiting for an elevator

is now old fashioned with

NEW TURNBULL PRIOR CALL EXPRESS

elevator system

P.C.E. makes waiting old fashioned



P.C.E. gives passengers express service

P.C.E. increases carrying capacity 20%-30%

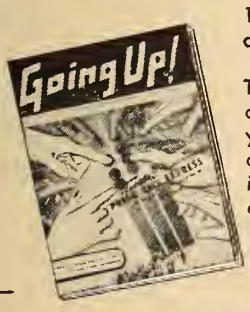
P.C.E. automatic programming leaves starter free to direct passengers

Elevators can now actually "think for themselves" when they're part of the exclusive new Turnbull system known as Prior Coll Express.

These elevotors are connected to o moster control thot sends them outomoticolly where they're wanted, when they're wanted. Service in large buildings is improved by 20%—30%.

Applicoble to o group of either self-serve or attendant operated cars, P.C.E. offers the complete solution to the problem of providing 100% service—on up and down colls—at all times.

P.C.E. is on exclusive by Turnbull, already proved in oction, now ready to serve you in new and old buildings ocross Canada. *Turnbull P.C.E. is the finest moster-controlled elevator system known.*



Write to "Publications Department", 126 John St., Toronto, for free copy of "Going Up" which contains the complete story of Turnbull Prior Call Express.

TURNBULL ELEVATOR COMPANY
LIMITED

Head Office: Toronto, Canada • Offices from Newfoundland to British Columbia

5301

Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

Dearborn Appointments. — Dearborn Chemical Company, Chicago, manufacturers of water treatment formulae, industrial and railroad cleaners, and No-Ox-Id rust preventives, announces the appointment of J. F. Wilkes to the position of Director of Research and Product Development. It has also been announced that S. C. Johnson is now a member of board of directors of the company.

●

J. H. Gibbs.—J. H. Gibbs, vice-president in charge of manufacture, Shawinigan Chemicals Limited, has been elected a member of the board of directors. Mr. Gibbs, appointed in January to the vice-presidency of the Company, directs production in the plants at Shawinigan Falls.

●

E. J. Cosford

E. J. Cosford.—Edwin J. Cosford has been appointed executive vice-president of the Canadian Car and Foundry Company, Limited. He was formerly vice-president in charge of sales.

●

Barringham Changes.—At the annual meeting of shareholders of Barringham Rubber and Plastics Limited, held in Oakville. Ontario, on March 13th, Arnold H. Smith, Leo. E. Ryan and A. Monsaroff, president, executive vice-president and vice-president respectively, of Monsanto Canada Limited, were elected to the board of directors.

Other board members appointed were Felix N. Williams and Robert K. Mueller.

At the directors' meeting held later in the day, the new officers of the Barringham Rubber and Plastics Company were announced as: Leo E. Ryan, president; A. Monsaroff, vice-president and J. Jekel, secretary-treasurer. Earl Moffat was appointed general manager and will be the operating head of the Company.

●

English Electric, Montreal. — The Montreal office of the English Electric Company of Canada, Limited, will vacate its present premises in the University Tower Building at the end of April. The new address will be Room 405 Crescent Building, 1411 Crescent Street, Montreal, Que. Phone Nos. will be BElair 3941-42-43.

●

Round Chain Co.—A new Canadian company, Round Chain Company of Canada has commenced operations. A plant, occupying 12,000 square feet, is located at Brampton, Ontario.

●

T. W. Fenton.—Thomas W. Fenton has been appointed works manager of the Adelaide plant, London, Ontario, of General Steel Wares Limited.

●

Wheelco in Montreal.—The Montreal address of the Wheelco Instrument Division, Barber-Colman Company is 6693 Park Avenue, Montreal, P.Q. The manager of the Montreal office is George Knowler.

●

Graham Manufacturing Appointment. —Graham Manufacturing Co. Inc,, New York, manufacturers of Graham heat transfer and vacuum equipment has announced the appointment of Consolidated Engines and Machinery Company, Limited as exclusive sales representatives in Canada.

Consolidated Engines and Machinery Company, have offices and warehouses in Montreal and Toronto.

●

Trade Fair Opening. — The Right Honourable C. D. Howe, HON.M.E.I.C., Minister of Trade & Commerce has announced that the Honourable Lester B. Pearson, Secretary of State for External Affairs, will open the sixth Canadian International Trade Fair in Toronto on Monday, June 1st.

●

A. M. Grant

A. M. Grant.—A. M. Grant, has succeeded Irving Smith as president of Canadian Cinch Anchoring Systems Limited, 455 Craig St. West, Montreal. Mr. Smith is now chairman of the board.

Mr. Grant joined the Company in 1936 and for the last four years has served as vice-president. He was formerly with Northern Electric Company and is a graduate of the University of Toronto. Canadian Cinch Anchoring Systems Limited have dealers from coast to coast and they supply expansion anchors for use on the major industrial engineering developments in this country.

●

R. N. Mathews.—Richard N. Mathews has been elected vice president of Kewanee-Ross of Canada Limited. He is in charge of the Company's new general offices located at 57 Bloor St. W., Toronto.

AT ALCAN'S B. C. PROJECT

AMONG a great variety of work for this project Dominion Bridge are supplying the following items:

- Structural steelwork for smelter buildings, service shops, passage-way buildings, storage bins, etc.
- Structural steelwork and erection of Kitimat highway bridge.
- Penstock liner, tunnel ribs, cradles for Soderberg pots, etc.
- 2-225-ton capacity powerhouse cranes
- Railroad bridge over Skeena River for Canadian National Railways.

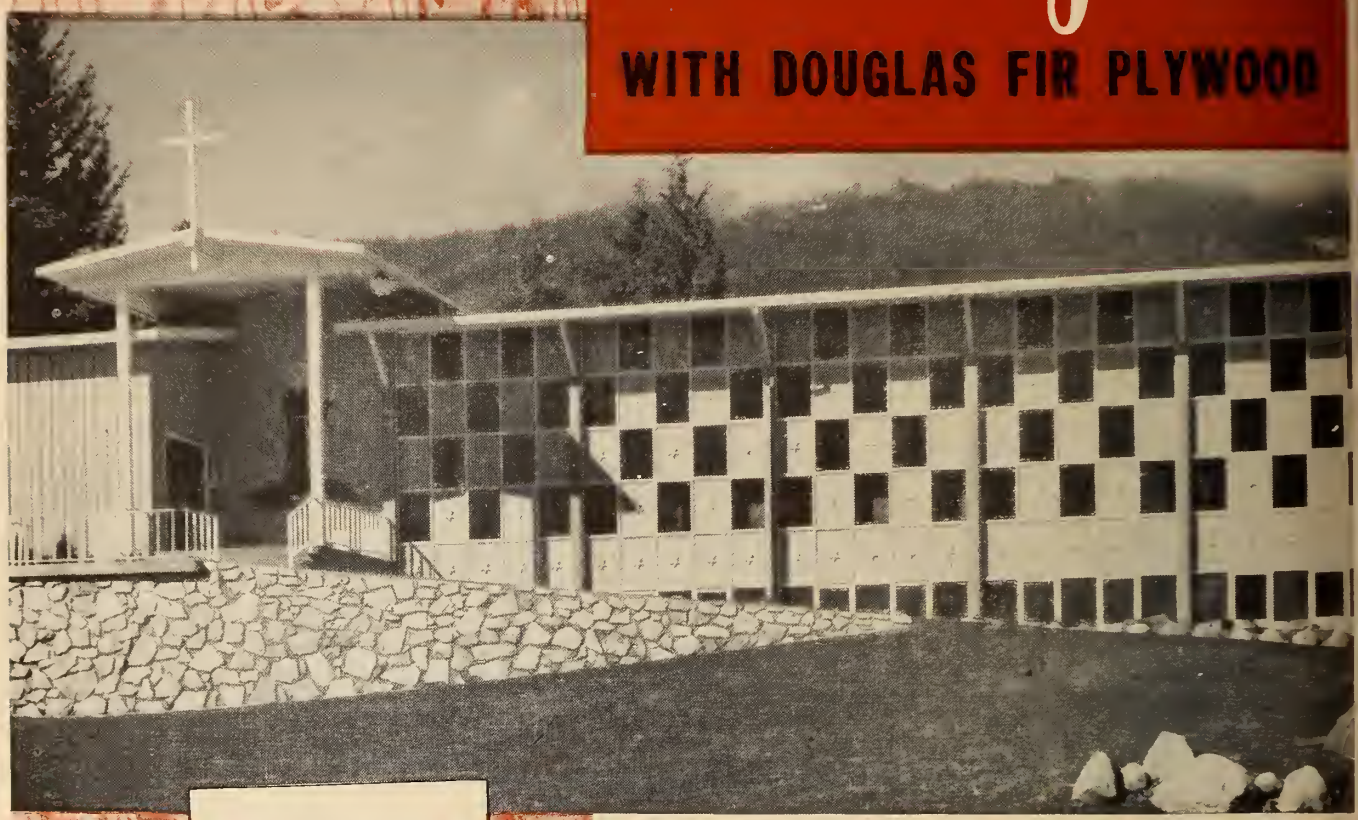
DOMINION BRIDGE COMPANY LIMITED

Plants at: MONTREAL • OTTAWA • TORONTO • WINNIPEG • CALGARY • VANCOUVER

Associate Companies at: AMHERST • QUEBEC • SAULT STE. MARIE • EDMONTON

Design

WITH DOUGLAS FIR PLYWOOD



St. Anthony's Church, West Vancouver, designed by Gardiner & Thornton

PMBC EXTERIOR

All Douglas fir plywood bearing this mark is bonded with completely waterproof phenolic formaldehyde resin-glue.

Architecture has always been a struggle between the physical limitations of material and the soaring imagination of men who would build better and more beautifully.

Pointing the way today to new architectural forms and expressions is the Douglas fir plywood panel, with its large unbroken surfaces and extraordinary strength-to-weight ratio. A natural building unit, the Douglas fir plywood panel not only enhances conventional wall construction; it has established new and challenging building methods not possible with any other material.

An example of post-and-beam construction using Douglas fir plywood is the new West Coast Church shown above. The panel quality of Douglas fir plywood is here frankly expressed to produce a harmony of design which is at once logical and refreshing.

53-4

PLYWOOD MANUFACTURERS ASSOCIATION OF BRITISH COLUMBIA
810 WEST HASTINGS STREET, VANCOUVER 1, B. C.

DOUGLAS FIR PLYWOOD

The recently formed company was established to provide engineering and sales service to Canadian industry on all types of shell and tube heat exchangers, coolers, surface and barometric condensers, steam jet ejectors, and high pressure steam boilers.

●

Westinghouse Changes. — Canadian Westinghouse Company Limited has made the following appointments in connection with a recent reorganization program. In the industrial products division J. E. Cranswick, M.E.I.C., has announced the following changes — T. R. Murphy is now manager of motor and control sales. J. B. McCallum is manager of marine and transportation product sales, R. E. Young is manager of distribution product sales and R. Brown is manager of specialty product sales.

●

J. E. McMynn.—John E. McMynn has been appointed superintendent of mines, north central district, by the Consolidated Mining and Smelting Company of Canada, Limited. In his new position, Mr. McMynn who is at present the Company's property superintendent at the H. B. Mines, will be in charge of mining operations in the Northwest Territories which includes the Con Mine at Yellowknife and the Pine Point development.

●

Johns-Manville Instructors.—Canadian Johns-Manville Company Limited has announced the appointment of Armand H. Choquette as "Transite" pipe installation instructor. Mr. Choquette's appointment brings the number of instructors in Ontario to three. He recently assisted in one of the largest "Transite" pipe installations in Canada

T. R. Murphy

R. Brown

J. B. McCallum

R. E. Young

COMPLETE HYDRAULIC SMS TURBINE EQUIPMENT

TURBINES • VALVES • PUMPS • GATES • TRASH RACK RAKES

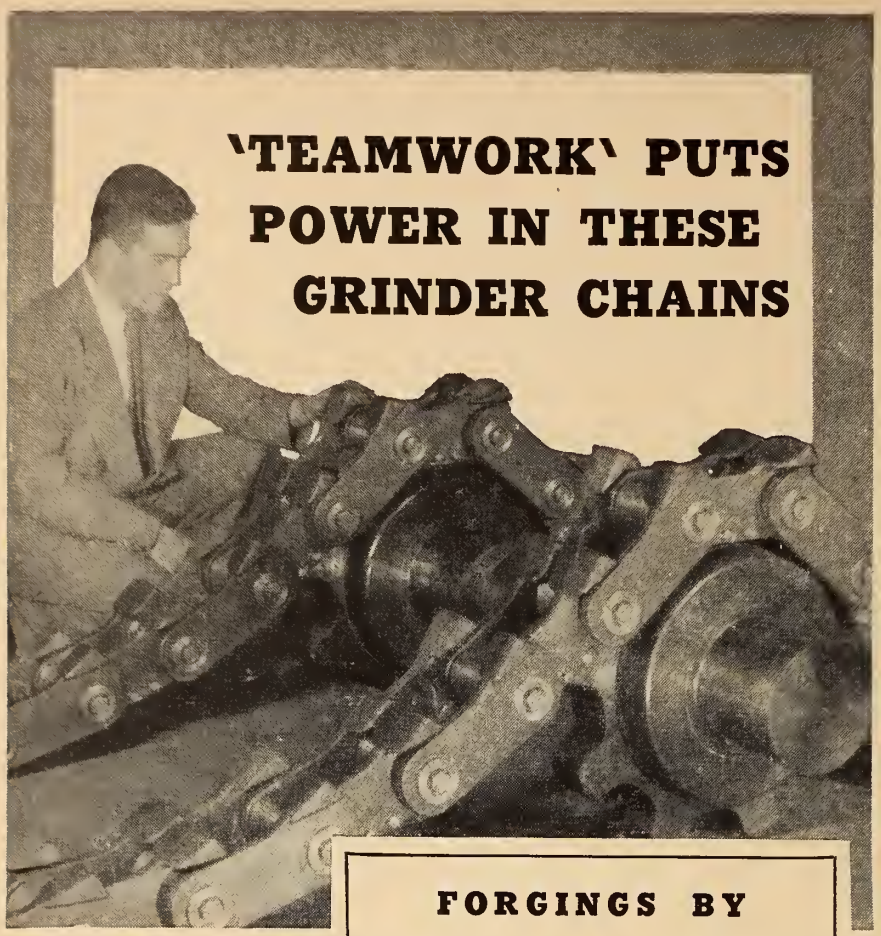
CATALOGUES AND INFORMATION ON REQUEST

●

S. MORGAN SMITH, CANADA, LIMITED

350 BAY ST., TORONTO 1, ONT.

ASSOCIATED COMPANY: S. MORGAN SMITH CO., YORK, PENN.



FORGINGS BY

Canforge

Look at these two sections of grinder chains manufactured by Forano Limited for paper mill grinders. Each individual grinder requires 4 of these chains approximately 40 feet long. Inside and outside links are supplied by Canada Foundries & Forgings Limited.

Canada's pulp and paper mills are large users of Canforge quality forgings. To meet the rugged service demanded in the various paper-making processes of this primary Canadian industry, Canada Foundries & Forgings Limited has developed the forging skills, complete machining facilities and a vast capacity to produce forgings of the highest quality. With this up-to-date equipment, Canada Foundries & Forgings Limited, is in a position to supply forgings as small as ¼ ounce or great forgings weighing up to 40,000 pounds.

Enquiries for Light or Heavy Forgings are always welcome at our Welland plants or through our District Offices

CANADA
FOUNDRIES & FORGINGS
LIMITED · WELLAND, ONT.
MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

—nearly four miles of 16-inch class 150 pipe in Alberta.

Noel P. Lavell has been named an industrial products specialty salesman for the Toronto area by the Company.

•

I. T. Richards

Canada Creosoting Company.—Canada Creosoting Company, Limited a division of Dominion Tar and Chemical Company, Limited, has announced the appointment of I. T. Richards as British Columbia regional manager. Mr. Richards will make his headquarters in North Vancouver, B.C. H. R. Stenson has been named eastern regional manager of the Company. He will make his headquarters at Leaside, Ont.

•

H. R. Stenson

More Westinghouse Appointments.—A. D. Elmhirst has been appointed manager of industrial sales in the Canadian Westinghouse Company's Toronto district. J. W. Henley, industrial relations manager, has appointed J. W. Nuttall as manager of industrial relations research and N. MacKenzie to the post of labour relations officer.

•

the Record proves that TURQUOISE holds a Needle Point

We sharpened a long, fine drafting point on an Eagle 4H TURQUOISE pencil, snapped it off and used it as the needle in an old-fashioned phonograph.

The point held without crumbling under the weight of the arm and the vibrations of the groove, and played the full record with surprising clarity!

Here is conclusive proof that the 100% "Electronic" graphite in the TURQUOISE lead gives it a particle fineness and compactness that produce non-crumbling, amazingly wear-resisting needle points.

100% "Electronic" graphite also gives unmatched denseness and durability, with the superior smoothness, uniformity and reproduction quality every draftsman dreams of.

PROVE IT YOURSELF: Write for a sample TURQUOISE pencil in any grade you desire, and test it at your own drafting board. Please name your regular supplier and this magazine.

EAGLE
"CHEMI-SEALED"
TURQUOISE
DRAWING PENCILS AND LEADS

Made in Canada

with 100% *"Electronic" Graphite

EAGLE PENCIL COMPANY OF CANADA, LIMITED
217 BAY STREET, TORONTO, CANADA

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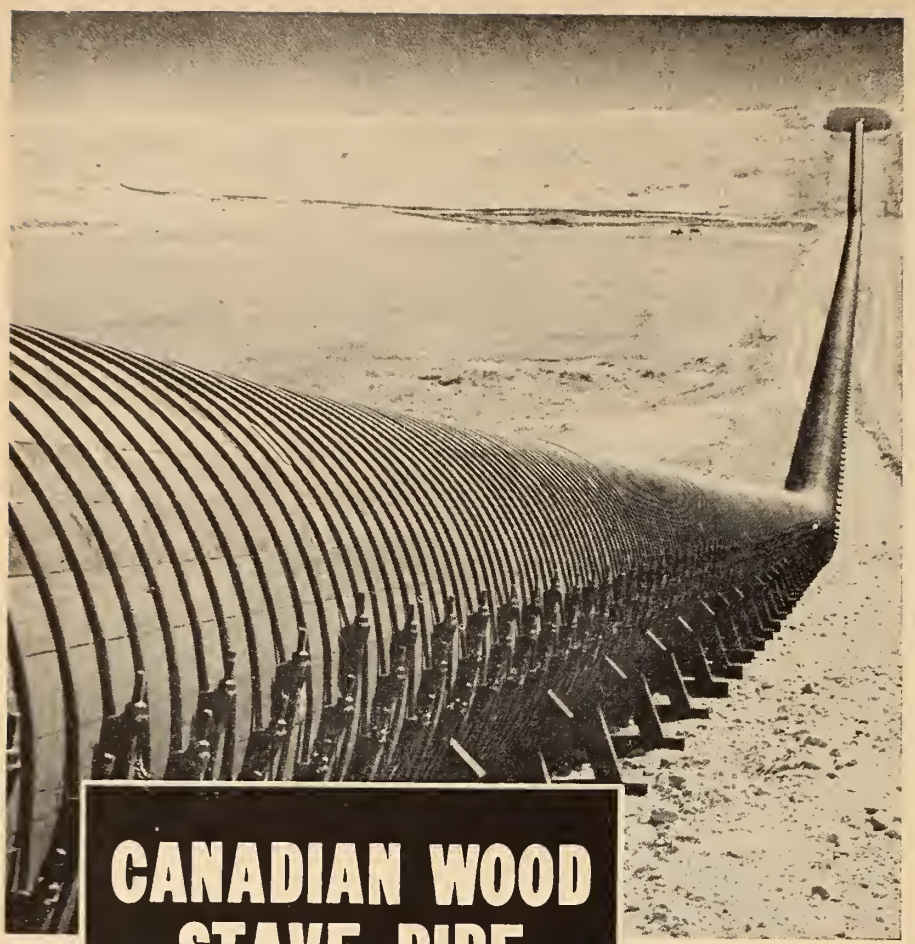

This 6 foot irrigation syphon completed last year for the Alberta Government at Grassy Lake dramatically illustrates the versatility and acceptance of "Canadian" Wood Pipe for projects of this nature.

Other uses include penstocks, and water supply lines for utilities, industries and municipalities. Be sure to specify Canadian Wood Stave Pipe for projects requiring flexibility to ground contour and watertight durability at low cost.

CW-4

Canadian
WOOD PIPE & TANKS LIMITED
550 PACIFIC STREET VANCOUVER 2, B. C.

New Equipment and Developments

B.L.M. Automatic Clutch. — B.L.M. Automatic Clutch Corp., of Canada, has incorporated in the United States and will soon be shipping parts from Canada for assembly in Boston, Mass., to supply completed clutch units for the American market.

●

New Canadian Company.—A newly created company, Canada Crane & Hoist Company, 19 McMurray Avenue, Toronto 9, Ont., has been formed by Roger Pocock, M.E.I.C. Among several items the Company is introducing the "Minilift Hoist", a hand powered portable hoist operated by a crank handle in place of the conventional pull chains. Complete information on all products they will handle may be obtained from the Company. (See Personals)

●

Communications Consolette.—A new consolette for communications and administrative control of sound systems in schools, hospitals, hotels and industrial plants was announced recently by the RCA Victor Company Limited.

Known as the RCA Type MI-14937 single-channel desk-top consolette is designed to provide recorded programs, radio programs, or local-origin sound programs and announcements to selected areas or to all areas reached by the sound system involved.

The unit will serve up to twenty rooms or areas, and can be expanded to sixty rooms if required. For complete details communicate with the Company.

●

T.V. in Ottawa.—The CBC has ordered television equipment for Ottawa so that viewers within approximately fifteen miles of the transmitting station will be able to see telefilms of the Coronation on June 2nd. The new transmitters will be temporarily installed in the existing sound studios of the Corporation.

The temporary arrangement will be enlarged after the Coronation to give Ottawa a permanent T.V. service. The transmitting equipment is similar to that used by the BBC in Great Britain and is being supplied by the Marconi Wireless Telegraph Co. Limited, member of the English Electric group, through the Canadian Marconi Company. When the equipment is moved to its present site, signals will go out from a 12-stack high-gain aerial. This will serve to increase signal strength to about 55 kilowatts, with an estimated radius of reception of some 40 miles, though this may be much wider.

Reason for this special aerial is one of economy. It is cheaper to use a low-powered transmitter with an aerial which steps up signal strength rather than a more powerful transmitter and a small aerial.

●

Rolls-Royce Engine. — Supercharged Rolls-Royce diesel engine powers a new Vickers-Armstrong tractor, which is being introduced in British Columbia and the Yukon Territory by Vancouver Machinery Depot Limited.

●

INDUSTRIAL Coatings LTD.

were pleased to have been able to supply the major portion of Elk Falls Company's stainless steel pipe, fittings, flumes and corrosion resistant linings.

Power Co's Ask Tax Lift.—Counsel for nine Quebec producers of hydro-electric power have announced that an appeal was filed on March 17th in the Supreme Court of Canada in Ottawa, to seek deduction, from taxable income under the Federal Income Tax Act, of amounts paid during the past seven years by the companies to the Quebec minister of hydraulic resources under the province's "Act to Insure the Progress of Education".

Finance Minister D. C. Abbott stated, earlier, that such payments will be deductible from taxable income beginning this year. At issue in the appeal, however, is income tax of $4,197,000 on the $10,192,000 which the nine companies paid into the Education Fund in the years 1946 to 1952 inclusive.

The appeal specifies only the income tax assessments for the year 1947 but is being regarded as a test for the other six years. The nine companies are Gatineau, MacLaren-Quebec, Northern Quebec, Ottawa Valley, Saguenay, St. Maurice, Southern Canada, Canadian Light, and Shawinigan.

The case arose three years ago when the Minister of National Revenue disallowed the companies' deduction from taxable income of Education Fund payments, these are levied on a basis of 15c per 1,000 kilowatt-hours of electricity generated from water power.

In 1951 the Income Tax Appeal Board ruled in the companies' favour, decided that the Education Fund levy was a royalty or rental in respect of natural resources, rather than a tax; that it was an expense laid out for the purposes of earning income; and that the income tax regulation under which deduction was refused was ultra vires.

The Exchequer Court reversed that judgment last January ruling both the Income Tax Act and the regulations under it to be valid and declaring the Education levy a specific corporation tax and non-deductible.

●

Controls Lifted.—On March 17th, the Rt. Hon. C. D. Howe, HON. M.E.I.C., Minister of Defence Production announced the revocation of the controls on the distribution of primary copper and aluminum.

●

Unique Canadian Product.—An exhibit which caused considerable comment at the recent Conference of the Society of the Plastics Industry, Reinforced Division, in Washington, D.C., was that of the Canadian Ingersoll-Rand Company Limited, the first company anywhere in the world to use reinforced plastics in the manufacture of industrial equipment.

The exhibit featured the reinforced plastic housing introduced three years ago by the Company on their portable compressors which has proved highly satisfactory under the most severe conditions all over Canada. Antedating similar developments in the United States, the Canadian Ingersoll-Rand application for reinforced plastics was developed in cooperation with Fiberlast of Canada Limited, reinforced plastics consultants, and is the first known application of reinforced plastics to heavy industry anywhere in the world.

Of special interest is the fact that the joint achievement of these two Canadian companies was accomplished wholly by private enterprise and in the open commercial market without benefit of government grants or defence orders.

●

Building Trades Outlook.—At a recent address before the members of the Toronto Builders' Exchange, John N. Flood of Saint John, N.B., and president of the Canadian Construction Association said "the outcome of labour negotiations in the building trades in the next few months will have an important bearing on whether the prospects for this year's building program will be realized".

In appealing for wage stability, he cited the high wages already paid to construction workers, reduced living costs and the need for reassuring potential purchasers of construction that costs will be maintained at reasonable levels.

Mr. Flood noted that construction contract awards total so far this year had shown a decrease of twenty-one per cent in comparison with the same period of the year previously. "Those contemplating construction need to be assured of cost stability in our industry if these prospects are to be realized and a high volume of activity maintained in the future. Without an offsetting gain in productivity, demands for higher wage rates will only lead to a reduction in the potential volume of work and decreased employment opportunities."

●

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DANIEL ORIFICE FITTING CO.

Barber ENGINEERING & SUPPLY CO. LTD.
CALGARY
EDMONTON

Cutting Attachment.—A new cutting attachment that cuts steel and other metals up to 8 inches in thickness has been announced by Dominion Oxygen Company Limited, Toronto. This attachment, designated as Type CW-202 is marketed under the trade name "Purox". It fits on the W-202 and W-201 welding blowpipe in place of the usual welding heads. It is intended for intermittent cutting on general, run-of-shop jobs.

From the Company twenty-three oxy-acetylene cutting nozzles are available for all types of cutting. Regardless of the nozzle used, all preheat flames — down to the smallest — retain their adjustment and can be used without popping or backfiring. This feature results from the use of an improved bronze mixer of the cartridge type that withstands head distortion.

The oxygen capacity of the CW-202 has been increased so that greater volumes of cutting oxygen can be used at lower operating pressures. Cutting oxygen of 55 lb. per square inch severs 4-inch thick steel, 100 lbs. per square inch is all that is needed to cut through 8 inches of steel.

Two head styles, 90 and 75 degrees, are available with the Purox CW-202 cutting attachment.

●

Ontario Hydro Expansion.—Ontario Hydro's program of rural construction for 1953 has been planned to bring some 29,456 new customers into the Northern and Southern Ontario Systems.

●

Nuclear Power.—Dr. C. J. Mackenzie, president of Atomic Energy of Canada Limited, recently expressed doubts that nuclear power had economic advantage over hydro or steam power. Two types of power generating reactors, however, may promise a change in the cost ratio. The foregoing information is taken from the monthly news letter issued by Isotope Products Limited, Box 127, Oakville, Ontario.

●

Switchgear In Mines.—To conform to government regulations covering the use of electrical equipment in mines, Canadian Westinghouse has produced a device for their DB-25 and DB-20 metal-clad switchgear which makes it completely acceptable for use.

Rule 354 of the Ontario Rules Covering the Use of Electrical Equipment in Mines reads: 'Unless a control device on circuit breakers above 300 volts makes a visual air break, if the control device, the circuit, or equipment controlled by the device requires adjustment or repair, there shall be installed between it and the source of energy a suitable air break disconnector". Westinghouse engineers have developed an arrangement of light and mirror for each compartment of the breaker. When the door is opened, the rear of the compartment is automatically illuminated and the rearview mirror makes it possible to view the position of the disconnecting contacts. The light and mirror are not closely associated with the power circuit, but are placed to one side of the breaker between the grounded housing and the grounded breaker frame. If necessary, the light may be replaced and the mirror cleaned without danger. Inspection by Department of Mines representatives has brought favourable comment.

●

Scarfing Stainless Steel.—Automatic power scarfing of stainless and other heat resistant alloys on the mill line at Atlas Steels Limited, Welland, Ontario, has aroused much interest in the steel industry.

Until recently conventional practice had been to roll stainless ingots into blooms, billets or slabs which were conditioned cold by grinding on or hand powder scarfing all surfaces prior to re-rolling.

At the request of the president work on the conversion of the Company's Lin-de-Surfacer to powder scarfing was started some time ago. Dominion Oxygen Company Limited, their U.S. Associates, Linde Air Products Company, with the co-operation of Atlas Steels, designed and tested a system of introducing powdered iron into the cutting flame of the scarfer. This addition creates an exothermic reaction which increases flame temperature with an accompanying fluxing action that overcomes the inherent resistance of chromium in the stainless to scarfing. By passing a hot slab or billet from the blooming mill through a set of scarfer burners, which operate simultaneously on all four sides, removal of the surface results. Depth of this cut is regulated by the speed with which the steel passes through the machines. Generally, less than 5% spot grinding of the slab is sufficient to remove any imperfections which extend below the scarfed surface.

●

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●

"Brackett" Screens can be supplied to suit many varied conditions, and over 800 "Brackett" Screening Installations are giving satisfactory, day and night service all over the world. Recent orders include an additional unit for J. Clark Keith Station at Windsor and also at McKinnon Industries, St. Catharines, Ont.

●

Full particulars of these SUPER-EFFICIENT SCREENS may be obtained from

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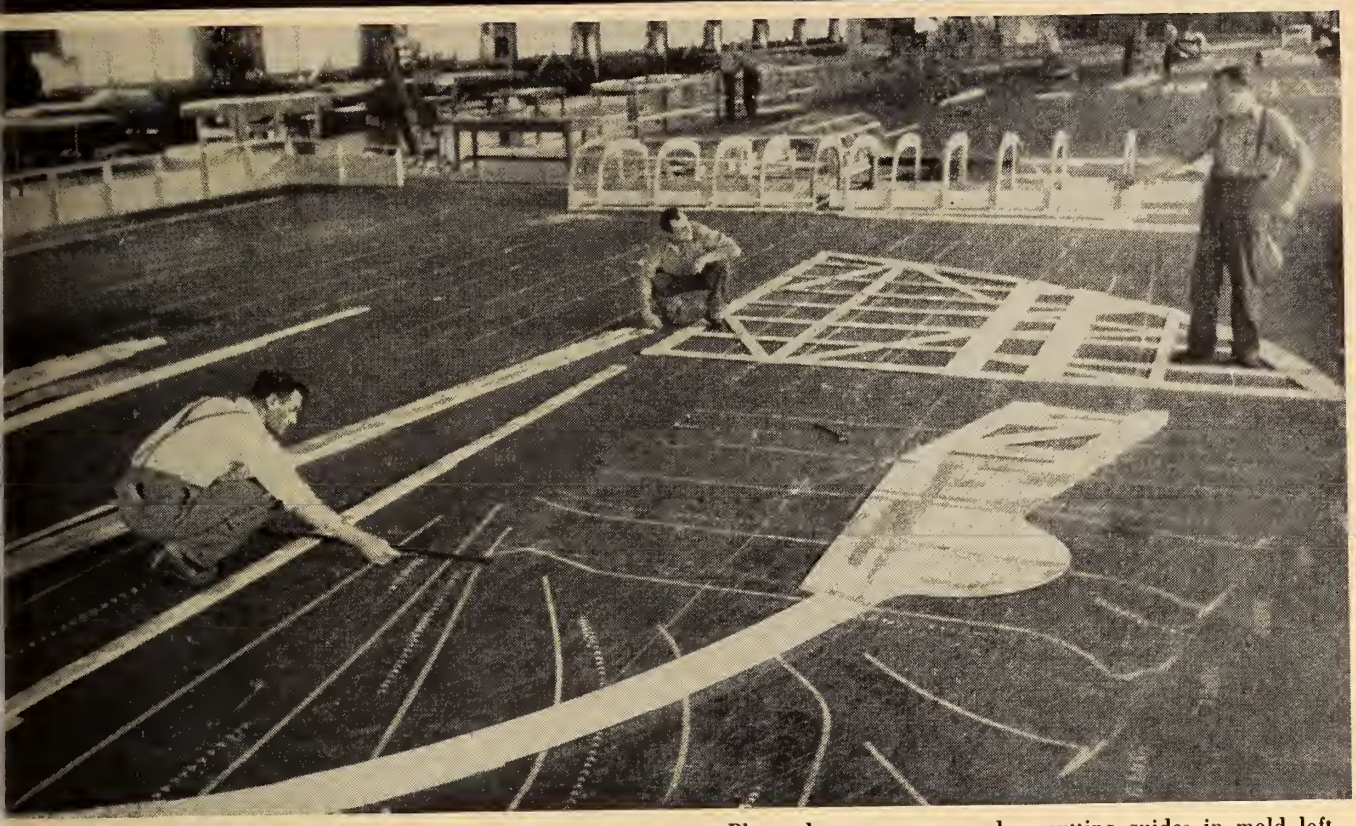
Look What HALIFAX SHIPYARDS Is Doing With . . .

SYLVAPLY WATERPROOF -GLUE PLYWOOD



Plywood patterns are used as cutting guides in mold loft.

setting a pattern!

As part of Canada's stepped-up naval shipbuilding program, powerful new sub-chasers are being built by Halifax Shipyards Limited. While much of the construction details on these ships is secret, it has been revealed that they follow the modern trend to all-welded hulls.

A striking feature of their construction is the ease with which they can be speedily adapted to mass production as required. With this modern method of shipbuilding, the various units of a single ship are prefabricated at plants located in any part of the country.

Each unit is prefabricated in such a manner that it can be accurately welded to the next unit of the same ship. To make this operation possible, exact patterns of Sylvaply plywood are used for cutting guides.

Sylvaply is used in this precision job because its lightness makes shipment of the patterns from one plant to another easy, and its strength and rigidity preserve the pattern from damage and distortion. Most important of all, the large size of Sylvaply panels makes it possible to cut single piece patterns without jointing.

This use in pattern cutting is but one example of the outstanding job Sylvaply is doing today. In practically all industrial and manufacturing fields there are countless new and valuable uses yet to be discovered for Sylyaply — the miracle wood of a thousand uses.

For information which may help you solve your particular problem write Technical Section, MacMillan & Bloedel Ltd., P.O. Box 335, Vancouver 1, B.C.

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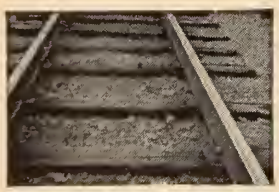
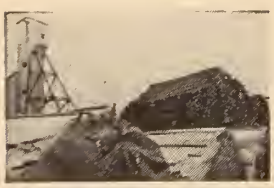


RAILWAY TIES. Osmose-treated Birch ties, 12 years in track and still sound. Untreated life in the same location, 3 to 4 years.

BRIDGE in P.Q. No rot 12 years after treatment. Untreated bridges, same road, needed extensive maintenance after 7 years.



QUANTITIES of "Osmose" used since 1936 in Canadian mines. Under severe conditions, treated wood lasted up to 12 times longer.

. . . as one of the many products made of wood. Under our climatic conditions unprotected wood is soon attacked by moisture, rot, insects and termites.

All this can be avoided by using tested and proven "Osmose" wood preservatives. Simply applied by mopping or dipping, "Osmose" utilizes the moisture in the wood to penetrate and protect . . . increasing the life of wood from 3 to 5 times.

This economical protection is widely used by Federal and Provincial governments, pulp and paper companies, leading mines and power companies, contractors and others. Its effectiveness is well substantiated by service records available on request. Write for descriptive literature — consult our free service department.

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MANUFACTURERS OF INDUSTRIAL AND DOMESTIC WOOD, PRESERVATIVES, PRIMERS AND SEALERS

Air Line Oiler.—An automatic air line oiler that is said to prevent the operation of air tools without adequate lubrication is now being manufactured in Canada, at Brantford, Ontario, by Gardner-Denver Company (Canada) Limited. It is one of several Gardner-Denver products now being manufactured in Canada.

•

New C.G.E. Centre.—A production and distributing centre for heating and air conditioning equipment is being constructed in Etobicoke Township for the air conditioning department of Canadian General Electric Company.

Located on a 4½ acre site on the south side of the Queen Elizabeth way, between Kipling and Royal York Road, the one-storey structure is expected to be completed in the near future. When in operation, the new facility is expected to employ about 100 people.

•

Fuel Additive.—A new fuel oil additive which acts as a dispersant and stabilizer for distillate fuel oils has been introduced in Canada by Canadian Industries Limited.

The new additive not only retards the formation of insoluble residues but reduces the size of the particles, thus practically eliminating the possibility of clogging.

This makes it possible for a refiner to blend catalytic cracked stock with a straight-run product without sacrificing in the blend. Being ashless, the additive is particularly suitable for use in blended fuels for diesel engines. It does not affect the colour of the product and can be easily added directly from the drum or in a special kerosene solution to decrease viscosity.

The new additive was developed in the petroleum laboratories of E. I. du Pont de Nemours and Company in the United States. It is marketed, by C.I.L., in Canada under the name "Du Pont Fuel Oil Additive No. 2".

•

Munck Hoists.—Used extensively in Europe and the Scandinavian Countries for many years, Munck electric hoists are now available in Canada. The hoists are made in Norway but a spare parts depot and complete servicing facilities have been established in this country. Canadian distribution and servicing is handled through Alliance Electric Works Limited, Montreal and Toronto. Complete information may be obtained by writing Sverre Munck, Box 7500, Montreal.

•

Pneumatic De-icers.—The first pneumatic de-icers for use on high speed aircraft are helping to keep the nation's fastest commercial airliners on schedule.

The new de-icers were developed by The B. F. Goodrich Company. They consist of a network of small inflatable rubber tubes which expand enough to crack off ice, yet not enough to materially distort the shape of wing or tail surfaces. The new De-icer is the result of seven years' research by the Company's scientists.

The new de-icers are electronically controlled and completely automatic in operation. Typical installation on Lockheed's Super Constellation consists of 21 De-icer Sections, each independently operated but cycled to inflate and deflate in pairs on either side of the wing or tail surface.

•

Westinghouse Progress.—H. H. Rogge, president of Canadian Westinghouse Company Limited, announced that the Company had an outstanding year in production and sales.

Operating costs were appreciably higher and net profits were lower. Profits were $2,864,984 in 1951 as compared with $3,479,883 in 1951. Among the factors which contributed to this decrease in profits was a considerable rise in operating costs resulting from wage and salary increases. "Rapid expansion of the Company's manufacturing facilities in Hamilton and elsewhere, and heavy capital expenditures requiring a 4½% debenture issue during 1952, were responsible for some of the higher operating costs during this transition period," said Mr. Rogge.

He also stated that during 1952 the appliance industry had made a marked recovery from the production levels of 1951 and early 1952. Sales volume, however, which suffered drastically when the Government's anti-inflationary fiscal measures were introduced in 1951, and repealed in April, 1952, did not fully recover until the fall of 1952. Removal of the regulations led to a great demand for television receivers and "the grow-

ing popularity is expected to maintain this market at a high level for some time to come".

•

New Rubber Coating.—An improved chlorinated rubber finish, claimed to be resistant to acids, alkalis and other chemicals has been developed by the paint and varnish division of Canadian Industries Limited.

The finish is suitable for both interior and exterior use and it is expected to be used widely in chemical plants, pulp and paper mills, commercial launderies and other industrial establishments where corrosive fumes, moisture and splashing chemicals harm ordinary wall and metal finishes.

It may be brushed or sprayed on and three coats — sprayed — yield a total film thickness of five thousandths of an inch which is sufficient for maximum chemical resistance.

A special metal primer must be used before metal surfaces are painted with the new finish but it may be placed directly onto masonry. For ends of pulp and paper machines, use of an acid and alkali resistant metal primer is suggested.

The product will be marketed under the trade name "Vitakote".

•

Phillips Electrical Changes.—Phillips Electrical Works Limited, Brockville, Ontario, a subsidiary of Automatic Electric Company, Chicago, announces that, in order to devote its future efforts exclusively to the manufacture of communication and electrical control equipment it has completed arrangements with British Insulated Callender's Cables Limited, of London, England, whereby effective as of April 30th, 1953, the latter company will acquire the wire and cable business of the Phillips company, including the factory buildings of the company located in Brockville and Montreal.

In making this announcement, the management emphasized that the manufacture of Strowger automatic telephone equipment, telephone instruments and allied communication and electrical control equipment will be continued in Canada, on an expanded basis, under the name Automatic Electric (Canada) Limited as one of the principal manufacturing units of Automatic Electric Company, Chicago and its affiliated factories.

While the communications equipment manufacturing will temporarily continue to occupy present space in Brockville and Montreal, Automatic Electric (Canada) Limited plans to erect immediately a new and modern plant in Brockville to house the expanded telephone manufacturing operations, with consideration being given to branch factories and warehouses as the growing communication requirements of Canada may dictate.

Sales distribution of the products of the Company will continue to be handled through Automatic Electric (Canada) Limited. As soon as practicable, Automatic Electric (Canada) Limited will change its name to Automatic Electric Sales (Canada) Limited in order that its present name may be available for the manufacturing company.

•

Shawinigan Expansion.—It has been announced by the Shawinigan Water and Power Company that three additional generating units, one at each of three generating stations, will be installed at Rapide Blanc, Trenche and at the St. Maurice Power Corporation's plant at La Tuque on the upper St. Maurice River. This will increase the total installed hydro-electric capacity by about 150,000 h.p.

A new high voltage transmission line will be built from La Tuque to Trois-Rivieres to help carry the increased amount of power from the upper St. Maurice generating plants.

The above announcement was made by J. A. Fuller, president of the Company.

Mr. Fuller estimated that the Shawinigan Company's capital expenditures at $38,500,000 for projects already planned between now and the end of 1955, the amount to include the additional units at Rapide Blanc and Trenche and the transmission line.

Concerning Shawinigan Chemicals, a wholly-owned subsidiary of the Power Company, Mr. Fuller said that business so far this year has shown some improvement over the corresponding period of 1952 and there are indications of alleviations of currency conditions in certain dollar-short areas which would bring about increased export sales. He said "The Canadian chemical industry is one of the country's fastest-growing industries, partly as a result of general growth in Canada and also, in large part, because chemical producers in other countries have been unable to supply Canadian demands on account of

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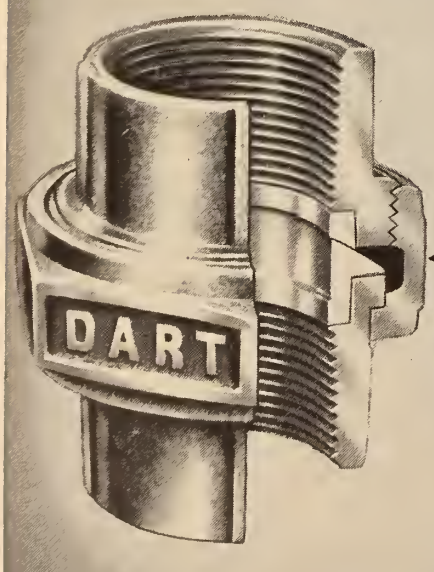
DART



Two
Bronze Seats
Ground to a
True Ball Joint

DART UNION COMPANY OF CANADA LTD.

HORTON WELDED GASHOLDER

stores gas at plasticizer plant

•

Left: 40,000 cu. ft. Horton gasholder 50 ft. in diam. and 50 ft. high.

•

The Horton welded gasholder shown above was installed at the plasticizer plant of the Canadian Resins and Chemicals Limited at Shawinigan Falls, Que. It is used for the storage of hydrogen gas which is consumed in large quantities in the synthesis of 2-ethyl-hexanol (an alcohol).

Write our nearest office for tenders and complete information on steel tanks and plate work.

HORTON STEEL WORKS LIMITED
TORONTO, ONT. FORT ERIE, ONT. MONTREAL, QUE.
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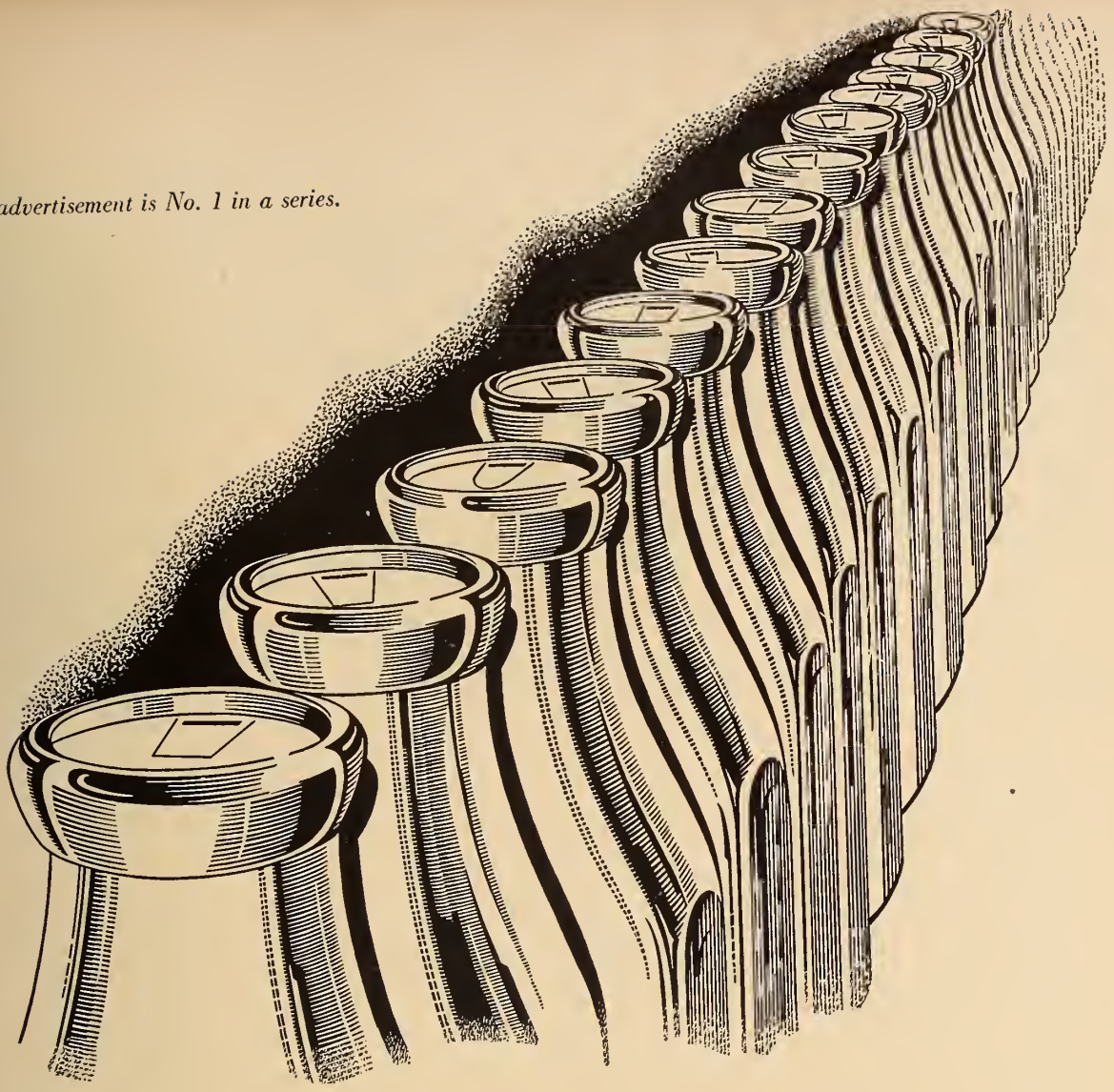
This advertisement is No. 1 in a series.



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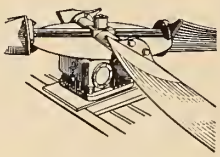
CLEVELAND Type CU
... ideal drive for cooling towers

● This worm gear drive is designed specifically for cooling tower service. It meets a long-felt need for a compact, heavy duty speed reducer that will operate continuously, at high speeds and for long periods. It is inherently quiet in operation. Extreme conditions of heat and humidity do not affect it. It carries high thrust loads and high radial loads without loss of efficiency. It lends itself to rugged mounting, and due to the simplicity of its design, it is easily installed, serviced and adjusted in the field.



Cleveland Cooling Tower Drives (built in sizes 50 CU to 500 CU inclusive) are rated under Class 2 service conditions, except that thermal limitation does not apply. Heavy, externally ribbed housing effectively dissipates heat to air stream.

Every CU drive is run in and pretested under load before it leaves the factory. Thousands of units now in use prove its reliability in all classes of service—in the oil fields, in industry, in air conditioning systems in commercial and public buildings—in short, wherever there's a cooling tower, you can depend on CU.

Write for Bulletin 135 for full description of Type CU. Peacock Brothers Limited, 224 St. Patrick St., Montreal 32, Que. Also Calgary, Noranda, Sudbury, Sydney, Toronto, Vancouver and Winnipeg.

Representatives in Canada of The Cleveland Worm & Gear Co., and The Farval Corporation.

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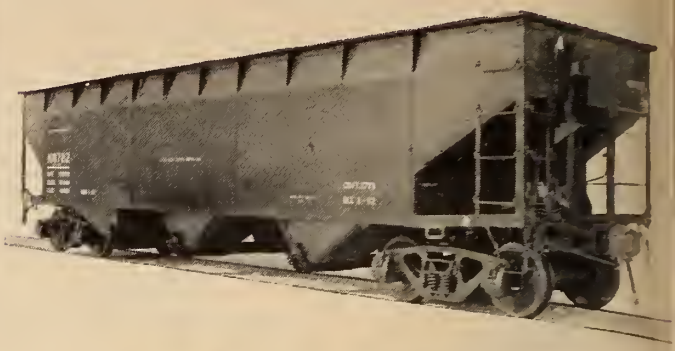
Worm Gear
Speed Reducers



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A very high percentage of the railway rolling stock, produced in Canada, rolls out from National Steel car, made to the most exacting standards. This output is only made possible by a combination of experienced management, skilled workmen, and an efficient and modern plant.

National Steel Car always welcomes the opportunity of placing definite recommendations, estimates and specifications before those interested in modern steel rolling stock and allied products.

NATIONAL STEEL CAR CORPORATION LIMITED

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BUILDERS OF TRANSPORT FOR CANADA

shortages of capacity. These shortages have largely been remedied, and competition among chemical producers throughout the world has now become more intense.

"The Canadian chemical industry requires more adequate tariff protection than is afforded at present. In general Canadian import duties are much lower than U.S. duties for similar chemical products, with the result that we are importing large quantities of chemicals, plastics and related products from the United States, but, because of practically prohibitive duties, are unable to export such products to the United States."

•

John Inglis-English Electric Report.—In his annual report to the shareholders, Humphrey B. Styles, president of the John Inglis Co. Ltd. and the English Electric Company of Canada Ltd., said that in the year under review the volume of business completed by the companies was 28% greater than that of the preceding fiscal year. The report covered the fiscal year ended December 27th, 1952.

When reporting to the shareholders a year ago reference was made to the program for the manufacture of marine steam turbines for anti-submarine escort vessels required by Her Majesty's Government, to be built to the designs of the English Electric Company of England in a new plant in Scarborough Township. The design, layout, erection and equipping of these works has been essentially completed, and the new plant is being progressively brought into production.

Throughout the greater part of the year 1952, production under this program continued in the existing Strachan Avenue Works, occupying a substantial percentage of that Works' productive capacity. With the transfer of these operations to the Scarborough Works, it will be possible to make available again to normal commercial production, assets which have been devoted to defence requirements.

Notable among the contracts delivered were a further two 60,000 sq. ft. surface condensers for the Richard L. Hearn Generating Station in Toronto, and two more 33,000 h.p. hydraulic turbines for the Otto Holden Generating Station.

English Electric Company of Canada Limited again produced and delivered a record volume of electrical apparatus, showing a growth in volume of 28% over the previous year. A substantial program to expand the manufacturing facilities of the Company at St. Catharines was embarked upon during the year. The operations of the year 1952, which were essentially at capacity, have confirmed the importance of this program. Satisfactory progress is reported both in the erection of the necessary building extension and in the equipping of the Works to achieve the required increase in productive capacity.

•

—STARTERS & CONTROLS—

A full range of standard electric motor starters and all necessary spares are available for immediate despatch from our Canadian stock.

Pushbutton stations, magnetic across-the-line starters and manual reduced voltage starters are particularly suitable for adaptation to machinery products of your own manufacture.

Controls are specially designed for cranes, mining and paper mill equipment, large multi-contactor panels for complex automatic sequence and liquid rotor starters and regulators can be supplied to meet your exact requirements.

Established upward of twenty-five years and with agents in all principal cities across Canada, ALLEN WEST (CANADA) LIMITED can meet your needs for all classes of industrial motor controls.

Write to us for details of our extensive range and our technical and service facilities.

—ALLEN WEST (CANADA) LIMITED—

247 DUNBAR AVENUE

MONTREAL 16, QUEBEC

—MANUFACTURERS OF MOTOR CONTROL GEAR—

Visit us at our booth at the Canadian International Trade Fair...3771 and 3773 Building E-3.

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

New Trane Booklet.—Trane Company of Canada Limited, 4 Mowat Avenue, Toronto, offer an interesting little publication "How Canada Builds Better". In the foreword of the publication it states "The importance of the architect and professional engineer is recognized in the field of industrial building. Today, more than ever before, this fact is evident. As "Canada Builds" we see example after example of their vital importance to Canada in helping industry provide needed facilities and expanded capacity to meet new and vital needs. "While most companies employ architects and professional engineers in planning a new building, the value of their experience and knowledge is of equal importance in building additions to present facilities. Advice on modernization is another service which pays big dividends to industry."

". . . In the following pages we are presenting a few examples showing how and why you benefit from the services of architect and professional engineer when you build."

To obtain copies write to the Company at the address given above.

●

Arc & Flame.—Canadian Liquid Air Company Limited offer to *Journal* readers their monthly periodical "Arc and Flame". To be placed on the mailing list for this publication, write to the Company at 1111 Beaver Hall Hill, Montreal, Que.

●

Atlas Steel News.—Atlas Steels Limited publish regularly, "Atlas Steel News", a publication which covers tool steels, high speed steels, mining drill steels, special purpose steels and stainless steels The publication is of a semi-technical nature and should be of interest to a number of *Journal* readers. To obtain copies write to the Company at Welland, Ontario.

●

"Instrumentation". — "Instrumentation" is the title of a well produced quarterly magazine which is released in Canada by the Minneapolis-Honeywell Regulator Company, Leaside, Ont. This publication is now in its sixth volume and it presents some interesting information on instrumentation in the industrial world. To obtain copies communicate with the Company at the address given above. Use official letter head.

●

"Brown Boveri Review".—Brown Boveri (Canada) Limited, 1111 Beaver Hall Hill, Montreal, Que., offer *Journal* readers copies of The Brown Boveri Review. This publication has been published by the parent company, in Switzerland, for many years. It is now in its thirty-ninth volume. Of a technical nature, the periodical is one of the most widely accepted and quoted of its kind. A limited number of copies are available in Canada and applications should be addressed to the Company. When writing for copies please use your official letterhead.

●

Dillon Brochure.—W. C. Dillon & Company Inc., P.O. Box 3008, 14620 Keswick Street, Van Nuys, California, have recently completed the revision of a brochure of the Dillon Dynamometer, Model "L" and Low Range Testers. Published as two separate brochures, these releases give the new addresses of the Company and the revised price structure of their products.

Write to the Company for copies.

●

Airmec Pamphlets.—Airmec Limited, High Wycombe, Buckinghamshire, England, manufacturers of electronic instruments, offer *Journal* readers copies of their publication covering their products. To obtain copies write to the Company at the address given above.

●

Laboratory Design.—The advantages of employing an integrated company to design and construct research laboratories for industry are pointed up in a new, illustrated, 8-page brochure issued by Walter Kidde Constructors, Inc., of New York and Houston.

The brochure illustrates and describes successful research laboratories designed and built by Walter Kidde Constructors, Inc., in a number of fields, including foods, electronics, paints, pharmaceuticals, chemicals, antibiotics and others. To obtain copies, communicate with the Company at 140 Cedar St., New York 6, N.Y. or 1205 Holman Ave., Houston 4, Texas.

●

Car Spotters.—A new book on the electric car spotters and drum-type car pullers, has just been released by Link-Belt Limited. To obtain copies write to the Company at Eastern Avenue at Leslie and Kesting Streets, Toronto 8, and ask for brochure No. 2092.

●

"Oxygen Tips". — Dominion Oxygen Company Limited, 40 St. Clair Avenue, E., Toronto 5, Ont., publish each month "Dominion Oxygen Tips".

This periodical will be of great interest to *Journal* readers who are concerned with welding procedures. Copies may be obtained, regularly, by writing to the Company at the address given above.

●

Transformer Stock List. — Ferranti Electric Limited, Mount Dennis, Toronto 15, publish, at regular intervals, an up to date stock list of standard transformers available at their various branches. To obtain, copies of these lists as released, communicate with the Company at the address given above.

●

Ungava Survey.—The Honourable C. D. French, Minister of Mines, Department of Mines, Parliament Buildings, Quebec, P.Q., has just authorized the release of a preliminary geological report on the country which is being pushed northwards from Seven Islands to the Ungava iron deposits. The report is based on the work of the Geological Surveys Branch of the Quebec Department of Mines. Copies of the report — No. 280 — and a preliminary geological map on the scale of one inch equals one mile, may be obtained from the Department.

●

Liquid Level Gauges.—A set of New Data Units, nine sheets covering complete line of Liquid Level Gauge Valves for both Tubular and Flat Gauges, regular, offset and with union connections to gauge are included in a new set of Data Sheets recently released by the Jerguson Gage & Valve Co. To obtain copies communicate with Peacock Brothers Limited, Box 6070, Montreal, Que.

●

"Bepco Journal".—No. 2 of Volume 11 of the "Bepco Journal" carries an interesting paper on the Vault Type Switch Gear by F. de Schulthess, of the Company's engineering department. In the same issue is an interesting article, by J. A. Cummings, on the Hydraulic Descaling of Steel. To obtain copies of this and other issues write to Bepco Canada Limited, 4018 St. Catherine St. W., Montreal, Que.

●

Power Transformer Selection.—Reliance Electric & Engineering (Canada) Limited, Welland, Ontario, have prepared an excellent little publication on how to select power transformers.

Selection data is given in terms of the latest standard specifications of the Canadian Electrical Manufacturers' Association on power transformers. The booklet attempts to show the economies of selecting standard equipment and

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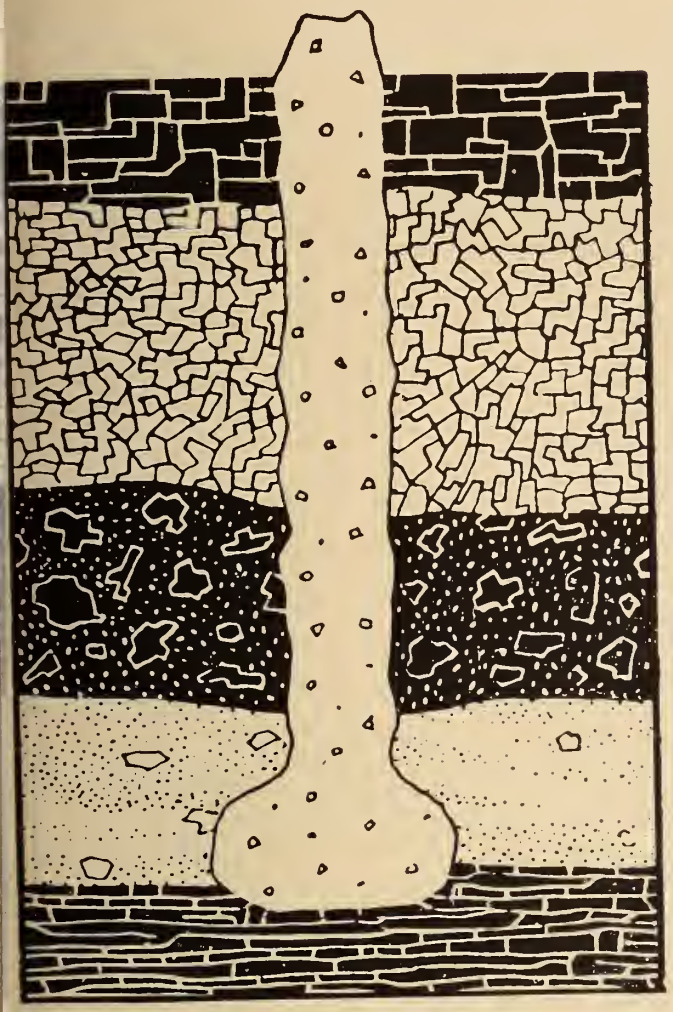

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points out what makes a power transformer special.

A discussion is included on the merits of selecting single phase or three phase units. The booklet also describes the various types of cooling power transformers. Copies may be obtained by *Journal* readers by writing to the Company.

•

New Sturtevant Fan.—The B. F. Sturtevant Company of Canada (Galt, Ontario) has announced that it produces and markets in Canada, for the first time, the Airfoil Centrifugal Fan.

The fan, which has established a good sales record in the U.S. in the past year, is intended for mechanical draft, high velocity air conditioning systems, heavy duty industrial applications and vehicular tunnel ventilation. Complete descriptive literature on this product may be obtained from all Sturtevant offices or from the Galt plant.

•

Cleveland Worm & Gear Catalogue.—The Cleveland Worm & Gear Company who are represented in Canada by Peacock Brothers Limited, have recently produced a new catalogue No. 400.

The catalogue is highly informative and presents details of the equipment in a most effective manner. No expense was spared in the production of the publication and it should prove to be a worthy addition to the data section of any engineer's library. To obtain copies, distribution is limited, write, on official letterhead, to Peacock Brothers Limited, P.O. Box 6070, Montreal, Que. Ask for Cleveland Catalogue, No. 400.

•

Hayes Products.—Furnace Engineering Co. (Canada) Ltd., Box 384 Postal Station "H", Montreal 25, offer a pamphlet covering the Hays line of combustion and industrial instruments and controls.

•

Steel Bolting.—Taylor Forge & Pipe Works, Chicago, Ill., offer *Journal* readers a copy of the bulletin No. 524, which covers modern steel bolting for piping and pressure vessels.

This bulletin was first presented as a paper before the seventh annual American Society of Mechanical Engineers, Petroleum Division Conference in Kansas City, Missouri, in September, 1952. Write to the Company for copies.

•

Minneapolis-Honeywell Publications.—A new 24-page catalogue No. 1550, describes and gives details on measurement and control of PH, Redox, and conductivity. The catalogue includes easy to understand theory behind electro-chemical measurements, and gives up to date information on recorders, controllers, amplifiers and electrodes. The catalogue also contains information on where and how to use automatic PH, Redox, and conductivity measuring and controlling equipment. To obtain copies communicate with Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario.

The Minneapolis-Honeywell Regulator Co. Ltd., also offers *Journal* readers copies of Instrument Data Sheet No. 4.3-4a "Fuel-Air Ratio Control Systems for Metallurgical Furnaces". It contains four pages of engineering drawings and equipment specifications for the basic type of Fuel-Air Ratio Control for metallurgical furnaces.

•

Elevator Magazine.—"Going Up" is the title of a publication produced bimonthly by the Turnbull Elevator Company, Limited. To obtain copies communicate with the Company at 126 John Street, Toronto, Ontario.

•

"Scotch" Tape.—"World's Strongest Tape" and "What's all this about the World's Strongest Tape?" are the titles of two illustrated booklets describing "Scotch" Brand Filament Tapes No. 880 and No. 890 just released by Minnesota Mining and Manufacturing of Canada Limited, London, Ontario. Both booklets are available at no charge from the Minnesota Mining & Manufacturing Co. Limited, P.O. Box 757, London, Ontario.

•

Chains & Sprockets.—A new bulletin on the Baldwin-Rex Roller Chains and Sprockets has just been published by the Baldwin-Duckworth division of Chain Belt Company.

To obtain a copy ask for Bulletin No. 52-1 and write to Baldwin-Duckworth,

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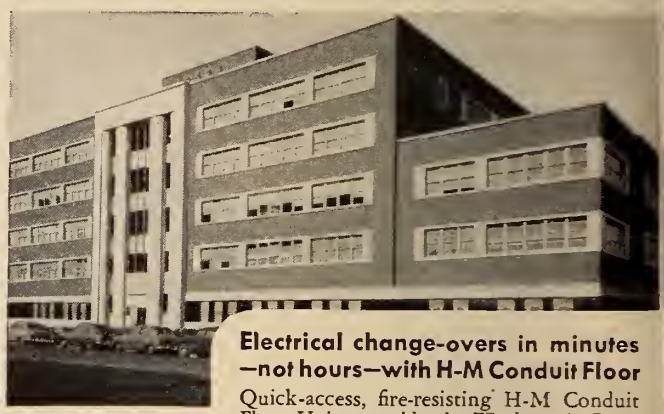

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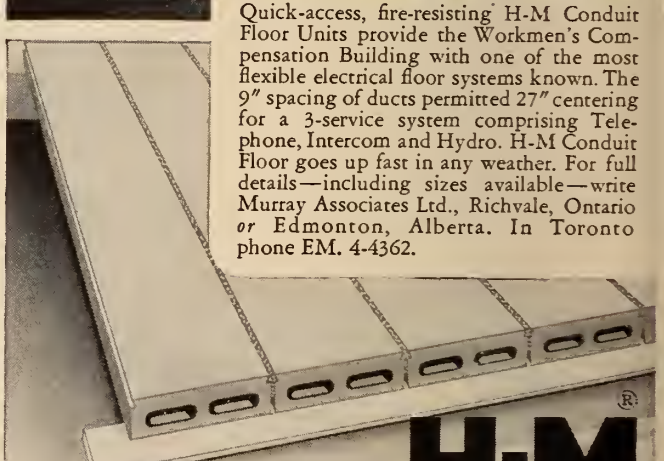

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●

"Imperial Oil Review".—The Imperial Oil Company Limited, have been producing, for a number of years an excellent periodical "The Imperial Oil Review". The February, 1953 issue will be of particular interest to *Journal* readers because it contains articles on the Muskeg north of the Peace River and on the ancient rock found in that territory. To obtain copies of this and fourth-coming issues write to the Imperial Oil Review Company, 56 Church Street, Toronto, Ontario.

●

Landing Mats.—The Goodyear Tire & Rubber Company of Canada, Limited, New Toronto, Ontario, have published a four-page two-colour, brochure covering landing mats which are particularly suitable for paper mills and other plants where heavy, fragile loads have to be handled. Write to the Company for copies.

●

Westinghouse Bulletins. — Canadian Westinghouse Company Limited, Hamilton, Ontario, offer a descriptive bulletin No. 11-200 covering the AC Magnetic De-Ion Life Linestarter products. This 24-page, two-colour, publication will be of interest to those who require starting equipment for across the line of squirrel cage induction motors or for the primary control for wound rotor motors. Communicate with the Company for copies.

Also offered is a highly informative publication on Large Induction Motors. This 28-page brochure is profusely illustrated and the text matter has been kept to a minimum to reduce reading time. For copies communicate with the Company and mention the publication required by name.

●

"Power Notes". — Diamond Power Specialty Corporation, Windsor, Ontario, are the publishers of a periodical "Power Notes". To be placed on the mailing list for regular receipt, communicate with the Company.

●

"Dexion News".—"Dexion News" is the title of a periodical produced at regular intervals by Dexion Limited, 189 Regent Street, London, W.I. The Company is represented in Canada by a number of prominent concerns. The publication deals with the uses of the Dexion angle, a patented, ingenious, piece of pressed metal which is highly suitable for small scaffolding, shelving, tables, etc., etc. To be placed on the mailing list for regular receipt of this periodical and to obtain the Company's comprehensive catalogue, "Build your own equipment", write to the address given above.

●

Shawinigan Report.—The Shawinigan Water & Power Company Limited, have recently released copies of their fifty-fifth annual report.

This report will be of interest to engineers, not only for the information it contains, but because of the excellent printing and general "make-up". Printed in four colours and containing forty-four pages the report reflects great credit on the Company and its printer. To obtain copies communicate with the Public Relations and Advertising Department of the Company, 600 Dorchester St., West, Montreal 2, Que.

●

"Weather Magic".—"Weather Magic" is the title of a periodical which is published bi-monthly by Trane Company of Canada Limited. This publication will be of interest to engineers who are concerned with heating and air-conditioning. To obtain copies communicate with Trane Company of Canada Limited, Mowat Avenue at King Street, West, Toronto, Ontario.

●

John Inglis Boilers.—The John Inglis Co. Ltd. of Toronto has just issued three new important publications on the boilers they manufacture. "Type C, Three Drum Water Tube Boiler". Some of the new principles of design which make these boilers suitable for requirements formerly considered too heavy for boilers of this type are explained in the publication. The boilers have been developed to meet the need for water tube types for smaller units. The booklet gives details of different firing arrangement and specifications for each of the four types. Ask for "Type C Three Drum Water Tube Boiler" booklet.

The second publication offers "Inglis Supreme Welded Boilers." The one piece construction gives unobstructed circulation and other unique features which lead to greater efficiency. Specifications and dimensions for all sizes are given in the publication. Ask for "Inglis Supreme Welded Boilers".

The third publication offered covers the "Economic Fusion-Welded Boiler" of which over 2,200 have been manufactured. Important features are low fuel cost and easy maintenance. The booklet gives fully illustrated details of all types of "Economics", with specifications and dimension sketch. Ask for "The Economic Fusion-Welded Boiler" booklet.

●

Foxboro Bulletin.—A 16 page illustrated bulletin has just been released by the Foxboro Company, Foxboro, Mass. It describes the restyled Foxboro Circular Case Controller. This instrument has been selected for more than 50,000 installations to automatically control temperature, pressure, liquid level, humidity or other process variables. Copies of the new Bulletin No. 465 will be sent on receipt of request by Peacock Brothers, Ville LaSalle, Montreal, Que.

●

Water Turbines. — The Canadian Fairbanks-Morse Company Limited, 980 St. Antoine St., Montreal 3. offer copies of a bulletin covering the water turbines manufactured by Gilbert, Gilkes & Gordon Ltd., England. Canadian Fairbanks-Morse has been appointed exclusive selling agent for these products throughout Canada with the exception of British Columbia.

These water turbines are finding ready acceptance in Canada and orders for two installations have just obtained for wheels for installation in northern Quebec.

To obtain copies write to the Canadian Fairbanks-Morse Company Limited at the address given above and ask for "Gilkes" literature.

●

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Foster-Wheeler Catalogue. — Foster Wheeler Limited, St. Catharines, Ontario, have produced a net catalogue No. CB-53-1, in which is described the Bison Scotch Dry-Back Power Boiler. This condensed catalogue contains complete specifications prepared in accordance with ASME Code for 125 and 150 lb. W.P. Write to the Company for copies.

●

"Plastics Sphere."—Canadian Industries Limited, polythene division, publish at regular intervals, "The Plastics Sphere". The "Sphere" is produced to promote a greater understanding of plastics and their many applications. It should appeal to a number of *Journal* readers who are invited to apply for regular receipt. Address letters to the Editor, the Plastic Sphere, Canadian Industries Limited, P.O. Box 10, Montreal, Que.

●

"Arcaloy" Electrodes—Canadian Liquid Air Company Limited, 1111 Beaver Hall Hill, Montreal, have available copies of a 4-page brochure in which are described, "Arcaloy, Stainless Steel Electrodes". The Company states that "government buying in the U.S.A. of this famous electrode has eased somewhat and this, together with increased production facilities, means more "Arcaloy" now available for industry in Canada". Copies of the descriptive brochure are available—address above.

●

Westinghouse Publications. — Canadian Westinghouse Company Limited, Hamilton, Ontario, offer two interesting booklets. The title of the first publication is "Rototrol—in the Steel Industry". "Rototrol" is a small, direct-current generator exactly similar in design and theory of operation to a standard, high-speed, quick-response, d-c generator. However with multiple field windings, which are connected in various ways, depending on the regulating problem, Rototrol functions entirely through the interaction of these fields. After initial adjustment no attention is required other than the routine maintenance associated with a d-c machine of similar size. The publication has been printed in two colours and contains twenty-two pages of well written, well illustrated material.

The second publication offered is "Westinghouse Equipment — to get the most out of Electric Arc Furnaces". This is a twenty-page, two-colour brochure which shows how Westinghouse equipment "saves power, cuts maintenance, prevents shut-downs and boosts output" to quote the publisher.

Apply to the Company at Hamilton for copies.

●

"Briefs" from Britain

Repetition Cutter.—For repetition cutting to a given length of any reeled or strip material, such as leather, rubber, woven or plastic fabric, a machine has been introduced which may be used in the production of belts, straps, wire, tape, electrical conductors, gummed paper strip and so on. Material is fed through feed rollers which rotate intermittently and in one direction only. The amount of material fed through the rollers can be determined by varying the amount of rotation of the rollers. The machine is made in three types: series "A" cutting from up to 24 inches, series "B" up to 12 inches; series "C" up to one and a half inches, and for special purposes up to 48 inches.

Maximum width of material on all types is four inches. On the series "C" 20,000 cuts per hour can be obtained. By feeding a number of strips at the same time, production can be increased. For example, a "C" machine operating on hard rubber ⅛ inch wide by 1/10 inch thick, fed with 20 strips abreast, will give an output of 40,000 pieces per hour. The unit is supplied motorized for d.c. single-phase a.c. or three-phase a.c. with all necessary tools. Manufacturers are E. W. Cowell, 7a, Sydney Road, Watford, Hertfordshire, England.

●

Petrol Engine Starter. — The "Standard Startall" which has recently been made available by G.S.L. Products Ltd., The Roundabout, Western Avenue, Greenford, Middlesex, England, in association with Standard Telephones and Cables Ltd., is a mobile mains operated petrol engine starter equipment. It is claimed that it will start the engine of any motor car or medium sized petrol driven commercial vehicle in as little as two minutes even when the battery is "flat". In use, the equipment is simply connected to the battery of the car, thus eliminating the necessity, except when the battery has completely collapsed, of removing it from the car. An automatic cut-out is incorporated.

Light in weight and easily manoeuvrable, the equipment measures about 23 inches by 11 inches by ten inches and is mounted on rubber wheels. On the instrument panel there is a switch for either six V or 12 V working, together with a mains switch and an ammeter with push-button control. This equipment eliminates the need for "slave" batteries and in addition to providing a convenient source of power for motor starting, offers rapid battery charging facilities and provides both a six V and 12 V supply for testing purposes.

●

Rust Prevention. — One of the latest methods of preventing corrosion in iron and steel has just been announced by a London firm. Called "Rustanode" it can be applied to steel by spraying, dipping or painting. It leaves a coat of pure zinc which is strongly adherent, ageproof, and permanently rustproof. Experiments have shown that the degree of protection afforded by such materials increases with the pure zinc contents of the coating.

This protection is attained, the manufacturers claim, in the highest degree by Rustanode which gives as much as 95 per cent of pure zinc in the dried film without sacrificing any essential characteristics. The pure zinc film deposited by the material ensures that metallic contact is maintained throughout the coating and between the coating and the base metal, thus assuring cathodic protection. Makers are C. & P Development Company Ltd., 122, Southwark Street, S.E.1.

●

Protection For Aero Engines.—A simple and economical protection against rust and corrision in aero engines is V.P.I., vapour phase inhibitor, the active substance of which is a slightly volatile nitrate salt — dicyclohexlammonium nitrate.

The unique characteristic of V.P.I. is that it does not react with, or remove either the moisture or oxygen, but instead operates successfully in their presence by actually inhibiting their corrosive action. If the chemical is properly used its vapour penetrates to every part of the aero engine and gives complete immunity from rust over a period of several years. Manufacturers are Shell Petroleum Company Ltd., Great St. Helen's, London, E.C.3.

●

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A Message from The President

THE HIGH HONOUR you have conferred upon me in placing me in the office of your President, is indeed deeply appreciated.

It is my earnest desire to merit this grave responsibility by doing everything in my power to further the progress of our Institute during my term of office.

In order that I may devote my entire time to the Institute, I have resigned from my regular position and, therefore, will be available at all times to perform whatever task presents itself. I would ask that all officers and members of this organization give me their utmost co-operation, and I look forward with confidence that this support will be forthcoming in the fullest measure.

It is my intention to visit each branch and section of the Institute. Through these visits I hope to meet many of our members personally, to renew old friendships and to make new ones—indeed a rare and pleasant privilege.

Ross L. Dobbs
President.

Improvements in Electrode Boilers

by

Milton Eaton, M.E.I.C.

Electrical Engineer
Shawinigan Chemicals Limited,
Shawinigan Falls, P.Q.

A paper presented at the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, N.S., May 20, 21, 22, 1953.

It has been proven in practice, that the performance of a high-voltage electrode boiler is much improved if water is taken from the boiler, the feed water mixed with it, and the mixture pumped through water spouts pointing upwards towards the tips of suitably designed electrodes. This process is defined as water-spout action, and the boiler is designated a water-spout electrode boiler. The development of the water-spout boiler is narrated in this paper and automatic control for electrode boilers, based on established principles, is described.

Improvements in electrode boilers can be fully appreciated only with a knowledge of their present application and performance. Although low-voltage electrode boilers in sizes up to 1,000 kw. are used extensively to supply steam for various purposes, the application of high-voltage electrode boilers of greater capacities is confined more to the utilization of surplus and off-peak hydro-electric power. A market for the steam is readily obtainable in industrial plants, such as paper mills and chemical works. Apart from a few widely-separated installations most of the boilers of this class are in Europe and Canada.

There are about 200 high-voltage electrode boilers installed in Canada, ranging in sizes up to 50,000 kw. with applied voltages of 2,200 to 13,000 volts, and having an aggregate capacity of about 2,000,000 kw. The three main types are General Electric boilers, Penzold boilers and Kaelin (Dominion Engineering) boilers.

General Electric boilers are divided into two compartments with equalized pressure. A pump is used to circulate water between the lower hot-well compartment and the upper electrode compartment mainly for load regulation. (The circulated water is directed around the electrodes to facilitate the release of steam). The Penzold boiler is characterized by the use of ceramics for increasing the electrical resistance of the boiler water.

Sectional views of a Kaelin electrode boiler are shown in Fig. 1. Electrodes 1, 2 and 3, symmetrically arranged within the ground shell 4, are normally immersed in the boiler water as indicated in section XX. Steam is raised by the passage of electric current through the water, the load being regulated by varying the water level on the electrodes.

Although conventional high-voltage electrode boilers are being used to great advantage, they have certain characteristics which tend to make their operation unsatisfactory. The size and arrangement of electrodes are such that the cross-sectional area of the conducting body of water decreases as the current paths converge on the electrodes, causing proportionally increasing electrical resistance. For this reason there is more energy dissipated and more steam generated, per unit volume of water, near the electrodes than elsewhere in the boiler.

Steam tends to adhere to the electrodes and to accumulate on them, increasing the contact resistance and creating a voltage gradient such that arcing occurs along the surfaces of the electrodes. The arcing aggravates the condition and is responsible for (a) accelerating the corrosion of the electrodes and (b) creating turbulence which is conducive to foaming and priming.

Another objectionable feature is that the minimum boiler load is at least 10 per cent of the rated capacity as determined by the minimum electrode immersion. Arcing conditions cause the electrodes to corrode away at their lower ends. If the water falls below the electrodes an arc forms, which usually results in a short circuit causing the boiler circuit breaker to trip. For these reasons the minimum safe electrode immersion for conventional electrode boilers operating at 2,200 volts is about 6 in., with as much as 12 in. allowed for higher voltages.

The electric current taken by an electrode boiler, before steam generation begins, is expressed by the equation:

$$\text{Amperes } I = \frac{9.2\ CEK_t}{\log_e \frac{B}{A}} \quad . \quad . \quad . \quad (1)$$

A = radius of electrode (inches)
B = radius of ground shell (inches)
C = immersed length of electrode plus A or plus $(B-A)$ whichever is less.
K_t = boiler water conductivity in mhos/cm²/cm at operating temperature.
E = boiler voltage (3 phase).

When steam generation begins the steam increases the resistance of the boiler water and

$$I = \frac{9.2\ CEK_t}{S \log_e \frac{B}{A}} \quad \ldots\ldots\ldots \quad (2)$$

"S" in equation (2) is defined as the steam resistance factor.

Curve 1, Fig. 2, indicates the voltage gradient in a boiler before steam generation begins. Points along the curve are determined by assuming an expanding electrode with an ultimate B/A ratio of 5. The rate of decrease in voltage, as measured from the electrode, increases with the ratio B/A. After steam generation begins the accumulation of steam on the surface of the electrodes results in the voltage gradient indicated by curve 3.

Although curve 1 is accurately determined, curves 2 and 3 are correct only in general shape. They serve to explain operating conditions. (Curve 2 will be referred to later). If we assume the distance between the surface of the electrode and the ground shell to be 10 in. and the voltage to ground to be 4,000 volts, then, according to curve 3, the voltage drop at one inch distance from the electrode is 2,000 volts. The voltage gradient indicated by curve 3 would therefore result in arcing on the electrode surfaces.

A demand for a high-voltage electrode boiler to maintain unity load factor in a system supplying a variable primary power load led to consideration of means for safely reducing the boiler load practically to zero at times of peak primary load. Maintaining a spout of water under each electrode seemed to offer a possible solution of this problem.

The Beaker Experiment

A 6 in. pyrex beaker, (Fig. 3), was fitted with a $\frac{5}{8}$ in. central electrode in a rubber cover and an outer thin metal electrode 4. Vessel 2 and small laboratory pump 3 with associated pyrex and vinylite tubing completed the essential parts of the apparatus. Power from a 220 volt source was supplied by a 5 kva. transformer. Suitable measuring instruments were provided.

The flow of water through the pyrex spout under the electrode was adjusted by means of clip A, so that with the water level at the top of the spout, the spout of water climbed about 3 in. up the electrode. The water level in the beaker was raised or lowered by adjustment of clip B.

The experimental results are shown on the graph, Fig. 4. It was found that the spout of water not only permitted the water level to be dropped below the electrode, gradually reducing the current to zero, but it also prevented arcing on the surface of the electrode when operating at higher water levels. The effect of water-spout action was vividly demonstrated by starting and stopping the pump. When the pump was stopped, violent arcing accompanied

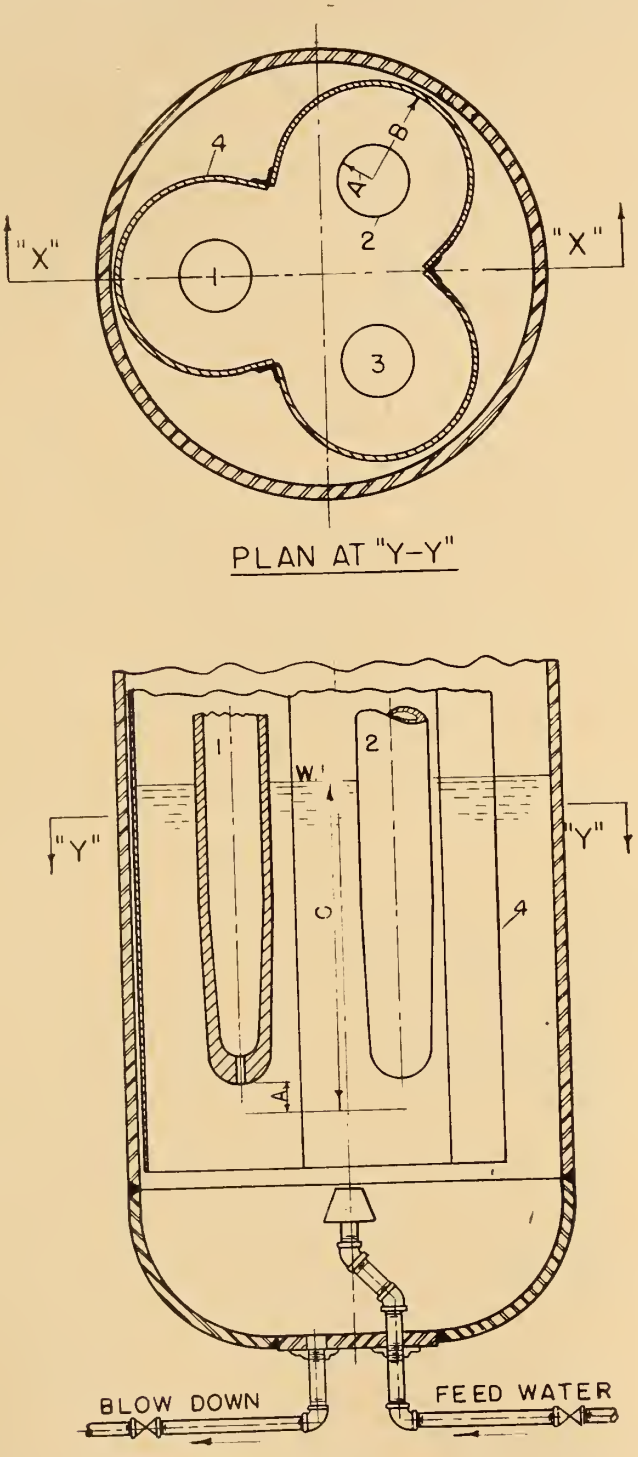


Fig. 1. Sectional views of a Kaelin electric steam generator.

by excessive turbulence and drop in electric current instantly occurred. When the pump was restarted the arcing stopped, the turbulence subsided, and the current increased.

It was assumed that the water-spout action prevented arcing on the electrode surface partly because the temperature of the spouted water was below the boiling point, thus prohibiting the accumulation of steam around the electrode. Vessel 2 was a metal pail which allowed the circulated water to cool appreciably before being returned to the beaker through the water spout. Obviously a similar effect could be obtained in practice simply by mixing the feed water with the circulated boiler water.

The increase in current with water-spout action is attributable to the decrease in the resistance imposed by the steam when it is not allowed to accumulate on the electrode surface. Referring again to Fig. 2, curve 2 indicates the voltage gradient with water-spout action. It is assumed that little steam occurs near the electrode surfaces or within 10 per cent of the distance to the ground shell. At this point the voltage drop is less than 1,000 volts (as compared with 2,000 volts with the voltage gradient represented by curve 3) and an arcing condition therefore does not exist.

A study of the experimental results indicated that if water-spout action were applied to a conventional electrode boiler, having a load range of 15 to 100 per cent, the load range would become in the order of 1 to 150 per cent. However, a limitation was observed.

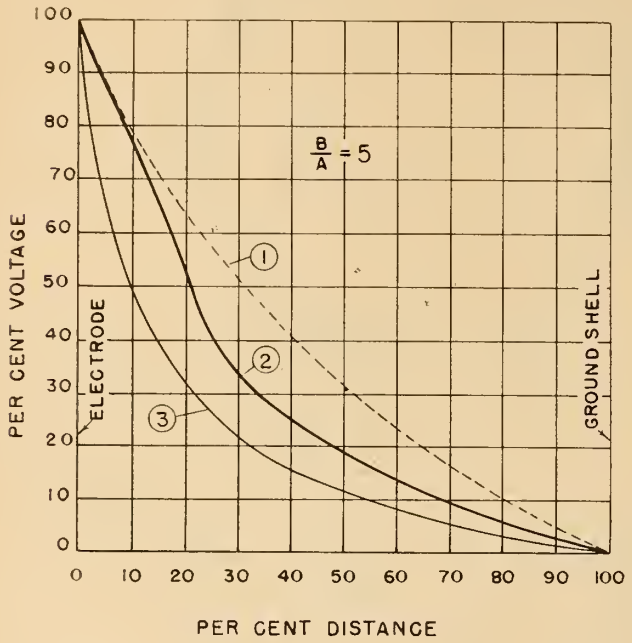
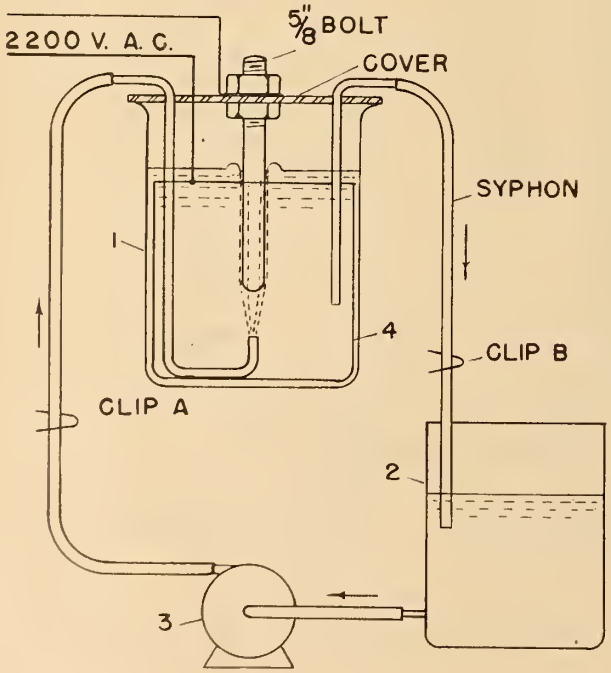
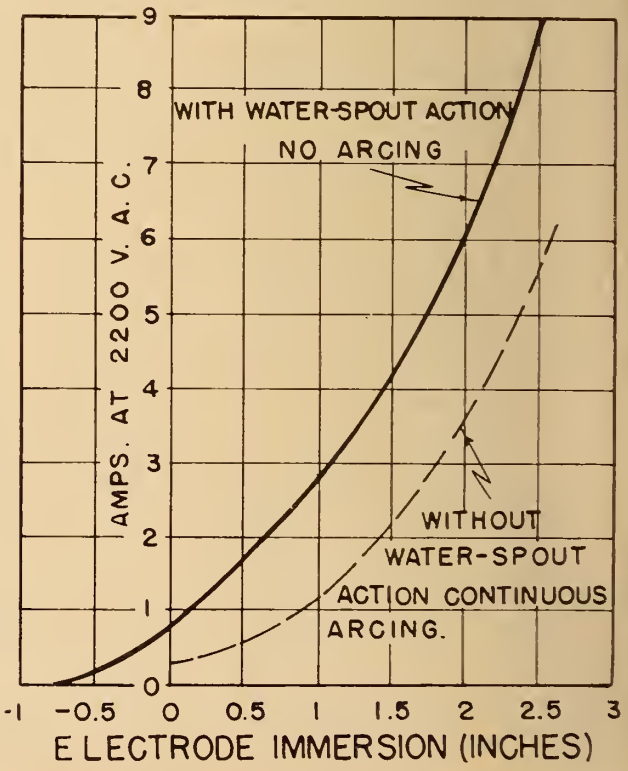


Fig 2. (Upper left.) Curves showing the effect of water-spout action.

Fig. 3. (Lower left.) Apparatus for the beaker experiment.

Fig. 4. (Below.) Voltage gradients in an electrode boiler.





When the power input to the beaker exceeded a critical value the boiling became so violent that unstable operation resulted.

The voltage gradient in an electrode boiler is a function of the logarithm of the ratio B/A. In order to avoid excessive arcing on the electrode surfaces of a conventional boiler this ratio is limited to about 4/1, depending on the operating voltage and boiler dimensions. In the beaker experiment the B/A ratio was 9.6/1, which accounted for the fact that there was more arcing on the electrode surface without water-spout action than would occur in the conventional boiler. The electrical resistance of the conducting body of water is also proportional to log B/A. It is obvious that with water-spout action boiler electrodes may be made much smaller, with B/A ratios proportionally greater, thus making it practicable to operate boilers of moderate capacities at considerably higher voltages.

The Water-Spout Electrode Boiler

Shortly after the beaker experiment there was a demand for an electric boiler to operate at 6,600 volts and with a load range of 0-2,500 kw. The engineers concerned agreed that, in view of the experimental results, it would be practicable to equip an existing 2,200 volt, 5,000 kw. electrode boiler with smaller electrodes and water-spout action to make it suitable for this application. This was done and the boiler was put into operation to supply a heating load.

The boiler was equipped as shown schematically in Fig. 5. A water-circulating pump 11 was made to take water from the bottom of the boiler and to discharge it through distributor 16 and water spouts 21-22-23, terminated with nozzles made as shown in Fig. 9. A valve was provided to adjust the rate of water circulation, which is measured by a suitable instrument having its flow-measuring element connected at 13. The feed water introduced at the suction side of the water-circulating pump served (a) to lower the temperature of the circulated water and (b) to prevent flash steam forming in the pump. (Flash steam, occasioned by drop in suction pressure, is believed to be responsible for impeller cavitation of pumps used for similar purposes.)

Although some alterations had to be made the expected performance has been realized. The boiler is now operating satisfactorily with a load range of 20 kw. to 3,000 kw. and with a voltage range of 6,500-7,200 volts. The water level has frequently fallen below the electrodes with no indication of arcing.

A modification in design was required to prevent boiler water oscillations which occurred when operating at loads in excess of 2,500 kw. As the water level on the electrodes was raised the spouted water tended to develop boiler water oscillations, which carried the spouted water on and off the electrodes. This was found to be the cause of rythmical variations in load current. The tendency of the boiler water to oscillate indicated that water-spout action is not complete unless the spouted water is guided beyond the tips of the electrodes.

Consideration of this problem led to the conclusion that the desired results would be obtained if the spouted water were directed up into the electrodes and allowed to run out through vertical slots symmetrically arranged around their sides. The apparatus used for the beaker experiment was again resorted to as a means for determining the electrode design most suited to this development. The choice of cast iron electrodes, made as shown in Figs. 6, 7 and 8, was the result.

When the new electrodes were being designed provision was made for increasing the capacity of the boiler, without making it less adaptable to light load operation. This was accomplished by tapering the electrodes from their tips upwards to a larger diameter, and by increasing their surface area by means of longitudinal corrugations as shown in Figs. 6 to 8. It was realized that spouted water (below steam temperature) would not come in contact with the outside rims of the corrugations.

Arcing does not result, however, because steam on these surfaces only deflects the electric current into the adjacent grooves. Sufficient spouted water was expected to spill over the electrode tips to prevent

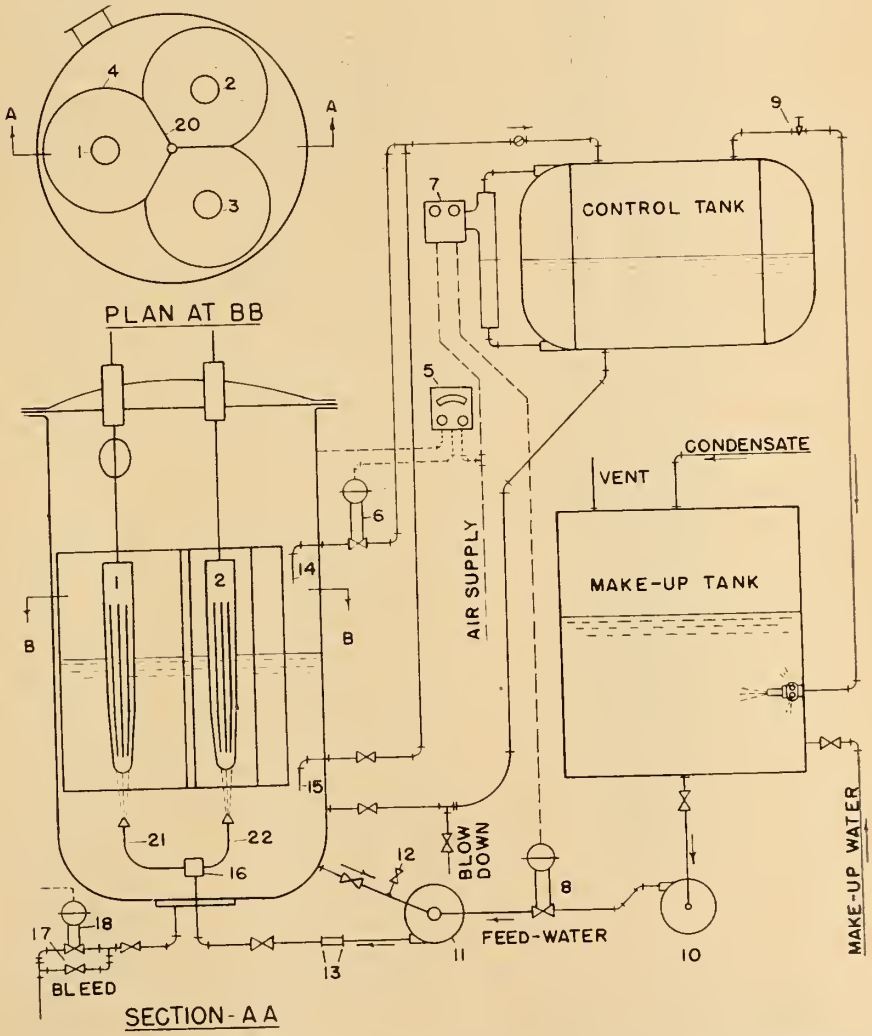
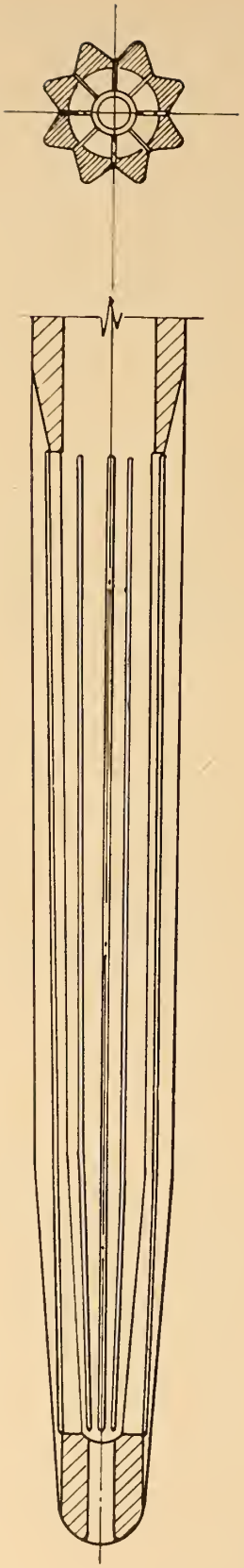


Fig. 5. Schematic arrangement of equipment for a water-spout boiler with automatic control.



SECTION "A - A"

Fig. 6. Details of electrodes for a water-spout boiler.

steam formation on their outer surfaces. Electrodes of the new design have been put into service with very satisfactory results. There is no further indication of boiler water oscillation and the steam-generating capacity is considerably increased.

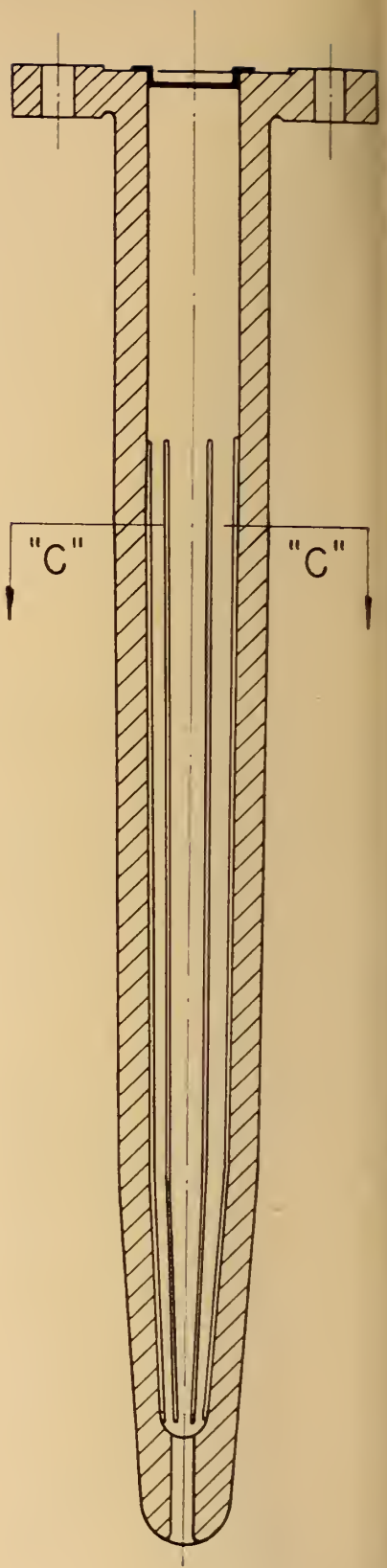
It is evident that if a conventional high-voltage electrode boiler were equipped with water-spout action, including electrodes of the new design, its capacity would be very much increased. There is, however, a limitation with respect to steam release area. For this reason it is not proposed to decrease the permissible minimum diameter of a water-spout boiler as compared with that of a conventional boiler of the same capacity. The length of the electrodes will be reduced with proportional reductions in the length of the boiler shell and size of the control tank.

The increase in steam-raising capacity resulting from water-spout action is partly due to the steam being released with less disturbance to the boiler water. Figure 10 is a plan view indicating the lateral flow of boiler water. It is assumed that most of the electric current is confined to the areas indicated as streams of water, and that the steam generated in these areas rises through the water in the intervening spaces "*S*".

The steam is therefore being directed through a number of well defined channels instead of being allowed to rise with indiscriminate distribution. There is also an improvement in electrical characteristics. The steam may be used to a greater extent for increasing the resistance of the boiler water without causing excessive current pulsations.

In order to obtain a comprehensive conception of the effect of water-spout action, let us first assume that a single phase electrode boiler 30 in. in diameter, and with a conventional electrode 3 in. in diameter, has been put into operation with the electrode immersed in water of normal conductivity and with 6,600 volts applied. Because of the B/A ratio of 10/1 the concentration of energy at the electrode would be such that the electrode would immediately become enveloped with steam to such an extent that the electrical resistance would be greatly increased, and violent arcing at the surface of the electrode would occur.

If the water level were lowered below the electrode an arc would form between the electrode tip and ground shell. Now let us assume



SECTION "B - B"

Fig. 7. Details of electrodes for a water-spout boiler.

that water, below steam temperature and with suitable volume and velocity, is spouted up under the tip of the electrode. The arcing on the electrode surfaces would then cease, and the water level could be lowered below the electrode, gradually reducing the load current practically to zero, with no danger of an arc forming to ground.

There would, however, still be a concentration of energy near the electrode such that the volume of steam generated in, and released from, that area would result in unstable operation unless the mean current density on the electrode were limited to a value corresponding with permissible current densities on the electrodes of conventional boilers.

There would also be a tendency to boiler water oscillations with associated variations in load current. Now if the electrode were changed to one made as shown in Figs. 6 to 8 the current density could be considerably increased, a pattern as illustrated by Fig. 10 would be created, the steam would be used to greater advantage as a means for increasing the electrical resistance, and the boiler would operate normally from no load to full load.

Automatic Control

The control[1] may be described briefly by reference to Fig. 5. Air-operated control equipment is used. Steam is bled from the control tank at a constant rate through needle valve 9 to the make-up tank or to a low-pressure system. When the steam pressure is on the control point, control valve 6, in response to controller 5, supplies steam to the control tank at the same rate as it is bled through valve 9, thus maintaining a pressure differential between boiler and control tank corresponding with the difference in water levels.

If the controlled steam pressure falls below normal, controller 5 functions to increase the opening of valve 6. Steam is then supplied to the control tank faster than it is bled off, thus causing the control tank steam pressure to rise and water to flow from the control tank to the boiler. This results in power increase with recovery of normal pressure. Similarly, if the controlled steam pressure rises, the opening of valve 6 is decreased, causing a reduction in power input which restores normal pressure.

[1]For a complete description of the automatic control see paper "Control of Electric Boilers", published in Electrical Engineering, page 991, Volume 66, No. 10, October 1947.

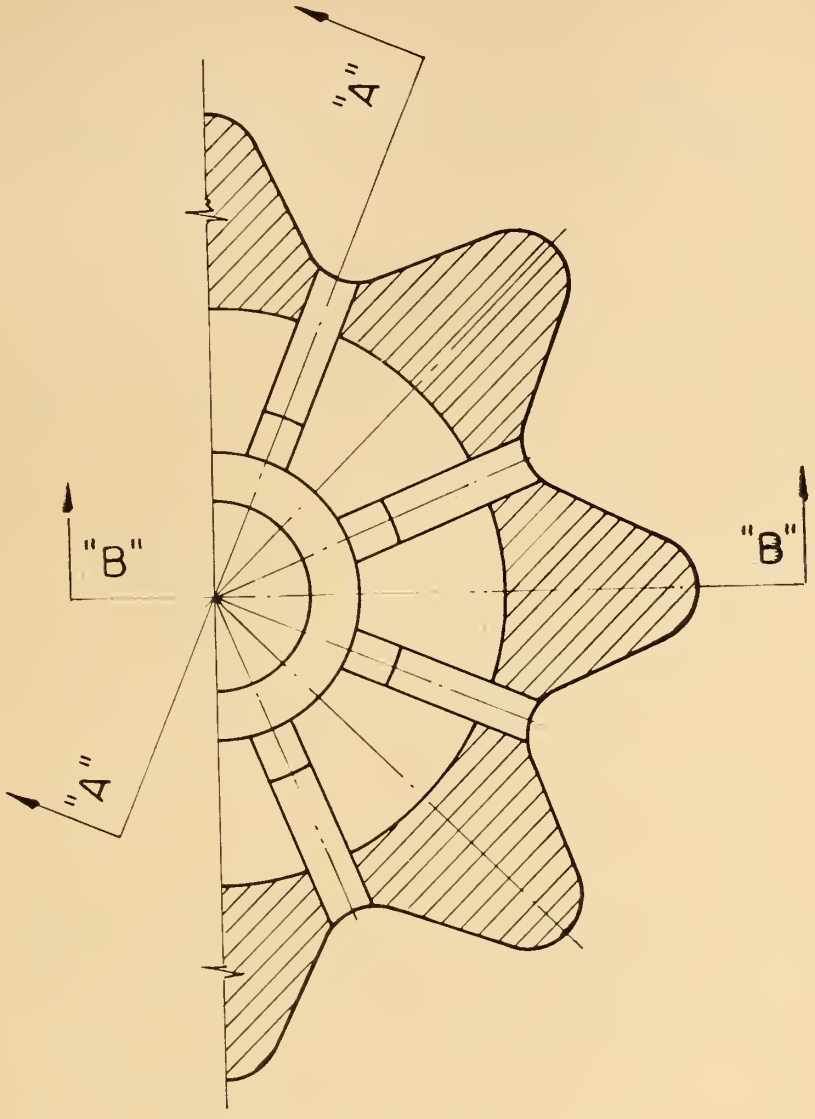


Fig. 8. Details of electrodes for a water-spout boiler.

According to ASME terminology, this is proportional-position controller action, in addition to which there is a self-regulating effect equivalent to rate action. A change in boiler steam pressure causes an immediate transfer of water to or from the control tank in the direction to restore normal pressure and at a rate proportional to the rate of change in boiler pressure.

Because of limited steam space in the control tank, self-regulation is more effective on rising steam pressure than it is on falling pressure. To compensate for this, the rate of bleed through valve 9 is so adjusted that when the controlled pressure is on the control point valve 6 is less than half open. For example, if valve 6 is fully closed with a diaphragm air pressure of 3 lbs. and fully open with a diaphragm pressure of 15 lbs., valve 9 is adjusted so that when the controlled

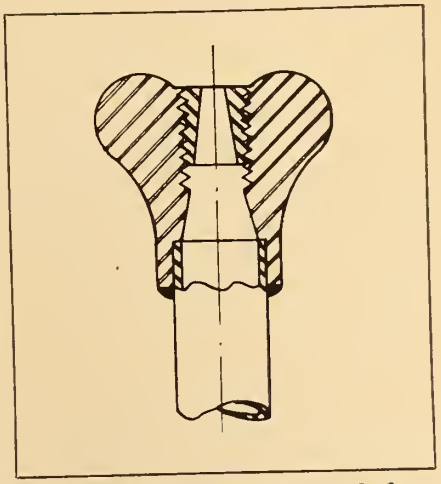


Fig. 9. Water-spout with nozzle for a water-spout boiler.

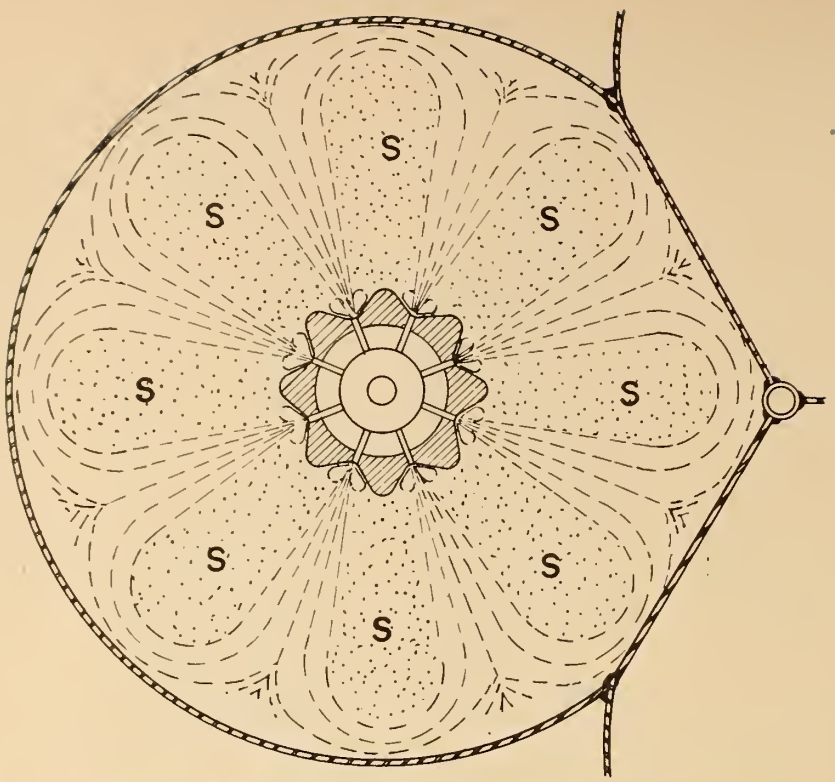


Fig. 10. Flow characteristics of boiler water associated with water-spout action.

pressure is on the control point the controller output air pressure is 7 lbs. The size of valve 6 is chosen to obtain, with these adjustments, a rate of bleed through valve 9 equal to about 1 per cent of the boiler capacity.

A liquid-level controller 7 with diaphragm valve 8 regulates the supply of feed water in response to the water level in the control tank which is normally half full. The conductivity of the boiler water is maintained within predetermined limits by bleed valve 18 operating in response to conductivity-measuring and control apparatus which is supplied with boiler water through connection 12. The upper and lower limits of the water level in the boiler are determined by the elevations of the ends of pipes 14 and 15.

Air-operated controllers are developed to such an extent that there are few applications for which suitable instruments are not available. For example, one manufacturer has developed what is designated an auto-selector controller for regulating two related variables. It may be used, with associated control devices, to regulate the boiler steam pressure, as long as a pre-determined peak load on the system of which the boiler load is part is not exceeded. When the peak load is reached the controller automatically transfers to load control. The steam pressure must then be controlled by supply of steam from an alternative source until the system load decreases.

Low-Voltage Electrode Boilers

Low-voltage electrode boilers comprise those designed to operate at voltages below 1,000 volts. Their operation differs from that of high-voltage boilers in the following respects:

(a) Bleed control apparatus is not required. Because a low-voltage boiler may be designed to operate with boiler water having a salt concentration several times that of the feed water a periodic blow-down maintains the boiler water conductivity within satisfactory limits.

(b) The water level may be lowered below the electrodes with no danger of arcing to the ground shell. For this reason complete water-spout action is not essential. Partial water-spout action may, however, be used to advantage and may be obtained simply by terminating feed water pipes with nozzles located under suitable electrodes.

Choice of Equipment

It is apparent to control engineers that, because of the time required to transfer water to or from the boiler, limited steam-storage capacity, and an adverse temperature coefficient of water resistance, an on-off type of control would be inadequate to maintain stable operation with fluctuating steam demand. It is recognized that with these conditions, the equivalent of proportional-position controller action plus rate action is required.

More simple controller action may be satisfactory if the object is only to hold the steam pressure within certain limits, with no regard for the stability of the power input. This may be justified if the boiler capacity is small compared with the user's total power demand. In any case, electrode boiler installations of 500 kw. capacity or larger warrant a design consistent with established principles in the arts of electric steam generation and automatic control.

Acknowledgments

Credit is due to engineers of the Aluminum Company of Canada for their co-operation and assistance in determining mechanical details essential for the most effective water-spout action. W. M. Harvey of the Iron Ore Company of Canada made helpful suggestions regarding the choice and arrangement of equipment, and useful information on operating conditions within electrode boilers was supplied by S. A. Williams, of Bastian and Allen, London, England. The author also wishes to acknowledge the assistance of his associates of Shawinigan Chemicals Limited in determining design details. √

Correction

"Analysis of Building Frames by Limit Design"

There are two errors in the figures in the article which appeared in the March 1953 issue of the *Journal* (page 224). The vertical load in Figures 4, 5 and 6 should be $\frac{1}{2}W$ instead of W, as shown. The computations are not affected. The captions of Figures 5 and 6 are correct, but the diagrams should be interchanged.

Aerial Topographic Mapping

by

D. H. Refoy

Topographical Supervisor,
Photographic Surveys (Quebec) Limited,
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Most civil engineers have had some contact with aerial surveying or with the maps it produces, but unless concerned directly with it, few know much about its methods, advantages and limitations, nor realize the many ingenious ways in which it has been applied. This paper, presented before the Montreal Branch on February 19, 1953, by P. F. Osler, president and managing director of Photographic Surveys (Quebec) Limited, is simple and lucid and should do much to clear up cloudy questions and to emphasize the very important place of aerial surveying as a tool of constructional development.

If we were to pick up almost any dictionary today and try to find the word "photogrammetry," it is doubtful if we would be successful, and yet this word is frequently heard today.

Briefly, photogrammetry is the science of obtaining reliable measurements by photographic methods usually with the aid of very precise instruments. Generally speaking, it is divided into two sections, terrestrial and aerial. Both of these aspects of photogrammetry are used in surveying but here only the aerial aspect is discussed.

Although photogrammetry began almost exactly 100 years ago, it was little used until the war years of 1939-1945, with their demand for rapid mapping of areas behind the enemy lines, accelerated both the production of photogrammetric equipment and the training of men and women in aerial surveying methods. As is not uncommon to processes developed under the artificial stimulus of war, many claims were put forward with regard to the ability of photogrammetry to perform miracles of mapping, some of them highly coloured. On the other hand, some thought that, while it was acceptable under wartime conditions, it would not stand up to the higher precision of peacetime mapping.

Use of Aerial Photograph in Photogrammetry

The land surveyor, before he makes a map, spends considerable time selecting points and tying them into a triangulation system, until he has a close network upon which he can build up the required detail. Although the photogrammetrist is dependent upon a certain amount of control fixed on the ground, his photograph itself is a complete record of innumerable points, the angles of which to the undetermined air station from which the photograph was taken can be measured. We say "undetermined" because, in fact, the station remains undetermined, although it is quite possible to compute its position accurately if it should be so desired. We have in effect a pictorial map, which differs from a true map, but

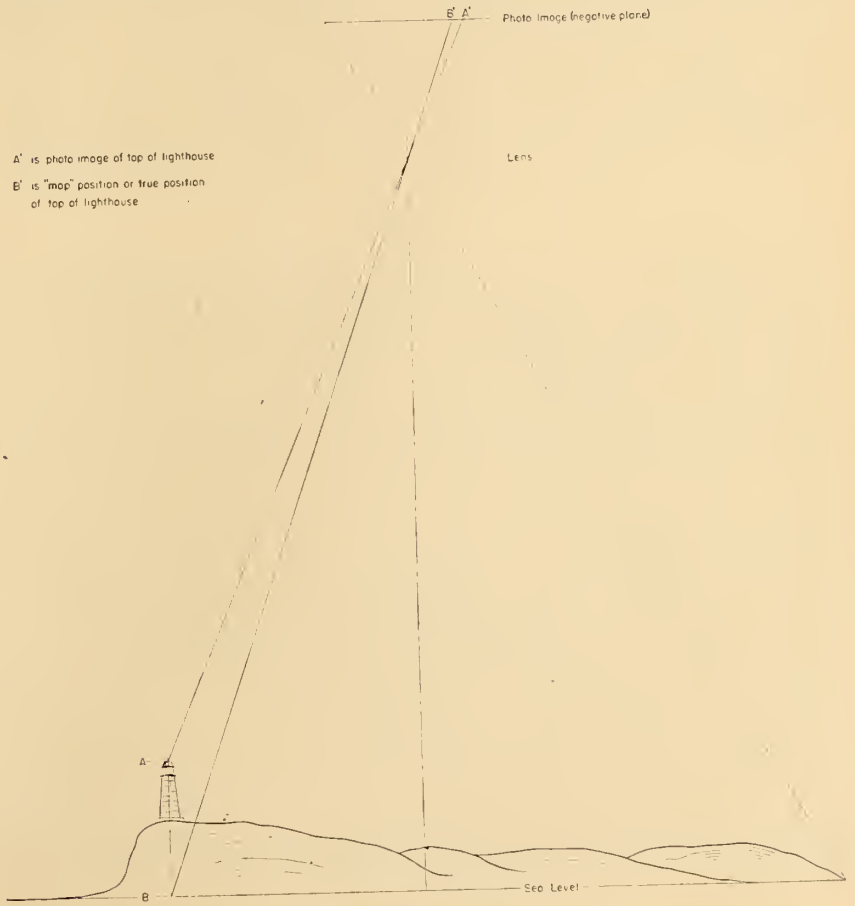

Fig. 1. Height displacement.

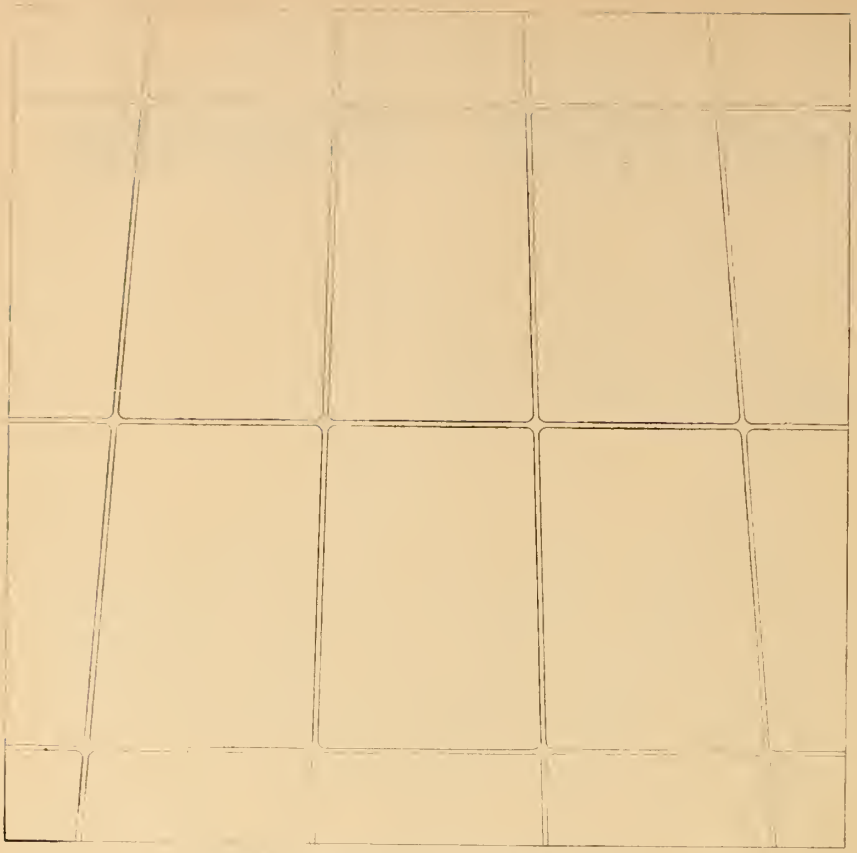

Fig. 2. Effect of tilt on straight roads.

can be converted into a true map. The most important difference is that it is distorted. This distortion is caused by a variety of factors, most of which vary considerably from photograph to photograph.

Imagine that we are several thousand feet above the surface of the earth. The ground directly below will be most nearly like a true map. As we gaze toward the horizon, we get a more oblique view. Thus, the wider the angle of the camera lens when taking a vertical picture, the greater the distortion around the edges of the photograph. This is the first and simplest distortion; only in the centre of the photograph do we get a truly vertical picture or "map" of the ground.

Second, the ground is not level. If we look at Fig. 1, it will be seen that objects with the greater elevation, i.e., objects nearer the camera, are displaced toward the edge of the photograph. The top of the lighthouse, A, in relation to the base B, is displaced on the photograph to A^1 while the plan or map position is shown at B^1. This "distortion" is used to advantage and is, in fact, the very foundation of topographic mapping.

Third, it is impossible to keep an aircraft perfectly stable, with the result that instead of a truly vertical photograph, we have a tilted one. Roads now take on the shape shown in Fig. 2, or assume a more complicated pattern if the tilt is both in the direction of the line of flight and, at the same time, across it. Attempts have been made to eliminate tilt with a gyroscopically controlled camera mount with considerable success, but the equipment is too heavy and too bulky for most commercial survey aircraft.

The fourth distortion is caused by the fact that it is impossible to make a lens that gives a perfectly true image, although in the best the distortion is kept within very narrow limits. Lens distortion varies with the distance from the optical axis of the lens; a typical distortion curve is shown in Fig. 3.

The fifth and last distortion is that caused by the deformation of the photographic film and paper during processing.

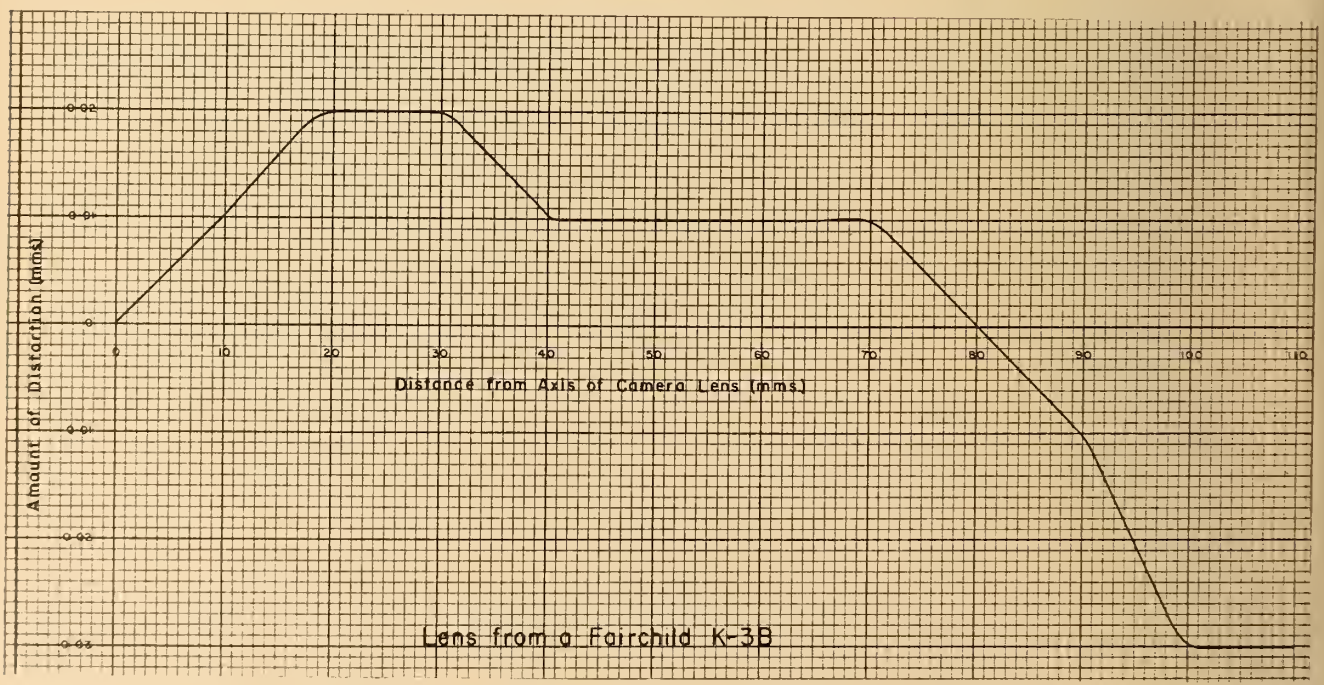

Fig. 3. Typical lens distortion curve.

There is another difference between a photograph and a true map, which tends to confound the person not used to handling aerial photographs. That is the fact that whereas a map shows only those features that the cartographer considers necessary, the photograph shows all detail, with the result that detail of minor importance often detracts the observer's attention from detail of greater importance. Photographic interpretation is an art in itself and a most important part of aerial surveying.

Distortions are corrected by means now to be discussed. The first distortion is caused by the oblique view at the edge of the photograph. This is automatically overcome in stereoscopic plotting instruments, where a true three-dimensional optical model of the ground is reconstructed from the photographs. For photographic mosaics, a camera of long focal length, usually 12 in., is used, thus reducing the angle of the photographic field.

Before discussing height displacement, we must first see how the area to be surveyed is covered by the photography. The aircraft flies in a series of parallel straight lines, so spaced that a photograph taken on one line overlaps one taken on the next line by 30 per cent. This is known as "lateral overlap". The interval between exposures along any one line is of such duration that the overlap between consecutive photographs is 60 per cent. This overlap is to ensure that any point within the area to be surveyed falls on at least two photographs, and it also confines the working area of the photographs to the centre.

Two consecutive photographs along a flight line are known as a "stereoscopic pair" and can be used with the aid of a stereoscope to view the overlapping area in three dimensions. It is this fact that turns height displacement to advantage.

If we consider Fig. 4, the top of the lighthouse, A, is displaced outward on the two overlapping photographs to points A^1, A^2, respectively, the base, B, being at points B^1, B^2, respectively. By placing the photographs under a stereoscope, we combine the images so that they appear as a three-dimensional optical model A^3, B^3, Fig. 5. To measure the height of the lighthouse, we measure the difference in the distances A^1, A^2 and B^1, B^2. This is the algebraic sum of $A^1 B^1 + A^2 B^2$ measured in the direction of the base line. In other words, the height of the lighthouse is directly proportional to $p^1 + p^2$. We call this "parallax measurement" and an instrument called the "parallax bar" has been designed to carry out this measurement accurately. Although we have used a lighthouse for demonstration purposes, all differences in height, even slight slopes in the ground, can be measured in a similar manner.

It is possible for an experienced observer to make measurements with a parallax bar on the photographs to an accuracy of about 0.02 mm. and thus to determine height differences to an accuracy of about 1/1000 of the flying height of the aircraft, i.e., if the plane flies at a height of 5,000 feet, we can determine height differences of about 5 feet (5 feet = 0.02 mm. of parallax) and contour to an interval of 15 feet.

However, as the prints contain distortions of tilt, etc., previously mentioned, a complicated system of correction is necessary, involving considerable computation and a number of control points, at least six, are required to be established in the field for each overlap. Thus, although this system has been widely used in the past, the advent of modern plotting instruments has made it almost obsolete. It can still be used to advantage when comparative heights are required in a small area of the overlap. For example, foresters sometimes want to know the heights of trees in certain areas, or the engineer looking for a likely site for a bridge might want an estimate of the height of river banks. The parallax bar can give a quick and accurate answer to such problems.

We now come to the most serious of the distortions, that caused by tilt of the camera. In the older methods of aerial surveying, this was a factor that was not always entirely eliminated, especially during the war years when personnel had to be trained as rapidly as possible.

The old and laborious methods of eliminating tilt have been superseded by the use of stereoscopic plotting instruments which completely remove this defect. These instruments, of which there are several types, vary considerably in detail but all operate on the same fundamental principle.

Referring to Fig. 6, we replace the photographs in the same relative positions that they occupied when they were exposed in the aircraft camera. Two diapositives, positive prints on glass plates, are set in the projectors and the projectors oriented until they assume the same relative position as the aircraft cameras. A beam of light is passed through them projecting an image

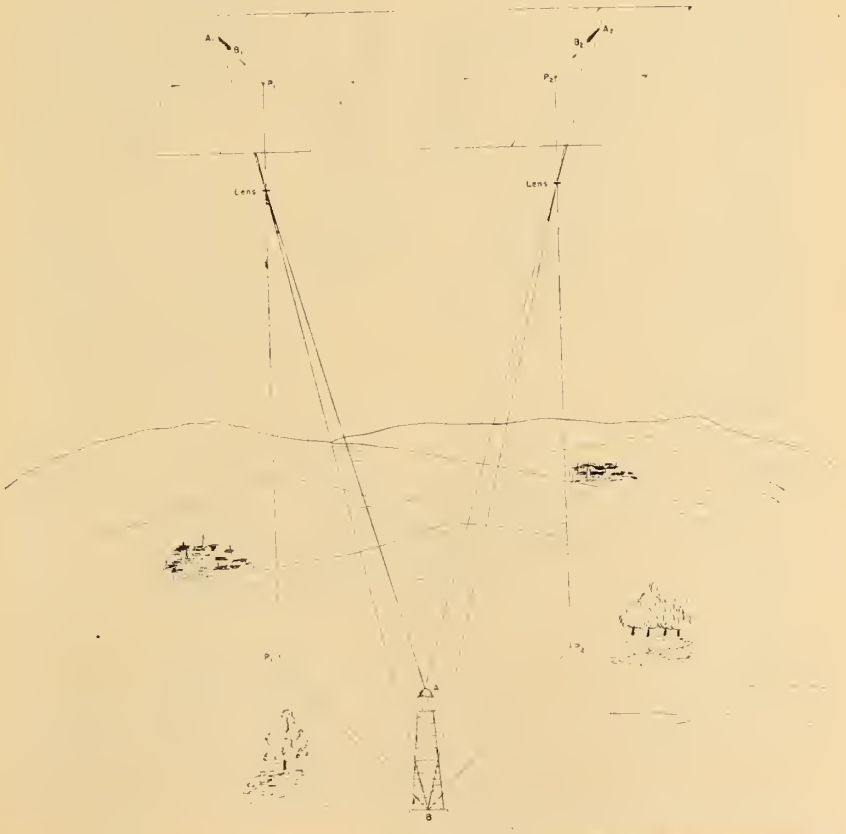

Fig. 4. Effect of height displacement on two overlapping photographs.

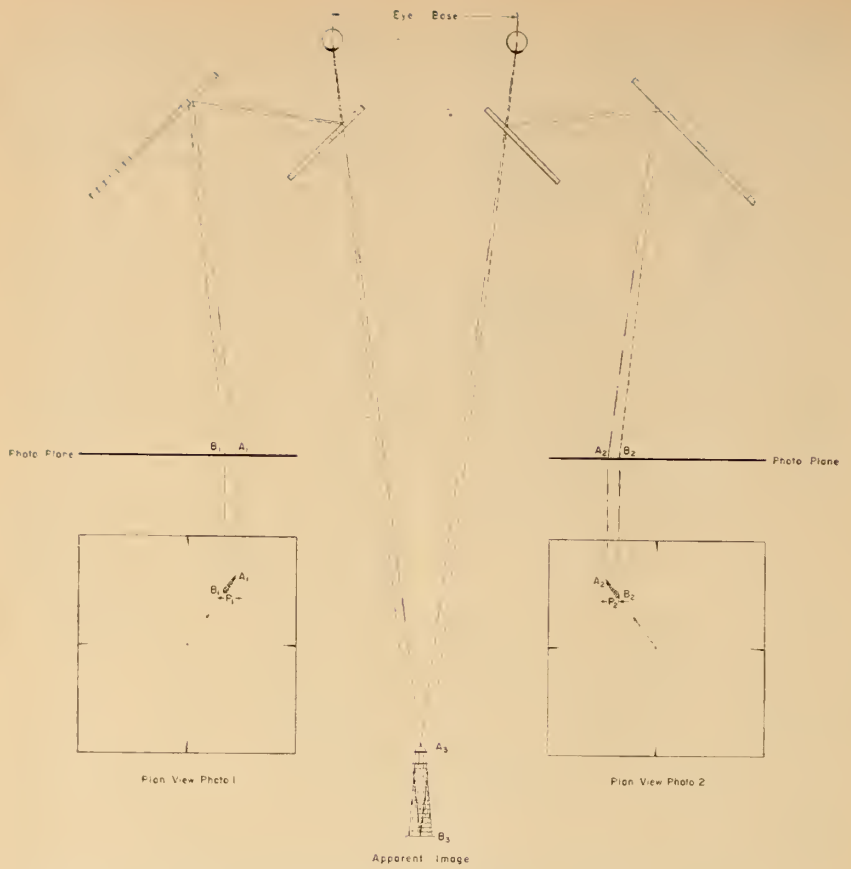

Fig. 5. Reconstruction of the stereoscopic model from photographs.

onto a plotting table, where it can be observed as a true three-dimensional optical model of that portion of the earth's surface covered by the overlap between the two photographs. This image is actually formed in space just above the plotting table and small areas are observed on an elevated platen. This platen contains an illuminated mark and can be moved both horizontally and vertically over the model. A pencil point is centred directly beneath the mark, so that by moving the platen contours and detail can be traced directly from the optical model onto paper placed on the plotting table.

In some instruments, the three-dimensional effect is obtained by projecting the two images in complimentary colours, red and blue. With spectacles with one glass red and the other blue, the eye looking through the red glass can see the red image, but not the blue image, and vice versa. Thus, we have the same effect as looking through a stereoscope. The left eye sees the image from the left-hand projector and the right eye sees the image from the right-hand projector. Other instruments use a system of lenses to view the separate images and vary considerably in complexity, notably the Swiss Wild instruments and the German Zeiss Stereoplanigraph.

In all of these machines, tilt distortions become apparent as a want of correspondence between the two images, that is, a point of detail will appear as two separate images that cannot be made to coincide exactly in the three-dimensional model. This is overcome by orienting the projectors until all points of detail are coincident. "Relative orientation," as this operation is called, is by far the most difficult problem facing a would-be operator. It is safe to say that any person who can carry out this operation in a reasonable time has the makings of a good operator.

We now have removed tilt distortion and can set the scale and level of the model with the aid of points surveyed in the field. In this operation the undistorted model is tilted in its entirety until the field-surveyed points are in their correct positions in relation to the datum. Three, and preferably four, points for this operation, well spaced over the model are desirable. They may be taken from existing maps, but this procedure is often unreliable, especially as it is rare to find maps at the same or a larger scale than that of the aerial survey.

Lens distortion, although impossible to eliminate completely in the camera lens, can be controlled; all cameras operating on government surveys in Canada are required to be calibrated by the National Research Council to ensure that this distortion lies within narrow limits. Some plotting instruments have compensating lenses made in such a way that they counteract the camera lens distortion. Other instruments have mechanical devices. For example, the Kelsh plotter has a cam which varies the focal length of the projector as the tracing table is moved to various parts of the model. This cam is accurately ground, so that the variation in the focal length in the projector exactly counteracts the camera lens distortion.

We are now left with the deformation of photographic materials. This was really a problem in the days when most of the work was carried out right on the photographs. Today we work with a very stable film especially designed for topographic mapping. With humidifiers attached to the camera and controlled atmospheric conditions in the processing laboratory, distortion in the film has been very largely controlled. In Europe, for large scale, high precision mapping, glass plates are used in the camera. In Canada, it has been found that the great expense and vulnerability of these plates is not worth the small amount of extra precision that they offer. We do, however, use glass plates in the plotting stages of the work, where a damaged plate can quickly be replaced.

Perhaps the most difficult thing for the unitiated to understand is that we are able to construct a three-dimensional optical model of the ground free from all distortion, on which we can make very accurate measurements, and which is perfectly true to scale in all three dimensions. We have, as it were, the advantage of being several thousand feet above the earth's surface with an eye base equal to the distance between successive camera exposures, thus being able to appreciate relief many hundreds of times less than that apparent to a normal eye base at that altitude.

There are various plotting methods, each with its capabilities and limitations. If we want to produce a planimetric map, that is, one without contours, we sometimes use what is known as the "slotted template" system. This is based on the fact that the displacement of any point on the photograph is radial from a point half way between the

centre of the photograph and a point vertically below the centre of the camera lens. This is called the "isocentre" and, on a truly vertical photograph, is coincident with its centre. For most practical purposes, the tilt of the camera is sufficiently small to enable the centre, or "principal point", to be used. Points are selected along the centre of the line of flight and in the lateral overlap between lines in such a way that they fall on as many prints as possible. Templates of metal, card or plastic are then made for each photograph, with slots punched over each of these selected points and radiating from the principal point. Trig points and other controls are also identified on the photographs and "slotted". A grid is prepared upon which all control is plotted and the templates laid down with studs fitting into the slots. These studs can move only on any one template in the direction of a line radial to the principal point which, as previously mentioned, is the only direction in which displacement takes place. Thus, as the templates are built up and the studs fitted into the several slots from each of the photographs that they appear on, they gradually fall into their true positions and steel pins are driven through the studs to mark these positions on the grid board.

The points, now adjusted to their true positions are transferred onto plotting boards. A "sketchmaster" which enables the observer to view the photograph and the plotting board at the same time is now brought into use. Adjustments make it possible to superimpose the photograph points over the adjusted points and so sketch in the required detail very accurately. This system is used principally on medium- and small-scale work and has been used with great success in the 1 mile to 1 inch mapping of the Province of Alberta and one-quarter mile to 1 inch mapping of Northern Ontario. For topographic mapping, many stereoscopic plotting instruments are used, among them those described below.

The first is the simplest, in many ways one of the most accurate, and certainly the most used in Canada. Named after its designer, Harry Kelsh, a noted American photogrammetrist, the Kelsh plotter is capable of producing maps varying in scale from 40 ft. to 1 in. to 1,320 ft. to 1 in. with, contour intervals varying from 1 ft. to 35 ft., respectively. It is by far the most useful instrument for large- and medium-scale maps in areas where adequate control is available or can be established. With this machine, we map at a scale that can be varied between four and a half and five times the photograph scale and the minimum contour interval is a little better than 1/1000th of the flying height. It is necessary to have four points surveyed in the field for each pair of photographs. An example of the type of work that is very suitable for this machine is large-scale development surveys requiring a contour interval of 5 ft. or less. With the addition of a pantograph, the plotting scale can be varied from one-half to five times the photograph scale, but the accuracy of both the detail plotting and of the contouring remains constant.

The Multiplex is more suited to somewhat smaller-scale mapping as, although it is possible to carry out large scale surveys with this machine, the enlargement factor of only two and one-half times the photograph scale necessitates flying at a much reduced height. Also, the diapositives, instead of being the same size as the photograph, as in the Kelsh plotter, are reduced about nine times. This results in a somewhat poorer definition on the model. For these reasons, it can produce contours only to an accuracy of about 1/700th of the flying height. The variation in scale is somewhat greater than with the Kelsh as we can go down to 2,640 ft. to 1 in.

Instead of two projectors, we now have a whole battery of them and in this feature lies the whole value of the Multiplex. If we orient the first two projectors to established control, we can tie in subsequent projectors to this fixed orientation. As we set up more and more projectors, moving further and further away from the first controlled pair, certain errors arise, but with the addition of two or three more control points along the line, we can analyse this error and easily correct it, as it follows a definite parabolic curve. This means that it is possible to cover very large areas with much less control than would be possible if we were using the Kelsh plotter. The Multiplex is ideal for strip mapping for hydro lines, prelimi-

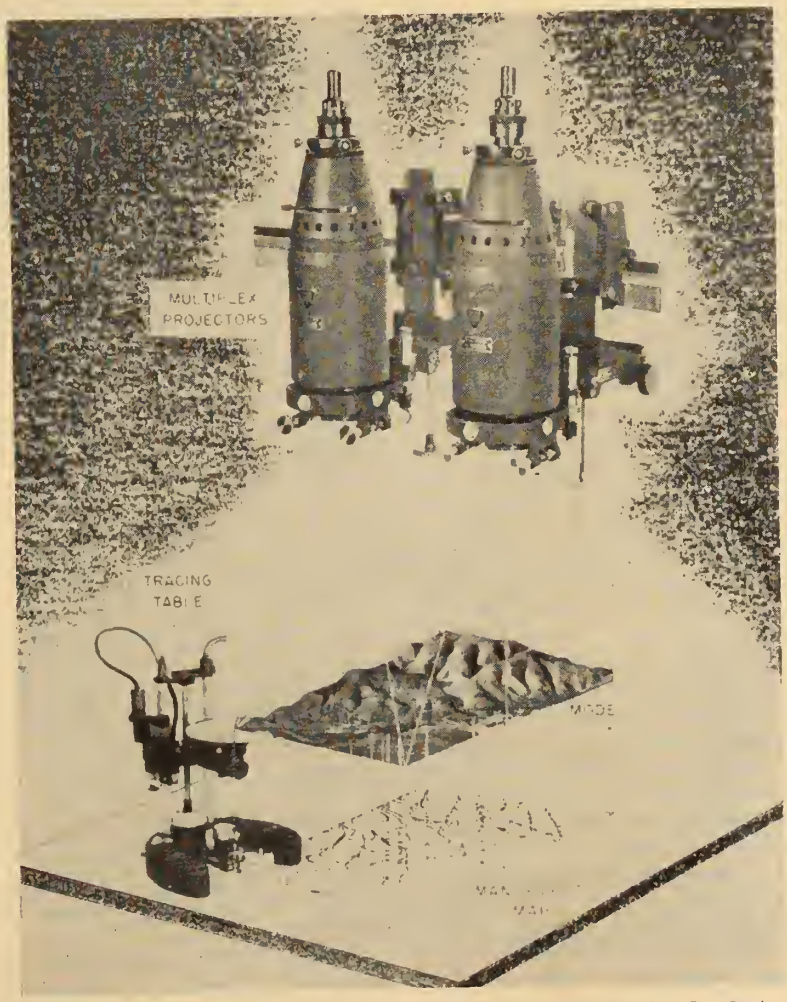

Fig. 6. Reconstruction of stereo model in instrument (multiplex).

nary surveys for road and railroad sites, selecting damsites, and many other purposes. It is a very satisfactory partner for the Airborne Profile Recorder, a device for determining elevations by means of radar in areas where little or no control exists.

The Wild A.5 and the Zeiss Stereoplanigraph are similar instruments and by far the most complex and expensive, both from the point of view of capital investment and of operation. However, their versatility more than compensates for their expense. Both instruments can plot directly from vertical aerial photographs, oblique aerial photographs, and from terrestial photographs as obtained from such instruments as the photo-theodolite. Also when used in conjunction with plate cameras, it is possible to plot directly from the negative plates. The range of scales that can be directly plotted with these instruments is large, varying with the A.5 from one-third to twenty times the photograph scale, and the accuracy for contouring gives a minimum interval as low as 1/1250th of the flying height.

The photographic plates are observed through a complex system of lenses containing a floating mark which can be placed on various parts of the optical model, by means of two handles and a foot treadle. These movements are transferred to the plotting table at the side of the instrument by a series of gears. The pencil point is raised from and lowered onto the paper by means of a second foot treadle. Thus, the operator needs both hands, both feet, and both eyes! Even the ears have to be alert for the sound of the alarm bell that rings when the operator nears the edge of the model.

The exact co-ordinate position and elevation of any point is shown on a series of dials. This enables a series of models to be set up in much the same way as on the Multiplex and also enables one to compare and correct points falling on the lateral overlap between strips. This means that an aerial triangulation can be carried out and control points plotted for use in subsequent detail work. The latest edition of the Stereoplanigraph has a device so that if the floating mark is placed on a certain point, a printed record of the co-ordinate position of that point is obtained. Another luxury is the choice of several colours for the floating mark. It is also possible with these two machines to record the exact angles at which the projectors were set when oriented and, so if there is any need to reset a pair of photographs, the resetting can be done quickly. These instruments are machined to the finest engineering standards and require highly skilled personnel for their operation and maintenance.

So much for the tools of the photogrammetrist, now let us examine some of his products. The first of these is the photographic mosaic, which is divided into two kinds, controlled and uncontrolled. The uncontrolled mosaic is made simply by matching the detail on the photographs and sticking them down onto a board. This gives an excellent overall picture of the area, but cannot be used for taking measurements, as the scale is likely to vary in different parts of the mosaic.

The controlled mosaic is much the same to look at, but is more accurate and requires a lot of painstaking work to prepare. A grid is prepared on the mosaic board and control points are plotted. Often when existing control is scarce, and it usually is, we use a slotted template lay-down to provide a number of control points on each photograph. Individual photographs are then reprinted through a rectifying enlarger, which adjusts scale and tilt so that the photo-points are coincident with the plotted control points. These rectified prints are then pasted down over the control points and to ensure a perfect fit, a great deal of patience and know-how is required. The resulting mosaic is thus true to scale, although local differences in elevation will cause a certain amount of distortion.

On both controlled and uncontrolled mosaics, it is possible to emphasize with coloured inks certain features — geological features for mining surveys, timber types for the forestry engineer, water sheds and drainage patterns for the hydro engineer, or roads and buildings for the town planner. These are known as "annotated mosaics" and the annotation is carried out with the aid of a duplicate set of prints for stereoscopic examination and by personnel experienced in the particular type of work involved. Today, all large air survey companies have their own geologists, foresters, civil engineers, etc., who are not only experts in their own particular branch of engineering, but also in the art of aerial interpretation.

Mosaics, while excellent for their purposes have the drawback that only experienced personnel can extract the required information from the unlimited amount of detail that the photograph portrays, so that it is often necessary to go a step further and produce a planimetric or line map, the preparation of which we have already described under the slotted template system which is economical for medium- and small-scale work. For work requiring greater accuracy or at larger scales, stereoscopic instruments are used.

The planimetric map has the following advantage over the controlled mosaic:—

1. It shows only necessary detail and thus can be used by people inexperienced in photographic interpretation.
2. When plotted with the aid of stereoscopic plotting instruments, it has much greater accuracy.
3. It can be easily reproduced in ozalid or similar form and used as a working plan on which additional detail can be drawn.

For very large scale work, we sometimes combine air and ground surveying, as much of the minor detail is obscured by tall buildings, trees, etc., although it is surprising just how much detail can be seen on an aerial photograph. On 200 ft. to 1 in. photography, used for 40 ft. to 1 in. mapping, manhole covers, hydro poles, fire hydrants, railway signal posts and switchgear, etc., can be seen quite clearly by an experienced observer.

Recently in England, the Eastern Section of the British Railways wished to estimate the conversion cost of electrifying a large section of its line. Aerial surveys were plotted at 40 ft. to 1 in. showing all visible detail. This made a sound base for a ground party to plot such detail as was obscured on the photographs, detail under bridges, covered platforms, etc. It was estimated that some 60 to 70 per cent of the detail was supplied by aerial surveying methods to an accuracy of $\pm$ 6 in., thus saving a considerable amount of time and expense.

It is in topographic mapping that aerial surveying offers the greatest saving in time and expense and, often it offers the only practical solution to a survey problem.

Contouring in the field is a long and tedious business, whereas the photogrammetrist can cover large areas rapidly with a high degree of accuracy. It has been estimated after a series of tests in Vancouver that a good operator can contour

as rapidly as 200 miles an hour. Also, because the operator keeps his floating mark constantly on the surface of the optical model, the shape of the contour tends to be more nearly perfect than when the field method of sketching in between the lines of levels are used.

The precision of photogrammetric instruments can supply contour intervals varying from 1/750th to 1/1250th of the flying height of the aircraft, with an accuracy better than one-half of the relevant contour interval. This statement applies only to areas where adequate control exists or can be supplied. However, in areas where control is sparse or even completely non-existent, we can show "form lines" which accurately portray the shape of the ground although relative heights in different parts of the area covered cannot be relied upon. In order to lay out form lines, we rely on various factors to help us level the model. Bodies of water, such as coast lines and lakes, are the most reliable, but drainage patterns, railroads, and the general lie of the land are other important aids. For many jobs where relative gradients are all that is required, these form-line maps give sufficient information. Examples of such jobs are reconnaissance maps for hydro line, railroad, and highway locations. Very often, it is desirable to combine these maps with details of geological structure and information on vegetation and swamp areas, etc.

It is with such work that the Airborne Profile Recorder, or "A.P.-R.", can convert what would have been a form line map into an accurate contour map. This method of determining heights by means of radar has been developed to the stage where it can be used to obtain elevations of sufficient accuracy required for 25 ft. contours. As the radar beam tends to be reflected from the highest point within the area of the beam, it requires an operator on the plotting instrument with considerable experience in working with this aid. However, it has definitely proved itself.

To attempt to explain all the different types of topographic maps and their uses, would be impossible, so we will content ourselves with an examination of a few odd examples.

A contracting firm wanted to bid on the construction of a bridge in a district very remote from its offices. Before doing so, in order to make an estimate as accurately as possible, it wanted to study the topography on one side of the body of water to be crossed. Naturally, at this stage, it did not want to spend any more money than it had to. The only photographs of the area were those of the RCAF at a scale of 1,800 ft. to 1 in. The Air Force agreed to supply diapositives covering the required area. The distance between two points along a telegraph line was obtained, together with two elevations on the highway and the height of the water at the time of photography. We plotted the area at a scale of 400 ft. to 1 in. with contours at intervals of 10 ft. This was then enlarged photographically to 50 ft. to 1 in. and drawn on linen, thus the total enlargement was about 36 times. A small part of the area surveyed had been previously contoured on the ground at 50 ft. to 1 in. When the two surveys were compared, there was a very satisfactory agreement. The time between the acceptance of the job to the final delivery—and this included getting the diapositives from the Air Force—was only one week, and the total cost less than the expense of sending one man to the area.

Flood line mapping is often of great interest to hydro engineers before the construction of dams. It may be that they wish to compute the volume of water that will be stored after the dam is constructed, or that they must buy or lease the area of land that will be submerged. Where a dam is being constructed at the end of an existing lake, it is often possible to map the floodline area without the necessity for additional control, by using the water level as a datum. If the area is extensive, it is usually a job for the Multiplex, as this instrument enables lines of six or more photographs to be set up to a common datum, so that although the lake does not appear throughout the line, it may appear on enough photographs to enable the work to be carried out.

One use that photogrammetry has been put to that illustrates its accuracy, is in the estimating of stock piles of timber, coal, etc., at pulp and paper mills. 200 ft. to 1 in. photography is flown for mapping at 50 ft. to 1 in., with contour intervals of either 3 ft. or 5 ft. By measuring the area of each contour with a planimeter, we can rapidly arrive at the volume of the pile.

Of course, the main advantage of aerial surveying is the time factor. In large surveys, the saving in time and consequent saving in cost can very well be great, but even in smaller surveys involving the use of only two or three photographs, the saving is often very considerable. Also, when photography is available, it is often possible to carry out topographic surveys during the winter months when it would be impossible to put a ground party in the field.

In conclusion, let us say that while aerial surveying is still dependent upon the field surveyor for control, and while there are still jobs that can be carried out only by field parties, it can and does offer an answer to surveying problems where speed and cost are vital factors. The land surveyor should not think that the photogrammetrist is trying to steal his thunder, but rather that air surveying is his partner, a help in speeding up the innumerable surveys called for by the rapid development of this country. √

Future Annual Meetings of the Engineering Institute:

QUEBEC, QUE.—May 12, 13, 14, 1954
Chateau Frontenac

TORONTO, ONT.—May 11, 12, 13, 1955
Royal York Hotel

Air Defence of Canada

by

Air Vice Marshal A. L. James, C.B.E., C.D., M.E.I.C.

Air Officer Commanding,
Air Defence Command

In these difficult times, Canadians generally are deeply interested in the support which Canada is giving to the United Nations and to the North Atlantic Treaty Organization. As a result, considerable attention is being directed both in public discussion and in the news to the measures taken for our security and to the growth of our armed forces. The average person realizes that an air defence system is being built in Canada; that fighter aircraft are being manufactured and pilots and groundcrew trained; and that anti-aircraft units are being strengthened and re-equipped. However, I do not think it is generally understood that the building of an air defence system is an engineering project of mammoth proportions, calling upon the skill and resources of almost all, if not all, branches of engineering science. It was therefore a timely gesture when the Institute invited me to present a paper at this Annual Meeting. It was an invitation which I was pleased to accept, because it afforded the opportunity of giving some prominence to the great contribution which engineers and the engineering industries are making to the security of Canada.

In this paper, Air Vice Marshal James gives a general, but authoritative, description of the goal toward which our air defence scheme is headed and of the methods being used to attain that goal. The paper is in pleasant contrast to much of what one finds in the popular press and was presented at the Halifax annual meeting in May 1953.

The Air Defence Problem

The role of an air defence system is to repel air attack. To do this effectively the system must be able to detect, identify, intercept and destroy air invaders. It must also be able to return friendly interceptors safely to base after combat. It comprises radars, communications networks, control and interception systems, airfields, fighter aircraft, anti-aircraft artillery and the necessary logistics support. All these must be welded into a single team, always on the alert, operating smoothly and efficiently, yet flexible enough to meet varied or concentrated attacks. There is need therefore, for control and direction by a single authority to ensure the close integration of activities and the co-ordination of effort so essential in a system so complex and widespread.

In Canada the responsibility for air defence throughout the country is vested in the Air Officer Commanding Air Defence Command, to whom authority is delegated by the Chief of Air Staff, who is the executive agent of the Chiefs of Staff Committee. The Canadian Air Defence Command comprises all RCAF Air Defence Units and the Canadian Army Anti-Aircraft Command.

In assessing the potential for air attack by an aggressor against the North American continent, the least capability it has seemed prudent to credit him with is the ability to launch, with little or no warning, an attack in substantial force against industrial complexes and other vital areas, This puts a tremendous premium upon forces being at their stations in appropriate states of readiness. The threat also calls for co-ordination of plans and activities between the United States Air Force Air Defence Command and ourselves. This co-ordination has been in existence now for some time and a real spirit of co-operation exists between the Canadian Air Defence Command and its counterpart in the United States. Plans are already in existence which will allow the two forces to operate together smoothly and efficiently in the event of emergency, and the relations between the United States Command and ourselves are excellent. During the large air defence exercise last July, the forces of the two countries worked together very well indeed, even though this was the first time the two air defence organizations had operated together on a large scale.

In addition to allowing an enemy the capability of launching a surprise attack in strength, we must also grant him the ability to deliver that attack at any hour of the day or night in all kinds of weather. We must expect that air defence operations will be around-the-clock and we must therefore, have an all-weather force.

Although the area to be defended is large, many of the vital targets are concentrated in a small area and are well suited to defence by local defence weapons. The aim of our planning is to exploit the inherent characteristics of each type of weapon to the fullest extent—to employ fighter aircraft, with their great flexibility, as far from the target area as possible, and to concentrate anti-aircraft guns, with their high capacity for prolonged fire against successive targets, for local defence.

Planning and Building Our Air Defence System

After the end of World War II, and for the first time in our history

we found ourselves faced with a serious threat to our security in the form of air attack with weapons of mass destruction. Having had no previous need for it, there naturally was no air defence system in our country. We did have, however, some obsolescent equipment which we could use for training purposes and which we could and did plan to use, with all its limitations, if an emergency occurred before a modern system could be produced and put into operation.

The planning and development of the Canadian air defence system called for careful study and assessment and prudent judgment on the part of those in Government and in the armed services. This will readily be appreciated when one realizes that it involved such problems as (a) evaluation of the threat, (b) assessment of the time element, (c) decision on type of equipment to be produced or acquired and (d) creation of industrial and engineering capacity for the manufacture of aircraft, radar and associated equipment.

Implementation of the plan placed a great burden on engineering industry and on manufacturers. Probably the construction side of industry had to bear the heaviest brunt, faced as it was with large postwar requirements for housing and for industrial facilities. The air defence plan called for the early construction of airfields and other stations, many of them in localities not easily accessible. Our construction needs included runways, operations buildings, hangars, barrack buildings, married quarters, roadways and electrical, water and sewerage systems. In fact, it meant the establishing of completely new communities, with all the attendant problems, often including the provision of new access roads.

Associated with this construction program was the necessity for the design of new buildings and the redesign of wartime buildings for new or special purposes. Each site had its own special problems, particularly with respect to water and power supply, drainage and sewage disposal. It was not economical to build up our own design staffs to meet this demand nor would the target dates permit. We called on civilian architectural firms and consulting engineers to help out and they came willingly to our assistance.

None of the new construction would have been of use without the operational equipment and the communication networks which tie all together. Here the burden fell on the electrical engineering and communication firms and manufacturers. Many of the new types of equipment had never been manufactured in quantity, and in some instances there existed only prototypes. The researcher, the designer, and the production engineer were all involved in this tremendous program and measured up to our demands. When the job is finally completed a great deal of the credit will be due our electrical engineering industry.

It may surprise some to find that I have not as yet mentioned aircraft. The production of aircraft was of prime importance in planning but, a smoothly operating ground control system is vital to the efficient employment of fighter aircraft. To stress this fact I have purposely delayed mention of the aircraft industry. The reorientation and growth of this industry in Canada since 1947 is the most outstanding achievement in the air defence field. It is true to say that no country has increased its aeronautical engineering capacity so much, relatively speaking, as Canada has over the past fifteen years.

A great deal has been written about the Canadian aircraft industry and its achievements and there is no need for me to repeat it here. However, there are one or two features I would like to stress. The industry has proven that it can produce aircraft in quantity to a schedule and at costs comparable to, if not lower than, others. It has also shown an ability to design modern aircraft and engines as good as any contemporary types. For the first time in our history we are manufacturing aircraft power plants and important ancillary equipment for which previously we were completely dependent on outside sources. In developing the industry every endeavour was made to utilize existing commercial facilities. In many cases, subcontractors had to modify their practices and develop new techniques to meet the exacting demands of aircraft design and specifications. Now there are over 400 subcontractors and suppliers in the engine and aircraft programs.

Occasionally, costs of aircraft today are compared to those of yesteryear. Such comparison is invidious when one considers the tremendous advance over the last decade in characteristics as well as in performance. The increased cost is directly related to the increased complexity and weight of modern aircraft. The modern all-weather fighter is a maze of radar scopes and scanners, intricate radio and navigational aids, precise instruments and armament sights, air conditioning and cockpit pressurization equipment, ejection seats and other safety features. The research, development, design and production engineering skills demanded in the production of the separate items and their combination into a reliable efficient unit are probably greater than any other engineering project, irrespective of size.

In all our planning we placed much reliance on the engineering profession and on engineering industry and on their ability to meet our needs to a formidable time table. I do not want to leave the impression that everything has been produced on schedule. There have been factors which could not have been foreseen, which caused some delay, but no really serious disruption to our plans has occurred. There is no doubt that the program can be completed within an acceptable time of the original target date.

Air Defence Command

The goal of the current RCAF expansion is an air force of 41 squadrons, of which 12 squadrons will be auxiliary and the rest regular. Ten out of the 12 auxiliary squadrons will be fighter squadrons, and the greater part of the regular squadrons, including the 12 squadrons in Europe, will be fighters also. This has enabled the RCAF to fulfil, in a small way, the intention of the NATO planners when they recommended the specialization of national forces. Fitting one integrated air division of 12 interceptor squadrons into the NATO defence organization is a much simpler problem than trying to fit a comparable number of squadrons of assorted types and roles into the same organization. Although Canada occupies a larger part of the North American continent than the United States, there is a vast difference between the resources and population of the two countries. Concentration on a fighter force, however, has permitted Canada to provide a scale of air defence over Canadian vital areas which is comparable to the protection which is given to adjoining United States territory.

There is a close link between the RCAF Air Division in Europe and the home-based Air Defence Command, although there is no formal command relationship between the two. Air Defence Command has the task of raising and training 12

Sabre squadrons which will make up the Air Division. Nine squadrons have already left Canada and the remaining three are now under training and will leave for Europe later this year. Before these latter squadrons leave the country, newly-formed CF-100 squadrons will take their places on the Command bases.

Coincident with the growth of the air element, a program for establishment of anti-aircraft artillery within the vital areas is being implemented. It involved the acquisition of guns and modern fire control equipment from the United States. The training of both regular force and reserve units, including conversion to the new type weapon, is being geared to the plans for deployment and the deliveries of United States equipment. These programs are closely integrated into the overall plans for the air defence system.

A predominant feature in any air defence system is the control and warning system with its network of communications. The system in Canada is made up of three major elements. First, there is the Ground Observer Corps. This is split into two divisions. The Northern Division makes use of personnel and communication facilities of the armed forces, the Department of Transport, the Hudson's Bay Company, and the Royal Canadian Mounted Police, and is required to report all multiengine aircraft movements in the north country. The other division of the Ground Observer Corps, not yet fully operational, will be an essential part of the apparatus to combat low-flying aircraft. Second, there is the radar network itself, which is the backbone of the control and warning system. Last, there is the extensive and complex communications network, required for fast and positive transmission of information and orders, which ties the whole system together.

The squadrons, the anti-aircraft guns, and the radars are the more noticeable elements in our air defence system and these have received the bulk of the publicity in the national press. These, however, are backed up by a growing system of bases, emergency strips, operational training units and armament ranges, plus all the domestic accommodation and logistics support required to keep the air defence system functioning smoothly.

The air defence system is manned on a 24-hour basis, but it would be manifestly uneconomical to provide regular force personnel for indefinitely sustained operations. We are, therefore relying on an active reserve of trained personnel, particularly in auxiliary squadrons, radar units and anti-aircraft batteries, to take their places quickly in the system in an emergency. In all exercises we have held the trained reserve personnel have proven their value by their ability quickly to fit into place. I cannot speak too highly of the reserve air defence personnel and hope that their numbers will be greatly strengthened as time goes on.

Operating the System

The main characteristic of an air defence system is the requirement for speed; there is only a limited time available for destroying attacking aircraft between its first detection and its arrival over a target. There is, therefore, a premium on the quick and efficient transmission of information. Information must be passed from radar to radar and from radar to operations centres. The operations centre has to communicate with airfields, anti-aircraft operations rooms, civil defence organizations and aircraft in the air. In the air, the pilot must be able to speak to fighter controllers and airfields on the ground and to other aircraft in his formation or elsewhere in the air. The key to the correlating of all available intelligence is an efficient communications system. It is, in fact, the lifeblood of the air defence organization.

It is well worth remembering that a communications system must not only be physically in being but it must also be reliable. In this respect electronic engineers have come a very long way in the past 15 years, but there is still room for development. We must remain technically ahead of the enemy all the time, or we may well be deprived of some of our key communications at a critical stage of an air battle.

The warning systems I have mentioned are required to report the movements of all aircraft. These reports go to filter and control centres for assessment. Consequently, these centres must have immediately available information on the movement of friendly aircraft. Identification of civil aircraft is made through flight plans, which they are required to file when operating within designated aircraft identification zones. If the centres are not able to identify an aircraft, fighters are immediately sent up to intercept and identify. If the track of the unidentified aircraft is towards a gun-defended area, the anti-aircraft batteries are alerted. If the unfriendly aircraft passes from one area of control, there must be quick and positive hand-over from sector to sector and from aircraft control to gun control. For such hand-over, there must be the closest integration of activities associated with the operation of fighter aircraft and of anti-aircraft guns. After an interception has been completed, each fighter aircraft must be returned safely to ground, either to its own base or to another, depending on the circumstances.

For the most effective use to be made of a fighter force, the system must be capable of providing not only recovery of aircraft after combat, but a quick turn around after return to base. The air defence system must therefore have navigational and landing aids to cope with all situations and all weather conditions. The time of turn around can be kept to the minimum only by good engineering design of re-arming, refuelling and ground handling equipment. The quick recovery of aircraft and quick turn-around are so vitally important that they could win or lose air battles.

In addition to improving aircraft and other weapons, we must continually add improvements to aircraft control and warning organizations, and introduce new equipments and techniques from time to time. As with aircraft, this will not demand new heavy construction, but will be mainly replacement and modification. We believe we have done our best toward avoiding recurring capital costs; our designers and engineers have looked a long way ahead. Many of our facilities have received compliments from friendly nations. I believe we can honestly and with some pride say we are building a modern air defence system which will not be surpassed by any similar system anywhere.

Benefits to Peace Time Economy

So much has been said about the costs of modern armed forces that I feel I should perhaps mention that, apart from the security which the forces provide, our normal peace time economy does derive benefit in some degree from the developments which accrue as the result of military requirements. The demand of aircraft designers for materials of a greater strength-weight ratio led to the development of the alloys of aluminum and magnesium which are in common use today. Production of high-temperature alloys has been stimulated by the demands of the gas turbine industry, itself a result of Air Force

requirements. Great interest is centred on the use of titanium, because of its physical characteristics, and if economical production can be attained, it promises wide utilization. The list becomes large when we consider the special machine tools and processes originally developed for the manufacture of weapons that are now in common use. The improvement in performance of civil aircraft and in safety of operation are the result of development and experience with service aircraft. Radar has been applied to civil needs, particularly for navigation purposes, and daily improves safety in the transportation field. Too, the atom bomb development has provided the medical profession with new treatments, which otherwise may have taken many years to acquire, and has opened a wide field for future exploitation.

Looking to the Future

Looking briefly ahead into the future the designers of aircraft and their rivals, the designers of guided missiles, are enthusiastic about the new equipment they can provide. Their enthusiasm is contagious, but enthusiasm is not a basis for making a choice, and possibly a fateful choice, between the many ingenious engineering suggestions, often radically different, which arise as a result of research and development progress. If we did not obtain the soundest advice available, we might be led to cling, through an excess of conservatism, to vehicles or weapons that are nearing their technological limits. On the other hand, playing optimistic hunches might lead us into blind alleys.

In Air Defence Command, we are keenly interested in the results of any research and development which might affect our task. With the effort that is being put into guided missile development, we naturally keep a close watch on the various projects. One of the developments on which our interest is centred is the air-to-air guided missile; a close liaison is maintained with such work being done in Canada. Ultimately fully automatic weapons will replace those in use today, but the transition will probably not be sudden, but rather a gradual process.

Conclusion

In conclusion, I would like to emphasize that we in Air Defence Command owe a very great deal indeed to the Canadian engineering profession. We do now have an air defence system in operation, admittedly not in its final form, but at least so far advanced that we can give a very good account of ourselves if required.

As to the future, we look forward to the completion of the presently planned system and to improvements which will increase our efficiency and also, will save manpower and money. An efficient air defence is a challenge to engineering progress. I hope this challenge will continue to be met in the future as well as it has been in the past. ✓

E.I.C.
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A New Approach to Sled Design

by

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Since 1945 the Canadian Army training program has taken increasing numbers of soldiers into the hostile environment of the Canadian winter. This has called for the transportation of personnel, supplies and special equipment over traekless, snow-covered country. So far the most practical means of oversnow transportation has been by the use of sled trains hauled by either tractors or snowmobiles. The conventional type of commercial bobsled has many undesirable features for such use, where much of the equipment carried is of a delicate nature and susceptible to damage through rough handling.

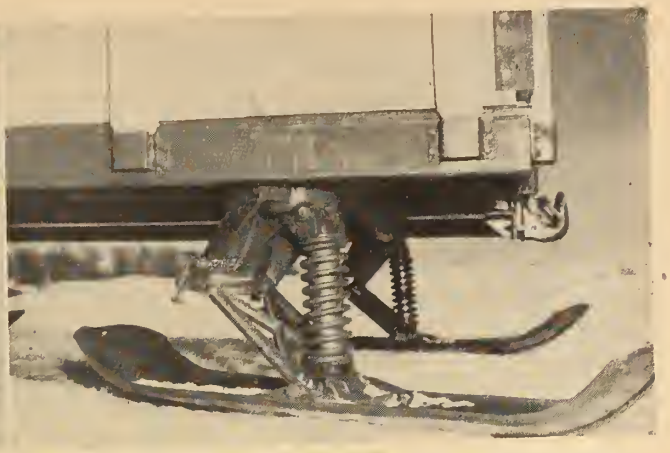
The stability of the conventional bobsled is sensitive to the distribution of its load; in rough eountry sleds frequently overturn, spilling the load and damaging both the load and the sled. Damage can also occur to the cargo and the sled from the repetitive shock loads imposed by an unsprung sled structure. The conventional, massive, bunk and bench design makes the basic sled heavy, with the result that the payload is only 60 per cent of the gross weight in the case of a two-ton cargo sled. The steering geometry currently in use is inefficient, depending for its operation on loose fits, slack ehains and skidding the runners. Due to the unstable steering geometry, bobsleds become damaged in use when many short radius turns are made.

As many man hours have been spent both on the trail and in workshops repairing damaged sleds, Canadian Army development engineers decided to approaeh the problem of sled design from a more scientific angle. The use of wood for the load carrying members was ruled out from the points of view of bulk, weight and the economics of supply. Ferrous alloys were kept to a minimum because of their weight. Light alloys were selected because of their attractive strength-weight ratio and consistent physical properties.

To increase the reliability and to reduce the possibility of damage to cargo, a sprung suspension was selected. To reduce the drawbar pull, with its attendant fuel economy faetor, an efficient steering geometry

This is the sled. Notice how all four runners skew as the drawbar is shifted, so that they track, as shown in the next illustration.

Track left by S-turns. Notice the perfect trackage.



The runner suspension, showing the knuckle casting, the spring and the hydraulic shock absorber inside the spring.

was designed. The load rating of the experimental sled was selected as two tons, to be within the towing limitations of existing snowmobiles. The final prototype has an unladen weight of 1,364 lb. and a 4,000-lb. payload. The unsprung weight is only 5 per cent of the gross weight of the loaded sled and the payload is 75 per cent of the gross weight.

The drawbar is made of 24 ST aluminum, with a towing eye secured by a shear pin stressed to fail at 8,000 lb. pull. A goose neck coupling at the sled end of the drawbar permits the drawbar to articulate about a horizontal axis and pivot about a vertical axis. This goose neck controls the steering geometry, turning all four runners as the position of the drawbar is varied. The steering might be classed as a "double Ackerman," all runners being tangent at all times to circles about a common centre.

The steering control linkage consists of light alloy tubes with adjustable clevises at their ends, the entire linkage operating in tension at all times. Each individual suspension unit is carried on tapered roller bearings and consists of a cast aluminum body, a coil spring in compression and a tubular hydraulic shock absorber located coaxially in the coil spring. The runner is fastened to the foot of this suspension system and is free to articulate about a horizontal pin and act as a walking beam. Runners are reversible, symmetrical and interchangeable between stations. They have a vee section and are swept up at each end. They are made of 24 ST aluminum with a steel keel which provides a wearing surface as well as acting as a guide.

The suspension units are carried on transverse beams located near the front and the rear of the sled. The drawbar pull is carried from the goose neck of the drawbar to the towing hook at the rear of the sled through a light alloy H extrusion. The transverse members carrying the suspension units are formed so that the H section sits on top of them at the centre, the outer ends being level with the top of the H section. This forms the basis of the floor structure. The floor is carried on a light alloy structural grid built about these three main members.

The platform is assembled by riveting, and a plywood floor is bolted onto the subframe. Longitudinal hardwood wear strips with metal on the wearing face, complete the floor assembly. Stake pockets bolted to the outer members of the sub-structure permit the platform to accept a range of superstructure types. A structural factor of safety of three or more was used throughout this design.

Critical loadings on stressed components are:

- Drawbar—60,000 lb. tension (calculated)
- Steering rods—20,000 lb. tension (calculated)
- Towing eye shear pin—8,000 lb. shear (calculated)
- Runner supported at ends only 3,000 lb. (confirmed by test)

Suspension factors are:

Dynamic coefficient . . .	2
Maximum deflection from static loading position .	4″
Maximum rebound from static loading position .	3″

Some of the components may appear to be over designed. However, in many cases physical dimensions are controlled by the requirements of rigidity or by fabrication techniques, analysis showing that in one component the safety factor runs as high as 27. One advantage of this feature is that in scaling up for larger sizes of sleds a number of components will be interchangeable so that, for example, the suspension assembly castings will also fit a four-ton sled.

An interesting feature of this design project is that manufacturing drawings were completed from the basic engineering on paper. The only changes made in actual production were substitutions of alternative materials due to availability, and some minor changes, such as in rivet locations, which were altered to facilitate production techniques.

On actual load test only two minor components required modification. At first glance the appearance of this sled may not be too prepossessing, but its performance is spectacular. In the deliberate trial abuse of the test runs, the sled was taken over snow banks and turns not encountered in normal use.

The action of the suspension and the floating runner gives an unusually smooth ride and keeps the platform level over all but the most severe obstacles. Executing a series of sharp S-turns in succession, the track left by the sled runners followed the trail of the towing vehicle almost exactly and there was no noticeable evidence of side slip or scuffing of the runners.

The stability base of the sled is the full width of the runner track, as opposed to the width of contact between bench and bunk in the case of the conventional sled. Taking into consideration the platform height and the height of the respective stability bases, the new sled can accept a load three times as high as the conventional sled can √

Sydney Foamed Slag as

A paper presented before the 67th Annual General and Professiona

Many of the physical and mechanical properties of Sydney foamed slag have bee determined and their engineering significance is discussed in this paper. For the aggre gate, the tests include the nature of the impurities, the sieve analysis, the durability the mortar-making properties, the thermal conductivity and the chemical behaviour For the lightweight concrete, data are given for strength; density; thermal conductivity volume changes; resistance to impact, to concentrated loads, to freezing and to thawing moisture penetration and acoustic properties. The use of the aggregate in construction is also discussed.

The Aggregate

Foamed or expanded slag is a cellular, light-weight, mineral aggregate produced from hot iron blast furnace slag by bringing it into contact with a limited amount of water. Such aggregate was first made from slag in Germany over 40 years ago. It was first marketed in the U.S.A. about 1928 as "Potsco" and began to be used commercially in Great Britain about 1934. In 1951 over 2,000,000 short tons, equivalent to 3,000,000 cubic yards were produced in 20 plants in the United States and Canada. The value of this aggregate was nearly $5 million.

This paper deals with the properties and engineering uses of the material produced at Sydney, N.S. by the Dominion Iron and Steel Co., Ltd., and with the concrete building units made from it. Since the characteristics of all foamed slag aggregates are approximately the same, so long as the gradation and weight per cubic foot are alike, the data in this paper may be considered as representative of this class of material (3).

Blast furnace slag is foamed or expanded by bringing controlled quantities of water into contact with the molten slag in such manner that the steam generated can convert the mass into a light cellular solid. This may be done either by machine or by allowing the slag to spread out on a wetter surface (1). The machines usually have revolving wheels or paddles, which bring water into contact with the hot slag and then throw it against a target plate. The static method consists in dumping the molten slag from the cinder ladle into a pit, truncated cone or tank, where a limited quantity of water can be introduced. The pit method is the one now used at DOSCO. Only enough slag is added to cover the pit bottom to a depth of a few inches and it foams until it is about a foot in depth. It is then quenched rapidly by a large volume of water. After quenching the foamed slag is removed and crushed to make a 0-3/8 in. product.

Foamed slag aggregate (Fig. 1) is highly cellular, but nevertheless non-capillary and non-hygroscopic. A large proportion of the cells are non-communicating and sealed away from the outer pores formed by crushing. The material dries quickly and in the air-dry condition weighs 50-55 lb. per cubic foot.

Results of Tests of the Aggregate

The aggregate is free from organic material and easily passes ASTM Specification C 40-48. When tested under the British Standard Elutriation Test, No. 877-1939, it was found that the weight of the heavy particles was 18.4 per cent of the total weight. These particles contained very small spheroids of iron, originally entrained in the molten slag. They are completely protected by a coating of slag and have no deleterious effect.

Grading as listed in Table I appears to be satisfactory.

Five cycles of the sodium sulphate soundness test gave the results of Table II.

Considering the porosity of the material, its resistance to deterioration is good. It meets the requirements of the ASTM specification.

The material passing the No. 30 sieve was compared with standard Ottawa sand by using both to make 1 : 2.75 cement mortar cubes. The standard sand specimens averaged 2,375 lb. per sq. in. when tested at 7 days, and 3,935 lb. per sq. in. when tested at 28 days. The lightweight aggregate specimens averaged 2,304 lb. per sq. in. when tested at 7 days and 2,645 lb. per sq. in. when tested at 28 days.

It may be pointed out that finely ground vitreous slag has considerable inherent hydraulic properties and quenched slag products con-

Table I — Typical Sieve Analysis of Aggregate

Sieve No	Retained per cent	Passing per cent	ASTM. limits Per cent passing
3/8-in.	0	100	95–100
4	12	88	55– 80
8	23	65	
16	23	42	
30	20	22	
50	10	12	10– 25
100	6	6	5– 15

a Lightweight Aggregate

Meeting of The Engineering Institute of Canada, Halifax, May, 1953.

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tinue to gain strength over long periods (4).

The thermal conductivity (*k*-value) of dry, loose foamed slag aggregate with bulk density of 51.9 lb./cu. ft. was determined by the Building Research Division, National Research Council of Canada, and found to be 1.03 B.t.u./hr. /sq. ft./ °F./in. thickness, which shows that it is a rather good insulator. It may be used as a dry, insulating fill in frame, hollow block, or cavity walls.

The rapid cooling of the molten slag prevents crystallization and leaves the material as a glass composed of silica, alumina, lime and magnesia, which constitute 95 per cent of the mass. The blast furnaces at Sydney produce a basic slag, but it appears that the rapid quenching is sufficient to prevent the formation of appreciable amounts of calcium orthosilicate. There is some evidence that devitrification of the aggregate may occur at an appreciable rate above 500°C. (932°F.), but the effect of such crystallization upon the strength of the aggregate is unknown. Slag should be used with caution in applications involving temperatures which would be deleterious to concrete. The strong hydraulic properties of vitreous basic slags cause the surfaces of the aggregate to behave like portland cement. They make a perfect bond with the latter due to both mechanical and chemical interaction and this bond develops strength with time.

This aggregate will not itself corrode steel, but lean nonplastic mixes produce porous concretes, and with such mixes precautions should be taken to prevent corrosion of the steel by atmospheric moisture and gases.

Slag is very stable in the presence of water, as evidenced by the following test. Two 100-g. samples of the aggregate were ground very fine, placed in distilled water and heated just below the boiling point for 70 hours. The water which evaporated was replaced automatically from calibrated flasks. The undissolved slag was removed by filtration, dried and weighed. The filtrate was evaporated to dryness and the residue analyzed by conventional methods. The results are shown in Table III.

Since this treatment is considered to be equivalent to many years of contact with rain and ground waters at ordinary temperatures, it shows that the aggregate is very stable in the presence of water.

Foamed slag aggregate has been used in the building industry in the Maritimes as lightweight concrete; lightweight building blocks; roof slabs, floor slabs and joists; loose insulation.

The lightweight aggregate concretes offer the advantages of low weight; nailability; ease of cutting, of channelling, of plastering and of stuccoing; good thermal insulation and excellent sound absorption. (5) Concrete having 25 to 45 per cent less weight than gravel aggregate concrete can be made by mixing the aggregate with cement and water to a semi-dry consistency. Lean plastic mixes cannot be placed because of the segregation of the cement paste, but rich plastic mixes are used to make roof slabs and similar products.

The data given in Table IV were obtained from cubes prepared in the laboratory from hand-mixed batches of nonplastic consistency. Machine-mixed concretes show much higher strengths (cf. Table V). In either case the bulk density, the compressive strength and the thermal conductivity all increase with the cement-aggregate ratio (6).

Foamed slag finds its widest

Table II — Loss of Weight in Sodium Sulphate Test

Sample Grading Between Sieve No.	and Sieve No.	ASTM. Specification C 88-46T Per cent passing Coarse sieve	Per cent of original passing finer sieve after test
⅜-in.	4	26	2.65
4	8	22	5.13
8	16	21	6.17
16	30	13	7.00
30	50	9	7.57
50	100	4	

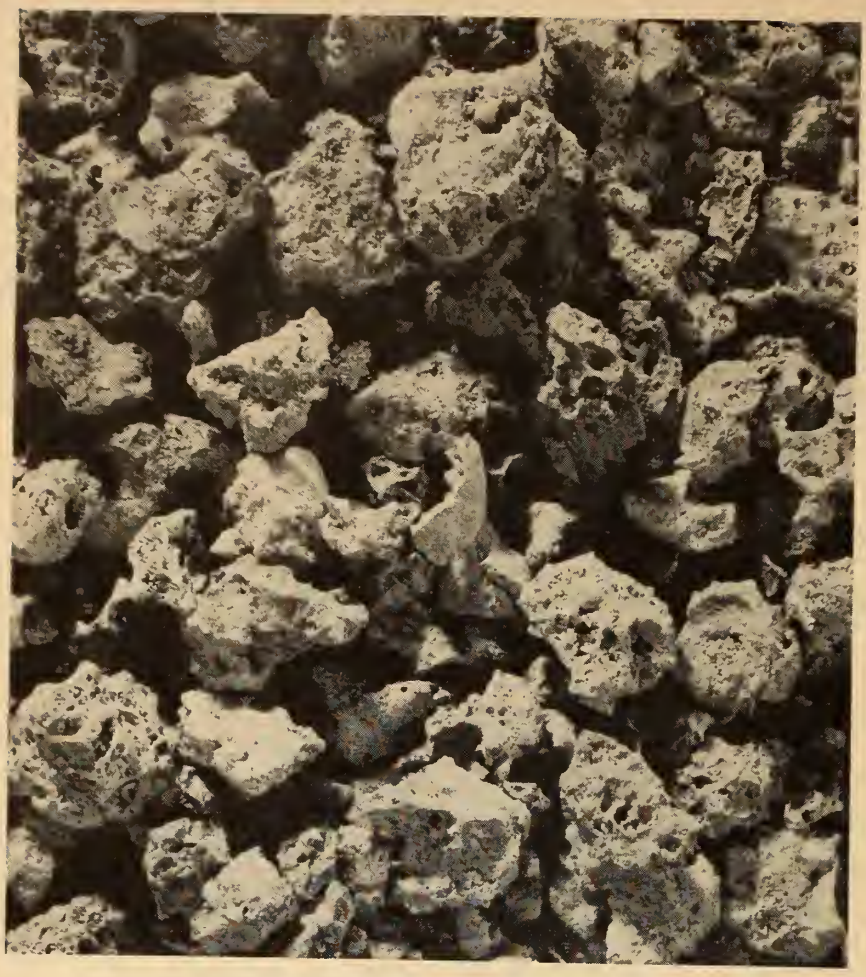

Fig. 1. Foamed slag aggregate.

field of application in the manufacture of precast building units (see Fig. 2). In these the initial shrinkage and much of the drying and curing shrinkage will have occurred before use. Extensive tests were conducted before standardized formulae and procedures for producing building units by machine could be perfected. Many tests were made, using various ratios of cement to aggregate; differing amounts of air-entraining agents; additions of fly ash, fine sand, or granulated slag; and different degrees of plasticity and vibration. The average results of the sampling done on some of the final products are shown in Table V.

The units comply with the requirements of ASTM. Specification C90-44 for hollow load-bearing concrete masonry units of Class B.

The compressive strength, thermal conductivity and density of hand-tamped specimens are all less than those for machine-vibrated samples of the same cement to aggregate ratio. Two specimens taken from the face shells of foamed slag blocks made from a 1 : 6 mix had bulk densities of 98 and 86 lb./cu. ft., compressive strengths of 1,310 and 1,190 lb. per sq. in., and thermal conductivities of 2.8 and 2.4 B.t.u./hr./sq. ft./F°./in. thickness.

Rich, vibrated, foamed slag concrete mixes of plastic consistency are used to produce concrete with compressive strengths as high as 5,000 lb. per sq. in. at 28 days for use in precast, reinforced concrete structural members such as floor slabs, roof slabs and joists.

The following tests were made on building blocks made by machine from a nonplastic mix, or on pieces and sections cut from them.

Tests have shown that the drying shrinkage and moisture expansion of the lightweight concrete made with nonplastic mixes of foamed slag and portland cement is somewhat greater than for gravel or stone aggregate mixes. Three different samples made from a 1 : 6 mix and thoroughly aged, were subjected to five cycles of drying to constant weight at 257°F., and soaking overnight in water. All length measurements were made at 68°F. The measured moisture expansion was 0.062 ± 0.002 per cent.

Thermal expansion tests were made on four moisture-sealed samples between 32°F. and 132°F. Each sample was given three cycles of heating and cooling without any change in weight. The resulting thermal expansion was $4.95 \pm 0.78 \times 10^{-6}$ in./in./°F.

ASTM. Test D3-18 for the toughness of rock was applied to one-inch diameter cylinders, one inch in height cut from the face shells of blocks. All five samples failed only when the hammer had fallen from a height of 5 cm. Marble usually breaks at a 3 cm. drop; limestone will withstand a 6 cm. drop. Thus these building units have greater resistance to impact and concentrated loads than marble and are nearly as tough as limestone. The units appear to be very durable and can be handled in transportation and on the job with a minimum of breakage.

Table III — Solubility of Ground Foamed Slag in Water

Sample	Water evaporated	Loss in weight	Analysis of dissolved material			
			SiO_2	R_2O_3	CaO	MgO
	litres	g. per 100 g.	g	g	g	g
1	7.7	1.1	.223	.088	.765	.005
2	8.0	1.6	.195	.076	.925	.006

Table IV — Properties of Some Lightweight Concrete Mixes

Cement: Aggregate ratio by volume	Bulk density lb./cu. ft.	28-day compressive strength lb. per sq. in.	Thermal conductivity *k*-value B.t.u/hr./sq. ft./-°F./in. thickness
1 : 10	72	247	1.7
1 : 8	76	320	—
1 : 6	78	560	—
1 : 5	83	832	2.2
1 : 4	85	1035	3.1
1 : 6 (gravel)	142	2180	10.20

Table V — Properties of Some Slag Building Units

Nominal size of unit	Average air-dry weight lb.	Aver. compressive strength over gross area per sq. in.
8 in. x 8 in. x 16 in. hollow blocks	33.25	829
4 in. x 8 in. x 16 in. hollow blocks	17.25	771
3 in. x 8 in. x 16 in. solid blocks	18.05	1261

Table VI — Insulating Value of Slag Block Walls

Description of Wall Assembly	*U*-values B.t.u./hr./sq. ft./°F.
Stucco, 8 in. hollow block, ¾ in. air space, plaster lath, plaster	0.21
Stucco, 8 in. filled block, ¾ in. air space, plaster lath, plaster	0.15
Stucco, 8 in. hollow block, ¾ in. air space, ½ in. insulating lath, plaster	0.17
Stucco, 8 in. filled block, ¾ in. air space, ½ in. insulating lath, plaster	0.13

Ten samples from six different mixes were subjected to two cycles a day of freezing and thawing. The samples from the thawing tank were drained for one minute before being placed in the freezer. After 50 cycles the length changes were negligible and the per cent loss in weight varied from 1.8 to 3.2. Even after 150 cycles there was no visible deterioration in any specimen. Outdoor freezing and thawing tests showed similar results, but the loss in weight was very small, so it appears that the laboratory weight losses were probably due to abrasion and solution.

The heat insulating properties of these hollow blocks may be calculated from their geometry and the *k*-value of the material. This value, as measured by the Building Research Division of the National Research Council of Canada, was 2.42 B.t.u./hr./sq. ft./°F./in. thickness when the dry bulk density was 84.7 lb./cu. ft. This has been used to calculate the *U*-value for the 8 in. by 8 in. by 16 in. blocks with the cells empty, or filled with loose foamed slag whose *k*-value is 1.03 B.t.u./hr./sq. ft. °F. in. thickness. In making these calculations it has been assumed that the transfer of heat is along parallel lines and that the hollow portion of the block is similar to a cavity wall. Thirty-five per cent of the block is solid and sixty-five per cent is hollow. The *k*- and *C*-values for air space and other materials were taken from the "Heating, Ventilating, Air-conditioning Guide, 1950." The actual thickness of the block is 7.6 in. and the face shells have a mean thickness of 1.62 in. Calculation yields *C*-values of 0.40 and 0.22 B.t.u./hr./sq. ft./°F. for the blocks with the cells empty and filled, respectively. The *U*-values for a 15-m.p.h. wind velocity on the blocks have been calculated to be 0.30 and 0.19. These values are comparable to the measured values reported for similar materials (7). The calculated *U*-values for some conventional wall assemblies are given in Table VI.

It should be pointed out that such walls have rigid insulation and will retain their thermal resistance indefinitely.

Since the insulating value of lightweight concrete is related to its bulk density, it is desirable to take precautions to prevent the transmission of water vapour from the interior to points in the wall where it might condense in cold weather. Condensed moisture will not do any harm to the block insulation except to temporarily increase its bulk density by a small amount, and since the moisture transmission through the block to the outside air is very rapid the condition of condensation will be only of very short duration. The thermal resistances and the vapour permeabilities of slag block walls embodying any suitable type of vapour barrier are such as to give an almost ideal arrangement.

Fourteen small walls were constructed of 8 × 8 × 16 in. hollow blocks and one small solid wall was made from hand-tamped foamed slag aggregate concrete. Each wall was 40 in. square and the face was kept flat. They were built on a trough-like steel base so that flow down the interior of the wall could be measured (see Figure 3). An area of 34 × 36 in. was exposed to a

Fig. 2. Floor slabs, joists and blocks made from foamed slag aggregate.

Fig. 3. Wallettes used for testing the resistance of walls to moisture penetration.

uniform spray of water from the top and the water was forced into the wall by an air pressure of 2 inches of water. The apparatus was built as nearly as possible like that used by the U.S. Bureau of Standards (8) and is shown in Figure 4.

All the walls were cured 28 days before testing, all joints were tooled except where stucco was applied and water ran over the wall at the rate of 40 U.S. gal./hour. A few of the observations on the walls are shown in Table VII where C = cement, L = lime, S = sand, CWP = cement-water paint, M = mortar, V = vinyl resin paint.

These tests gave conclusive evidence that strong winds will drive rain into a porous, unprotected wall; that most of the water drains down inside the outer shell of the wall and runs horizontally only at the mortar joints or other obstructions; that complete stoppage of the penetration can be achieved with cement-water paints or stucco; that mortars made with foamed slag and sand, together with a porous stucco, make the wall permeable enough to drain the penetrating water down inside its outer shell; and that paint films cannot bridge the pores of a coarse textured material. The pores should be filled with grout before painting.

Walls with the cells filled with loose foamed slag were observed by retesting walls Nos. 2 and 11. No. 2 was a bare wall and leakage occurred immediately, but did not appear at the central trough for some little time, because of the water holding capacity of the dry fill. Penetration through the back of this wall appeared to be increased. Wall No. 11 showed no leakage when the cells were filled with loose foamed slag. It may well be that the previous wetting had caused a curing of the cement-water paint. These test conditions are unusually severe, but building walls have been observed to behave similarly during severe and prolonged rainstorms.

The admixture of fine sand with the first coat of cement-water paint (No. 14) appeared to reduce the crazing of the paint in the large pores and increase its effectiveness. The various cement-water paints appeared to be equally effective when used according to the manufacturers' directions.

When this lightweight aggregate is used in non-plastic mixes to make porous, open-textured concretes, the latter become good absorbers and disseminators of sound. The bare

Table VIII — Absorption and Transmission of Sound in Slag Blocks

Frequency	128	256	512	1024	2048	4096
Absorption of slag blocks	—	.50	.39	.22	.19	.26
Absorption of Celotex	.10	.24	.63	.61	.63	.63
Transmission loss, Wall A	6.5	6.0	8.5	16.0	18.0	20.0
Transmission loss, Wall B	—	33.0	36.0	45.0	48.0	45.0
Transmission loss, Wall C	12.5	15.5	21.0	27.0	30.0	30.0

Table VII — Moisture Penetration Tests on Small Walls

Wall No.	Description of Wall	Time for leakage from central trough to commence, hr. and min.	Maximum rate of leakage from centre trough gal./hr.	Time for water to show on back of wall, hr. and min.	Maximum rate of leakage from back of wall, gal./hr.
1	1 : 3 CM, bare blocks	0 — 3	35.5	0 — 9	1.3
2	1 : 2 : 7 CLSM, bare blocks	0 — 2	34.5	0 — 5	1.1
3	1 : 2 : 7 CLSM+2 coats CWP-1	*n* 30 — 0	0	*n* 30 — 0	0
4	1 : 2 : 7 CLSM+3 coats CWP-2	*n* 30 — 0	0	*n* 30 — 0	0
5	1 : 2 : 7 CLSM+3 coats stucco	*n* 30 — 0	0	*n* 30 — 0	0
6	1 : 1 : 5 : 5 CL slag M. bare blocks	0 — 2	29.0	0 — 4	1.4
7	1 : 1 : 5 : 5 CL slag M+2 coats CWP-1	*n* 30 — 0	0	*n* 30 — 0	0
8	1 : 1 : 5 : 5 CL slag M+2 coats stucco	*n* 30 — 0	0	*n* 30 — 0	0
9	1 : 1 : 5 : 5 CL slag M+slag stucco	0 – 10	1.2	8 – 15	0
10	Masonry CM, bare blocks	0 — 4	33.8	0 — 8	1.6
11	1 : 2 : 7 CLSM, 2 coats CWP — thin	21 – 30	0.3	*n* 30 — 0	0
12	1 : 2 : 7 CLSM, 2 coats CWP — thick	*n* 30 — 0	0	*n* 30 — 0	0
13	1 : 2 : 7 CLSM, 2 coats VP	0 — 3	32.0	0 — 4	0.7
14	1 : 2 : 6 CLSM, 2 coats CWP+sand	*n* 30 — 0	0	*n* 30 — 0	0
15	Cast-in-situ bare wall, 10 in. thick	0 – 20	not done	*n* 24 — 0	0

"*n*" indicates that no leakage occurred so test was discontinued.

blocks can be used to make excellent sound absorbing walls which require no further treatment unless they are partitions. Then the intercommunicating pores make the unrendered wall a poor sound insulator. The sound transmission is reduced by applying any coating which seals the pores from the outside. If cement-water paints, ordinary plasters or acoustic plasters are used on both sides of a partition, the transmission can be made as small as that of partition walls made from gypsum blocks or hollow clay tile (7).

A few preliminary measurements of the transmission loss through three slag block walls have been made and the absorption coefficients have been derived from the reverberation times of the rooms. These are shown in Table VIII. In this table the absorption coefficient of slag blocks is compared with that of Acousti-celotex, Type C-1, cemented to plaster. Wall A was a bare slag block wall made of 4 × 8 × 16 in. hollow blocks with ½-in. mortar joints. Wall B was the same as Wall A, but had been plastered with acoustic plaster on both sides and then painted. Wall C was the same as Wall A, but was covered on one side with thin plywood nailed to 1 × 2 in. furring strips. The transmission losses are given in decibels, and every precaution was taken to eliminate space irregularity, the effect of openings, other materials in the room and extraneous noise. The measurements include a nominal geometrical loss which is small, but present in general use.

Wall C was not truly representative, because strips of wood had been accidentally placed in some horizontal joints, causing longitudinal cracks in the wall, and these may have increased the sound transmission. It appears that walls having a sound reduction of 50 decibels or more might be built by attaching furring strips to the 4-in. blocks by means of clips and finishing the wall with lath and plaster. Measurements should be made on double walls with special cores in order to retain the sound absorption while preventing sound transmission. The reduction in sound transmission of 6- or 8-in. slag block walls with the pores sealed has not been accurately measured, but by analogy with walls of expanded slag from other sources it is believed to be in excess of 50 decibels.

During World War II, the British Government undertook a program of research and development to discover improved methods for the rapid and economical production of buildings. Foamed slag was used to produce monolithic concrete structures which were found to be suitable for rehabilitation projects (9). The construction methods used by the British Ministry of Works in Northolt and Chesterfield have been adapted to Canadian needs and Maritime climatic conditions. Four units have been completed with a fifth under way. Some of the builders' experiences are noted below.

The methods used for the in-situ construction of buildings from foamed slag concrete are much the same as the standard methods of monolithic concrete construction using plywood forms. The differences are due to the fact that foamed slag concrete is not used in a plastic mix, hence it cannot be poured into forms, but a semi-dry mix must be tamped and vibrated into place. Since it will not flow, it is necessary to make provision for ramming or packing it into place beneath windows and other horizontal forms (11). It is interesting to note that wire mesh forms may be used instead of non-porous forms.

Since lean mixes of foamed slag concrete do not have much strength in tension, care has to be taken to provide adequate structural members over openings and at other points of severe stress. Nevertheless, the reinforced walls develop remarkable stability in a few days and withstand heavy winds.

Exterior walls should be sealed against the entrance of moisture by stucco or cement-water paints. Although the material permits rainwater to drain down through the outer layers, this method of handling water cannot be recommended, because of the increased thermal conductivity and the danger that percolating water will run inward at defective flashings above openings or at the tops of basement walls.

Subsequent construction is greatly simplified due to the nailability of the foamed slag concrete. Ordinary wire nails can be used to attach trim, partition studs, roof slates, window frames and other finish, but cut nails are better where they can be used. The concrete is easy to cut and fashion for openings and inserts. It can be sawn with an ordinary saw, but the latter is ruined for other work so it is better to cut it with a chisel (10).

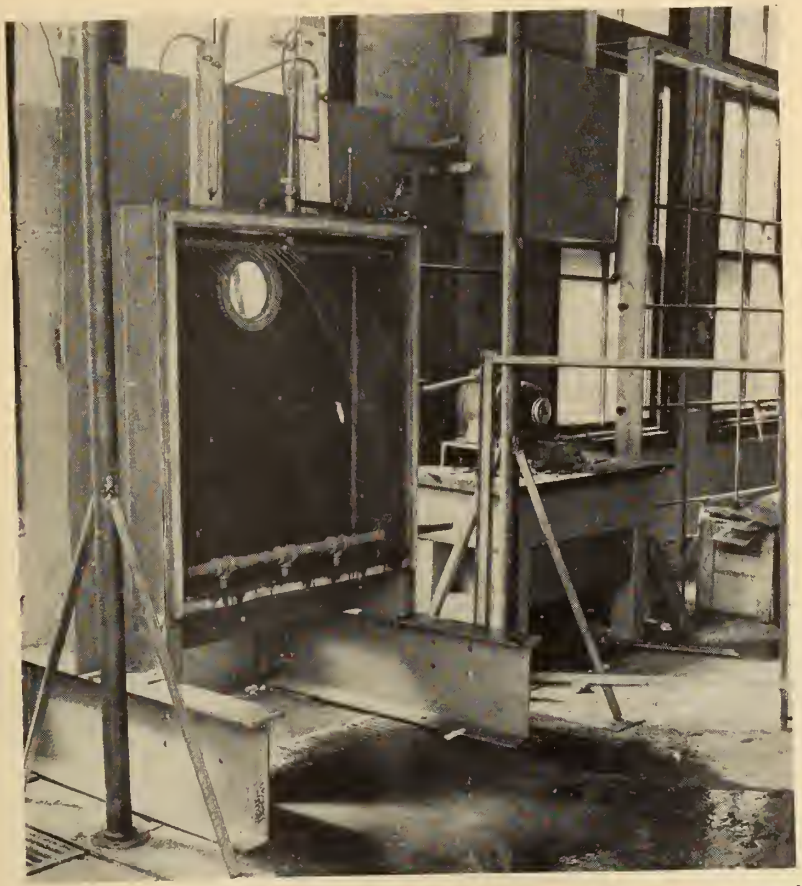

Fig. 4. Apparatus used for simulating a severe rainstorm against a wall.

Foamed slag concrete is suitable for pouring flat slabs in basementless construction where its non-capillarity and thermal insulating qualities are utilized. It can be floated, through the application of cement-sand grout, to a good level finish and the surface made suitable for attaching finished floors. Roof slabs can be poured in place on lath and floated to a proper slope to receive conventional built-up roofing; the concrete often provides sufficient insulation. Bridge decking can be built in the same manner as flat slab floors with a considerable saving in weight.

Masonry units made from foamed slag aggregate have been well received by the construction industry and by architects in Nova Scotia. Foamed slag bricks have been used for the construction of chimneys and for special spacing and architectural effects in walls. Over ninety-five per cent of the foamed slag produced has been manufactured into blocks, bricks, roof slabs, floor slabs and joists. Nearly a million of these units were made in Halifax, Saint John and Sydney in 1952.

To conclude, lightweight aggregate produced by foaming blast furnace slag is a clean, strong, durable, non-organic, non-hygroscopic, insoluble, cellular material which does not contain heavy impurities in deleterious form, does not corrode steel, nor give off gases. It has latent hydraulic properties and makes strong mortar cubes when crushed to a sand. It has good thermal insulating properties and is suitable for loose fill in walls and under floors.

The lightweight concretes made from the aggregate by using a semi-dry mix may be placed in-situ or manufactured into units. These concretes have low k values and are 25 to 45 per cent lighter than gravel aggregate concretes. Concretes of considerable strength may be made by using more cement. The volume changes due to temperature and moisture alterations are only slightly greater than those for gravel-aggregate concretes. These concretes have remarkable resistance to freezing and thawing and to impact. They are very suitable for rather severe moisture condensation conditions. The unrendered concretes are good absorbers and transmitters of sound.

The authors wish to thank the Dominion Iron and Steel Co. Ltd., and the L. E. Shaw Company for their permission to publish some of the data used in this paper. They also wish to thank the Building Research Division of the National Research Council of Canada and the Nova Scotia Research Foundation for their co-operation and financial assistance.

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Delayed Action Blasting

An important advance in the technique of blasting was exemplified recently when 2,200 pounds of dynamite were exploded by a Montreal contractor with scarcely any outward and visible signs that an explosion had taken place. No bang was heard — only a dull thud and the 6,000 tons of limestone broken by the blast lifted up gently a few feet at the surface, then settled quietly back into place.

This was made possible by the development of a new type of cap which produces detonations in a series separated by infinitely short intervals of time ranging from 25/1000ths to 75/1000ths of a second. For the blast referred to above there were 19 firing periods.

The rock broken by the firing of the charges primed by the first period will have scarcely begun to move when it is struck by the force of the charges from the next period and so on throughout the entire blast. The net result is exceptional confinement of the explosive gases and a churning, grinding action as the forces work at closely spaced intervals to make for a greater use of the energy available from the explosives than has heretofore been considered possible.

A full month of preparation was necessary to drill the 1,300 separate holes, each averaging 13 feet in depth, which were required for this undertaking. Altogether some 16,500 tons of rock were broken by four successive blasts. The first blast was the most spectacular from the point of view of the spectator and the picture at left shows its effect on the rock body. The second blast is believed to be the largest of its type yet attempted in any metropolitan area in Canada and is the one described in detail above.

Oil and Aviation

by

James E. Doolittle

Vice-President.
Shell Oil Company, Limited.

An address before The Canadian Club, Toronto, Ont., November 3rd, 1952.

I am delighted to be back in Toronto. I deeply appreciate the invitation to come and your kindly welcome. I am here this time wearing an oil man's hat. On some previous visits I wore an aviator's cap. Today once again the oil man's hat represents my primary interest. It has, with time out for World War II, ever since I first put it on almost 23 years ago, when I started working for Shell.

Combined with this is another strong interest — my first love — aviation. The two industries, oil and aviation, have become vitally important forces in the lives of modern nations. I am especially glad to have this chance to talk with you today because, here in Canada, these potent fields have achieved a significance that requires serious consideration.

The interdependence of oil and aviation with peace and prosperity represents a great and challenging responsibility for Canada in the years ahead. The subject is complex. To keep things as clear as possible, these comments are divided into three main parts; a statement of the new obligation; a brief analysis of how the obligation came about; and a few comments on what is being done to meet it, and what can be done to insure continued success in meeting it in the future.

The obligation is this. The inexorable processes of contemporary history are giving Canada an ever greater part in the big job of protecting freedom and helping to strengthen freedom-loving people everywhere. It is a large order. Freedom offers mankind the only chance for progress, usefulness and happiness. The full realization of a man's worth can come only when he is free to work out his own spiritual and material destiny; with proper safeguards to assure that the freedom does not become license to hurt another.

It is what one of our patriotic songs calls "Liberty and Law". This sort of freedom can come only in a democracy — and only with peace. For as many years as we can look ahead, peace will depend largely on the *strength* of peace-loving nations. Now, with the recent, rapid development of her great potential strength, Canada assumes an increasingly important role in world affairs.

Tracing the rapid growth of aviation, the author shows how the transition to jet propulsion will increase the demand for crude oil, and outlines how the oil industry is meeting that challenge. Discussing the world's oil supplies, he shows how western nations, though they lead in oil production, possess only forty per cent of known world oil reserves. Canada, herself a leading air power, must develop her crude oil reserves rigorously so she may fulfil the responsibilities she seems destined to bear.

Aside from the critical question of manpower, and I have learned through long experience the high quality of your manpower, national strength rests to a large extent on two things: oil and aviation. There has long been an intimate relationship between the two. That relationship is most important. In it and its changes lies the key to what I want to discuss today.

Growth of Aviation

The change in aviation has come smoothly and rapidly, as aviation has grown up. The entire history of controlled flight has unfolded within the memory of many of us here today. Safe and fast flight have become commonplace. Men, still active, who used to get all worked up telling each other that the Wright Brothers were crazy, now give only a passing glance at such newspaper stories as the recent one about the Canberra that flew across the Atlantic twice in eight hours.

We are entering a new era in air transportation. Jet airliners are capable of cruising eight miles up and at speeds in excess of 450 miles an hour. Military aircraft are regularly flying faster than the speed of propagation of sound. There are, at this moment, some 40 commercial aircraft in flight over the Atlantic, between this continent and Europe.

Although piston engines still account for the great majority of air miles flown all over the world, and piston engined aircraft will continue to fly the airways for years to come, the jet has become the real centre of interest for people looking ahead in aviation. Your country has a record to be proud of in the field of jet development. Canada, who has long been known for her great fliers, developed the first jet airliner on this side of the Atlantic.

This project was well advanced, when, unfortunately, the Korean war and the overall international situation called for maximum effort in the production of military aircraft. As a result, your great Toronto firm, A. V. Roe, has been forced to place the jetliner under wraps and concentrate on the perfection and production of the CF-100, a splendid all-Canadian twin engine jet fighter.

In addition, Canada is making other important contributions toward broadening the scope of military aircraft production in North America. In Montreal, Canadair is turning out F-86 Sabre Jets not only for the RCAF but also for the British and U.S. Air Forces. Two other aircraft, the two-seater T-33 Jet Trainer and the T-36 Trainer, are in production. In the T-36 also, Canada provides mili-

tary equipment for its U.S. partner.

At the de Havilland plant in Toronto, the Beaver is in full production. This extremely rugged, dependable plane, which is ideal for work in the bush, is being used by both the U.S. Army and the USAF as a liaison aircraft. Many other names, famous the world over in aviation, are now well established in this country — among them Rolls-Royce, Fairey and Bristol.

It is impossible to talk about pioneers in jet aviation without giving due credit to the magnificent work being done in Great Britain. The new Comet, designed and built by de Havilland, is so revolutionary that it has opened up entirely new fields of study in operation, navigation, meteorology, communications and flight procedure. The Comet flies high and fast, — between 30,000 and 40,000 feet and at average speeds of more than 400 miles an hour.

Yet despite this speed over the ground, the Comet, in addition to radio aids, uses astral navigation, basically the same kind used by the skippers of Nova Scotia fishing schooners, but with a special difference. It is streamlined and speeded up so as to project navigational data fast enough and far enough ahead to make them valid for a plane moving at such speeds.

The Comet brings new problems, — or makes old ones more difficult. Weather reporting and traffic control must be fast and accurate. The Comet must have accurate weather information long before it reaches its destination because, for efficient operation, it must fly straight for the field, begin letting down many miles away, then come in and land as directly as possible. You can't stack jet aircraft up over a field to stooge around for a couple of hours waiting for their turn to land. Their fuel consumption is too high — especially at low altitudes.

The fact that the Comet made its first history-making flight from London to Johannesburg only a few months ago and is now in regular service between England and South Africa is evidence of its excellence.

Jet transportation is here to stay. However, the emphasis in jet aviation is still heavily on the military. It will take time and more favorable world conditions to realize the full potential growth of jets for civil use. But the growth will come, and Great Britain and Canada are doing excellent jobs of encouraging it.

Continued progress is sure, and it will be rapid. However, it involves more than good design and construction of aircraft and the training of personnel. It also involves the problem of developing better fuels for the new planes. And here we come to a second aspect of the relationship between oil and aviation — a second aspect of the new challenge for Canada.

Development of Fuels

During the development of aviation, fuels have grown up with the planes that used them. Oil refiners have turned out better fuels as manufacturers have built better engines. In the early days, we didn't know too much about fuel characteristics and their relation to engine performance. If the fuel burned, the engine ran, and the plane flew, we figured something quite remarkable had been accomplished. Looking back on those days, I'm sure of it.

World War I provided the initial impetus for serious research into the problem of fuel composition for engines of advanced design. Men working on the problem have to watch two main points: performance and economics. For example, a certain hydrocarbon may be theoretically perfect as a fuel for engines of a certain advanced type. Let's say we can make this hydrocarbon from crude oil in our refineries. Let's say, also, that we can get only a little of it out of each barrel of crude, that if we ran our biggest refinery full blast to produce all we could of that product, we might get a thousand gallons a month.

That is not much, in view of the fact that such a refinery has a normal capacity of many million gallons a month — and not enough. So this is a case in which performance must give way to economics. There have been many such cases in the long and arduous search for better fuels. The final result has always been a fuel that gives excellent performance, yet can be produced in sufficient volume and at a price that will make it economically available to everyone requiring it.

The success of the researchers, manufacturers and others in the oil industry has been well demonstrated in the superior aviation fuels available today. When a conventional four-engine transport takes off from one of our airports, the engines may generate as much as 14,000 horsepower, enough to light a town of respectable size.

Yet only a short time before the plane took off, the heat energy converted by its engines into mechanical energy, had been locked deep in the earth as crude oil. The production of a new fuel, a new engine, a new plane, or any real scientific achievement, is like a bright pinnacle on top of a pyramid. People may notice the crowning achievement but frequently overlook the great mass of support under it. It takes a broad, firm base of research and experiment to provide the foundation for modern achievements.

The story of fuel development, manufacture and delivery in World War II bears this out. Perhaps the greatest challenge to the oil industry was that of supplying aviation gasoline of super high quality in the extremely large quantities needed by the allied air forces. The job was done. It has been said that the Battle of Britain was won on the strength of a few octane numbers.

In repeating this I do not minimize the importance of Radar, the excellence of the Spitfires and Hurricanes, and above all the courage and skill of the pilots; they are already legendary. I simply point out a basic truth in aviation. Airplanes cannot give their best performance unless they have the proper fuel for their engines. Everything else being equal, in the air war the side having an adequate quantity of better fuel will win. If General Forest were saying it today, he would say: "Victory comes to the side that gets there fastest with the mostest of the bestest."

Jet aircraft are just beginning to become an important factor in civil aviation. In military operations, on the other hand, jet aircraft are already a major factor and are responsible for a very important change in our aviation fuel requirements. Because of this, we are gradually completing a cycle in our demands on crude oil. In the early days of the oil industry, the big demand was for middle distillates, mainly kerosene for lamp oil. Gasoline was an annoying by-product.

Then, as the internal combustion engine developed, the call was for gasoline, and we began to concentrate on maximum yields of the lighter fractions of crude oil. Now come the jets, which burn petroleum products partly in the gasoline range, partly in the kerosene and heavier. For aviation usage, we are moving back toward greater demand on the middle fractions of the crude oil.

If you will permit a gross oversimplification of the refiner's problem; there are two important points to remember about jet fuel. First,

t appears that a suitable jet fuel is going to be far simpler to make than high octane aviation gasoline. That is not to say we have not done a lot of research on jet fuel, but, unless the specifications become unduly restrictive, jet fuel can be produced with less complicated equipment and lower capital investment. Second, a barrel of crude oil will yield considerably more wide boiling range jet fuel than gasoline.

West Has Less Reserves—More Production.

What are the implications of this from the point of view of national self sufficiency? If turbine fuel for jet planes can be made in large quantities with relatively uncomplicated manufacturing equipment, then the prime requisite of any nation wishing to power a jet fleet will be an adequate supply of crude oil. Thus, if a nation can make jet planes and has a supply of crude, it stands an excellent chance of being able to fly them.

You can draw your own conclusions. We all know which countries can make jet planes. Who's got the crude? As things now stand, the old world has the edge. The Middle East has 52 percent of known reserves. Russia has about 5.5 percent. The Far East has a little less than two per cent. No one can say how much more may be found. But in terms of actual discoveries, the old world has about 60 percent of the world's total. Of the new world's 40 percent, North American has 29 percent; South America, 11 percent.

Perhaps the most significant development in the crude oil picture since World War II has been the increases in the Middle East reserves — from 42 percent of the total three years ago to the 52 percent now. The Middle East countries are still among the free nations. It is most desirable that they remain free and that other free nations do everything within reason to demonstrate the advantages of remaining in the family of free nations.

However, the political and economic character of the entire Middle East has become increasingly volatile during the past few years. The possibility — in fact the virtual military necessity — of acquiring this conveniently located half of the world's proved crude reserves must certainly be a great temptation to an aggressor nation. A realistic attitude toward world affairs therefore forces us not only to consider and solicit every possible ally, but also to look closely to our positions within the boundaries of those nations most firmly dedicated to our principles.

And what is our position? Generally, good. In the United States, which has only a little more than a quarter of the world's crude, the oil industry is producing more than half of the total world production. The domestic economy and the mobilization program demand it. Yet despite these great withdrawals, discoveries of new reserves are more than keeping pace. Reserves are greater than ever. There is no immediate danger of running out. There is, of course, always the need for continued, successful exploration in order to maintain and increase reserves.

In this respect Canada has shone most brilliantly during the past few years. As recently as 1946, Canada's crude reserves were virtually negligible. Today they are on the order of one and three quarter billion barrels. No nation has shown greater activity or made greater relative progress. The Western Provinces today may be considered to offer as much promise as did the great oil-producing areas of the United States. As an illustration, the territory in Western Canada favourable to the accumulation of oil is calculated to cover approximately 700,000 square miles. It is almost three times as big as Texas. Only a relatively small amount of the area has been explored. Experts estimate that Western Canada's proved reserves should increase at the rate of about 300 million barrels a year.

Canada's Oil Vitally Important

The development and proper exploitation of her tremendous potential is what I described as the obligation and the opportunity facing Canada in the years ahead. It can be summed up like this: you have a strong position in the development of jet aircraft. The technical facts of life in the oil industry make crude reserves the dominant factor in supplying jet fuels. Fortunately, you in Canada have fast-growing crude reserves.

Now, what factors will maintain and improve Canada's position and help her development toward the great responsibility she seems destined to bear? First, your obvious determination to continue your excellent work in aviation; second, continued, vigorous efforts to develop still greater crude reserves; third, a carefully planned program for developing the oil industry as an integrated part of the economy as a whole.

That third point represents a long term proposition. Canada is still a net importer of crude oil, even though recent discoveries have been great. As your reserves and production grow, you will take less from outside, principally the United States. This will have two good effects. It will relieve the States of a substantial demand on their crude reserves. And it will release a sizeable block of economic potentital for other uses in Canada.

Work is already under way toward this end. Large sums of money are being invested in Canadian oil development. About $1,200,000,000 between 1946 and 1951. We in the United States are proud of our share in this, — a clear sign of American faith in the Canadian future. However, to have oil in the ground is not enough. In Canada, it has been found mainly in the interior. Large diameter pipe lines are required to carry the crude to refineries and products to market.

The interprovincial pipeline carries oil from the Alberta fields to the area around Superior, Wisconsin. From there, lake tankers carry oil to the huge Ontario refining centre at Sarnia. The transmountain oil pipeline, now being built from Edmonton to Vancouver, will supply crude oil to refineries on the Pacific coast. This gigantic engineering job, a 24-inch pipe line across the Rocky Mountains, will have a designed capacity of 200,000 barrels a day. This is far greater than the capacity of the refineries in Vancouver, so some Canadian crude oil will soon be seeking export markets. There is an over-all crude shortage on the west coast, so this is a natural outlet.

Finally, in the East, products pipelines are being laid to carry refined products from the manufacturing centres in Sarnia and Montreal to the huge consuming areas of Central Ontario. This vigorous expansion of your oil and aviation industries is not just a matter of manufacturing potential and great natural resources. Many countries have these in abundance.

Far greater assets are your people, your form of government and your way of life. Good government is a reflection of good people — stability combined with vision fits the Canadian people to shoulder their great responsibilities and accept the challenge that lies ahead. For many years Canada and the United States have shared this great continent which is rich in resources and opportunity. We Americans are proud to be your neighbours and your friends. √

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

Thirty-fifth Anniversary

With this issue *The Engineering Journal* marks its 35th anniversary. In May, 1918, the first of a continuous series of 420 monthly issues was presented to the members, and judging by the correspondence, was well received. It filled a need that was apparent for some time.

It is a fascinating experience to go over the old pages, to see the news items, the branch activities and the committee reports; to note so many problems that have been solved since and so many that remain with us. To see the personals and photographs of individuals and groups is to see the profession in the making. To those who were aware of these events and personalities, who practised their profession in those times, the old *Journals* are a treasury of history and opinion.

So that all members may enjoy the experience, it is proposed to print in each current issue of the *Journal*, extracts and comments on the corresponding number of 35 years ago. The series starts with this issue.

It is too bad that the illustrations cannot be reproduced satisfactorily. It is a rare treat to see how friends looked 35 years ago when they had more hair and less waist line. Alas, many whose faces appear in those issues are no longer with us, but it is pleasantly surprising to realize that so many associates of today, prominent engineers and business executives, were active in the Institute so long ago.

While it is expected that extracts from the old *Journals* will be of interest to many, it is realized that they afford but a sketch of the past. To those members who have their old copies it is suggested they re-read them. Only then will they get the full enjoyment; only then will they recall the contributions made to the Institute and the profession by their own associates, and earlier pioneers. Only then will they appreciate the great things of professional and national importance that have been initiated and carried out by The Engineering Institute of Canada in its long and useful life of 67 years.

The *Journal*—Thirty-five Years Ago

This is the first of a series of notes and comments on the material in the *Engineering Journals* of 35 years ago. It is planned to make this page a regular feature of all future *Journals*.

The following notes refer to the May 1918 issue of the *Journal*. That was the inaugural number of the publication which has appeared every month since that date, for thirty-five years.

The first of all editorials started like this—

> "Your faith that some day an intercommunicating medium would be provided, devoted to the welfare of the Institute and its members, assumes realization in the appearance of this, the first issue of The *Journal* of The Engineering Institute of Canada.
>
> "It is yours.
>
> "With you rests the decision as to its future, as to how far it shall be nourished and grow and wax strong in the likeness of the mental and moral qualities of the members of this Institute, for you are its sponsors and its guardians, even its progenitors. Until it has thrown off the swaddling clothes of its infancy, you will, like good parents, be not unduly critical of your own offspring.
>
> "Just how human it may become will be determined by the amount of active co-operative interest you take in it. Here, all that pertains to the doings of the Institute, will receive full and free discussion. In it, our activities, our aims and our expectations may find expression."

The sentiments expressed in those paragraphs are just as true today as they were then. The *Journal* is just what the members make it. An increase in membership and in activities has been followed by an increase in the number of pages.

COVER PICTURE

"Ladies and gentlemen, the Queen!"

Photograph by Dorothy Wilding

The first number, May 1918 had 84 pages. This May issue has approximately 180 pages.

In the year 1918 the president of the Institute was the late H. H. Vaughan. The vice-president was J. M. R. Fairbairn, who became the president in 1921. The councillors were Ernest Brown, Walter J. Francis, R. A. Ross, H. R. Safford and Arthur Surveyer. The editor and manager of the *Journal* was Fraser S. Keith to whom great credit is due for the whole enterprise.

The list of associate editors makes interesting reading and they are as follows: C. M. Arnold, Calgary, Frederick B. Brown, Montreal, J. B. Challies, Ottawa, A. G. Dalzell, Vancouver, J. N. deStein, Regina, George L. Guy, Winnipeg, A. W. Haddow, Edmonton, Geo. Hogarth, Toronto, W. Lefebvre, Quebec and E. G. Marriott, Victoria.

A great portion of this first issue of the *Journal* was devoted to the report of the first general professional meeting which was held in Toronto on March 26th and 27th. The theme of the whole meeting was the fuel power problem of Canada. On page five of this early publication there is a picture of all those attending the first professional meeting. In it can be readily identified a great many engineers who are still with us.

New Branches

At that time there were only 13 branches and it is interesting to see notes in this issue of the formation of branches at Montreal, Halifax and Saint John.

The members who signed the petition for the formation of a branch at Montreal were: R. F. Hannaford, R. S. Lea, Frederick B. Brown, J. A. Burnett, Geo. K. McDougall, Onisphore H. Cote, R. W. K. Massey, A. J. Matheson, Sir Alex. Bertram, L. G. Papineau, J. A. Duchastel, W. Chase Thomson, H. P. Borden, M. Brodie Atkinson, R. DeL. French and H. G. Hunter.

Those who signed the petition for the Halifax Branch were Messrs. C. E. W. Dodwell, Philip A. Freeman, Roderick McCall, T. M. Schenk, J. McD. Campbell, F. H. McKechnie, J. F. Pringle, J. N. Finlayson, J. L. Allan, Hiram Donkin, J. R. Freeman, Kenneth H. Smith, Chas. A. Hodge, W. P. Morrison, A. C. Brown, L. G. Van Tuyl and F. A. Bowman.

The Saint John Branch petition was signed by E. T. P. Shewen, A. Gray, C. C. Kirby, W. Colin Ewing, J. K. Scammell, H. H. Donnelly, G. N. Hatfield, R. H. Cushing, A. B. Blanchard, G. G. Murdoch, E. G. Horne and A. R. Crookshank.

News of the Ottawa Branch

That year the chairman of the Ottawa Branch was G. G. Gale, the secretary was J. B. Challies, who subsequently became president of the Institute in 1938.

The present custom of the Ottawa Branch of holding its meetings at noon in the Chateau Laurier was in existence in 1918. The report says "The practice of having a monthly luncheon at the Chateau Laurier at which men prominent in public and professional life are guests of the branch has proven to be an important factor in getting the engineers together for the purpose of mutual acquaintance and discussion of professional matters."

It is interesting to read of the construction of the Parliament Buildings under the heading "New Parliament Buildings near Completion." The article goes on to say "Except for the main tower which is to be two hundred and sixty feet high, all the steel work of the new Parliament Buildings is placed." The report states that members of the Ottawa Branch and their friends paid a visit to the new buildings.

The branch report takes two full pages which is quite a contrast with the length of the reports today, but at that time there were only 13 branches whereas today there are forty-five.

In the report reference is made to many engineers who were well known. Included are C. R. Coutlee, W. J. Stewart, A. A. Dion, S. J. Chapleau, R. F. Uniacke, G. A. Mountain, A. St. Laurent, John Murphy, Alex Gray. These gentlemen in succession had all been chairmen of the Ottawa Branch since it was organized in 1909.

Other people who get into the news are C. A. Magrath, Dominion Fuel Controller, subsequently an honorary member of the Institute; Noulon Caughon, who even then was talking about town planning; J. B. MacRae, who led an expedition from the branch to the new water supply intake.

It is interesting to see how the Institute even in those days was so closely associated with the National Research Council, which at that time was known as "The Council for Scientific and Industrial Research." Mr. Lesslie R. Thomson was appointed permanent secretary; Mr. J. B. Challies who had been acting as honorary secretary of the research council since its organization was carried on as honorary recording secretary.

Employment

The employment situation then was much simpler than it is now. As a matter of fact there are advertisements there for only seven engineers. No salaries are mentioned so it is difficult to make any comparison with today's conditions. The positions which are open described briefly are — superintendent for a manufacturing plant; a chemist for a manufacturing company; a junior mechanical for a railway drafting office; a junior to commence as a surveyor for a large mining corporation in Northern Ontario; a mining chemist for a mining corporation; an Ontario municipality is looking for a heating and ventilating engineer "one who is not interested in the manufacture of apparatus and appliances."

There is an interesting item of a personal nature which announces the birth of a son to Mr. and Mrs. J. R. W. Ambrose of Toronto. The heading on the two-line article is "A Future Councillor."

The branches which were in existence at that time were Calgary, Edmonton, Halifax, Kingston, Manitoba, Montreal, Ottawa, Quebec, Saskatchewan, Saint John, Toronto, Vancouver and Victoria. Thirteen in all, but there is a note after the heading for the Kingston Branch "Activities discontinued until the close of the War".

Product Design Scholarships

The National Industrial Design Committee has announced that it will again offer scholarships, each tenable for two years and worth $1,500 annually, to graduates of recognized universities or industrial design schools who are presently doing practical design work in Canadian industry but who wish to do further study in the field of product design. Two scholarships are available this year. Applications must be received before June 10, 1953.

Further information can be obtained by writing to Donald W. Buchanan, secretary, National Industrial Design Committee, Design Centre, Ottawa.

The President in the Maritimes

The photographs on these pages will complete the account of President Stirling's tour to the Maritimes, which appeared in the April Journal.

Fredericton, March 2

(Photos at top of page)

Left. Mrs. Turner, Dr. J. B. Stirling, Vice-Chairman Charlie Weyman, Premier H. J. Flemming and Mrs. Stirling.

Right. Bob Kavanagh, E.I.C. prize winner: Earl Bryenton, president of the Engineering Society of University of New Brunswick; and President Stirling.

Saint John, March 3

(Photos at left, and below)

A head table group. Left to right: A. G. Watt, chairman; Mrs. Stirling, R. M. Richardson, Mrs. J. M. M. Lamb, F. L. Doty, J. M. M. Lamb.

Another view of the head table. Left to right: Mrs. F. L. Doty, Mrs. A. G. Watt, President Stirling and A. G. Watt.

Left to right: Mr. and Mrs. Howard Townshend, and Mr. and Mrs. F. P. Vaughan.

Below. Left to right: Mrs. W. R. Godfrey, J. N. Flood, C. N. Wilson and Mrs. Robert Sadler.

Prince Edward Island, March 5

Below. Left to right: Mrs. V. A. Ainsworth, Dr. Stirling, V. A. Ainsworth, Mrs. Stirling and Mrs. Ron Smith.

In the photo at the right hand corner are: Ted Chandler, Bill Brennan, Larry Slaght, Mr. and Mrs. Clive Stewart, Mrs. Brennan, Mr. and Mrs. John Gilmore, Mr. and Mrs. Jim Hearn, Lou Hacker and Reg. MacLean.

Moncton, March 4

Top left. At the Moncton meeting. Left to right: Mr. and Mrs. W. J. Quartermain. A. R. Bennett, G. L. Dickson, Mrs. F. A. Dibblee.

Top right. Left to right: Mrs. R. F. Weir, Mr. and Mrs. R. M. Wickwire, Mr. and Mrs. M. F. K. Leighton, R. T. Sansom, Mr. and Mrs. R. L. Parsons, Mr. and Mrs. L. E. Trynor, Mrs. B. B. Hansom.

Centre left. Left to right: R. C. Boby, Archie Gordon, Mrs. K. R. Thompson, K. R. Thompson, W. D. G. Stratton, Mr. and Mrs. H. J. Williamson, and A. W. Purdy (in foreground).

Bottom left. Left to right: J. B. Stirling; Chairman W. D. G. Stratton, Councillor N. B. Eagles; V. C. Blackett, secretary-treasurer; L. Austin Wright, general secretary.

Amherst, March 6

(Top of opposite page)

Top row, left. Left to right: G. F. C. Bennett, Mrs. Macnab, Dr. H. W. McKiel, Mrs. C. D. Carter, Dr. Stirling.

Top row, right. Left to right: Mrs. Mackenzie, J. F. F. Mackenzie, Dr. Ross Flemmington, prosideut of Mount Allison University, Mrs. Flemmington, T. F. Kennedy.

Second row: Mrs. McKiel and N. B. Eagles at the head table; Dr. Stirling and Chairman C. D. Carter. The third picture shows G. F. C. Bennett, Halifax, C. D. Carter and N. B. Eagles, Moncton.

Halifax, Mareh 9

(Lower half of opposite page)

Third row, left. Left to right: G. F. C. Bennett, Mrs. J. B. Stirling, W. T. Dauphinee, Minister of Trade and Industry, Province of N.S., Mrs. R. A. Donahoe and I. P. Macnab.

Third row, right. Left to right: Mrs. G. J. Currie, Dr. A. E. Cameron, president of Nova Scotia Technical College, Mrs. I. P. Macnah, Mayor R. A. Donahoe.

Fourth row, left. Left to right: Mrs. A. E. Cameron. W. E. Jefferson, Mrs. G. F. Bennett, G. J. Currie.

Fourth row, right. At St. Mary's University, left to right: Father F. J. Lynch, S.J., president of the University; James Ryan, dean; and President John B. Sirling.

Cape Breton, March 10

(Photos on this page)

Top left. Left to right: Mrs. H. A. Marshall, Mr. Marshall, Mrs. Stirling, President Stirling; Mr. and Mrs. J. R. Wallace, C. N. Murray, Mrs. E. J. Prince and Mrs. C. N. Murray.

Top right. Left to right: Mr. and Mrs. G. W. Ross, Mrs. H. F. Arthur, Mr. Arthur and Miss J. Arthur.

Second row, left. Left to right: Mr. and Mrs. C. Kezel: W. A. Burgess, Mrs. R. A. Bradley and Mr. Bradley; Mrs. J. Todd and Mr. Todd.

Second row, right. Left to right: A. Foulis, Mrs. E. D. Brown, W. S. Wilson and Mrs. Wilson, Mrs. D. G. Burchell.

Third row. Left to right: H. A. Marshall, L. Austin Wright, President Stirling, J. Rod Wallace, chairman, E. J. Prince, secretary-treasurer.

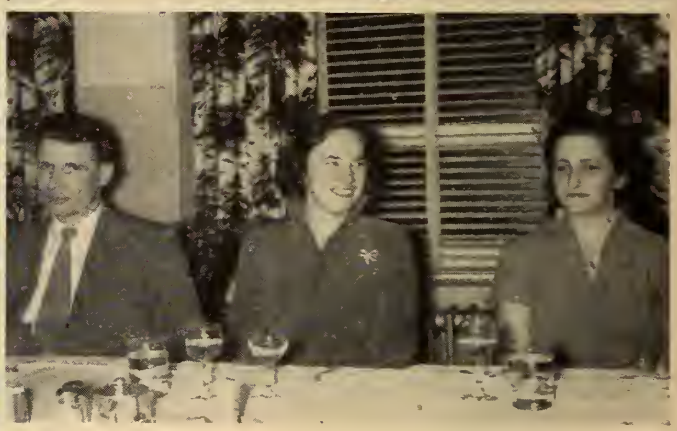
Bathurst, March 12

Top right. At the Bathurst Branch inaugural dinner, left to right: Mrs. R. C. Eddy, President Stirling, R. C. Eddy, chairman, and Mrs. Stirling.

Lower St. Lawrence, March 13

Centre right. Hubert Lebrun, Miss B. D'Anjou and Jean R. Menard.

Third row. Left to right: Mrs. Leo McLaren, President J. B. Stirling, Leo McLaren, and Mrs. Stirling; Mr. and Mrs. Leonard Auger and Mrs. Leopold Caron.



Dalhousie

The president was the guest speaker at the annual meeting of the Engineering Society of Dalhousie University on February 12.

This group includes, left to right: President J. B. Stirling, President Balcom, Prof. H. R. Theakston and Prof. G. Vibert Douglas.

Employment of University Graduates and Undergraduates

The following material is supplied in a regular bulletin issued by the Federal Department of Labour. It bears on a subject of interest and importance to members of the Institute, and gives figures which only the government can supply. Although there is real significance in the figures and comparisons, the bulletin makes no comment. Apparently it believes the significance will be apparent to the reader. The *Journal* believes the same thing and also refrains from comment. — Ed.

Attendance at Canadian universities has increased by about 175 per cent since 1921, while, in the same period, the number of young people of university age (18 to 22) in the population has increased by only 45 per cent.

However, the supply of professionally-trained young people has barely kept up with the demands in many fields in Canada in recent years, and in some fields there have been serious shortages.

What about the future? From the point of view of population increase alone, the number of university graduates could not be expected to be adequate, since there are actually fewer young people today between the ages 15 to 19 than there were in 1939 due to the low birth rate of the depression years. An important source of university students — veterans from the Armed Forces of World War II, obtaining their education through government assistance — has almost ceased to exist. Immigration is a source of supply, but past experience has shown that only a small proportion of immigrants are professionally-trained, and these must be balanced against Canadians with similar training who leave the country each year.

It would appear that if future supplies of university graduates are to keep up with demands, the proportion of young people seeking higher education must continue to increase, at least for some years to come.

One strong indication that the trend towards higher university attendance will continue is found in the remarkable rise in high school attendance in recent years. Since 1921, high school attendance has increased by 150 per cent, while the number of young people of high school age has increased by only 29 per cent.

A total of 12,402 young men and women are now completing their final year in university, compared with last year's graduating class of 11,500. All these graduates will not be available for employment, however. Past experience indicates that wastage may cut down the classes by as much as four or five per cent. Perhaps ten per cent will return to university for post-graduate work, and many of the young women will be making plans to get married. For the next few years, total graduations will remain at about the 1953 level — the present registrations in the 1954 graduating classes total 10,455, in the 1955 classes 12,073, and in the 1956 classes 12,140.

Included in the 1953 graduating classes are the following groups:

Arts	3,547
Engineers	1,317
Education	1,094
Commerce, Business Administration	809
Science	752
Medicine	732
Nursing	536
Pharmacy	425
Social Work	396
Household Science	347
Law	314
Agriculture	287
Dentistry	213
Chartered Accountancy	37
Journalism	22

Total hirings of engineers, including those of newcomers to Canada and transfers from job to job, were 4,000 in 1950, 5,000 in 1951, and an estimated 4,000 in 1952. The number of graduates in the same years were 3,521 in 1950, 2,427 in 1951, and 1,700 in 1952. Enrolment in the engineering graduating classes of 1953 is as follows:

Civil	405
Mechanical	296
Electrical	235
Chemical	155
Mining	46
Eng. Physics	45
Geological	28
Eng. and Business	28
Forestry	24
Metallurgical	19
Petroleum	18
Agricultural	12
Aeronautical	6

As in previous years, the National Employment Service has sent a questionnaire to about 7,000 employers in Canada to estimate their requirements this spring for graduates, and for undergraduates in summer employment. The returns received so far indicate a strong demand. Up to February 24, 10,240 jobs had been uncovered, of which 3,444 were for graduates and the remainder summer jobs for undergraduates. In addition, the federal civil service will require about 500 new graduates and others will be entering the Armed Forces.

News of Other Societies

The National Association of Corrosion Engineers, an American association of individuals and organizations concerned with the control of corrosion, has authorized the formation of a Canadian regional division. Canadian membership in N.A.C.E. has tripled in the last year and is still growing. The following temporary executive has been appointed: chairman, G. I. Russell, Union Gas Co. of Canada, Ltd., Chatham; vice-chairman, Dr. L. W. Shemilt, University of B.C., Vancouver; secretary-treasurer, G. M. McPherson, Imperial Oil Ltd., Calgary; membership chairman, W. F. Croft, Koppers Products Ltd., Toronto.

A Toronto section has been organized and it is hoped soon to form sections in Montreal, Hamilton and Vancouver. Others will be formed as soon as local membership is large enough to support them.

A third biennial briquetting conference will be held on August 31 and September 1 at Banff Springs Hotel, Banff, Alberta. The briquetting industry of the United States and Canada together with the Natural Resources Research Institute of the University of Wyoming are developing a program of papers and plant visits of interest.

Information may be obtained from Neal Rice, coal research chemist at the Natural Resources Research Institute, University of Wyoming, Laramie, Wyoming.

The 63rd annual convention of the **Canadian Electrical Association** will be held at the Manoir Richelieu, Murray Bay, Que., June 25 to 27, 1953.

Special train and boat accommodation is being arranged, and registration forms are available from

the managing director of C.E.A., Room 704, Tramways Building, Montreal 1.

The **Canadian Construction Association** (384 Bank St., Ottawa, Ont.) has announced that its 1953 regional meeting will take place at the Elgin House Hotel, Muskoka, Ontario, June 22-24. This will be the first post-war regional meeting held in the central provinces and a record attendance is anticipated.

All reservations should be sent to the C.C.A. Head Office.

New developments in fungicides and insecticides, and the latest findings in medicinal chemistry and industrial chemistry will be among the subjects discussed by the 100 speakers at the 36th annual conference of **The Chemical Institute of Canada**, Windsor, Ont., June 4, 5, and 6, 1953. The program will also include eight papers on rubber chemistry.

The office of C.I.C. is at 18 Rideau St., Ottawa 2, Ont.

Meetings of two divisions of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) are announced:

The annual conference and exhibit of the A.S.M.E. Oil and Gas Power Division, will take place at Hotel Schroeder, Milwaukee, Wisconsin, May 25 to 28, 1953.

The Management Division of A.S.M.E. is planning the seventh annual management executives conference. This invitational conference will take place October 25 to 28, 1953, at the Skytop Club, at Skytop, Penna., and will be limited to 80 participants. T. A. Marshall, Jr., is chairman of the conference committee.

At the 10th annual meeting of the **Canadian Fan Manufacturers' Association** on February 17, 1953, the following officers were elected for the ensuing year: W. C. Caldwell, president; C. W. Johnson, vice-president; and George W. McCormick, Jr., secretary-treasurer.

For the 1953 annual meeting of the **American Society for Engineering Education**, at the University of Florida, Gainesville, June 22 - 26, information can be obtained from Prof. C. Reed, head of the mechanical engineering department at the University of Florida.

Listed in a calendar of future meetings of the **Institute of the Aeronautical Sciences** (2 East 64th Street, New York 21, N.Y.), are the following: July 15 - 16, the annual summer meeting and honours dinner, I.A.S. Building, 7660 Beverly Blvd., Los Angeles, Calif.; Sept. 7 - 17, fourth international aeronautical conference, London, England, sponsored by I.A.S. and Royal Aeronautical Society; and Dec. 17, the seventeenth Wright Brothers Lecture, U.S. Chamber of Commerce Building Auditorium, Washington, D.C.

The first Basic Materials Conference will be held June 16 to 18 in New York, concurrently with the first Exposition of Basic Materials for Industry. Information about the conference, which will be held in the Hotel Roosevelt, can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

The American Welding Society (33 West 39th Street, New York 18, N.Y.) will hold a national spring technical meeting at the Shamrock Hotel in Houston, Texas, June 16 - 19, 1953, accompanied by a four-day welding and allied industry exposition in the Shamrock Hall of Exhibits, adjoining the hotel.

Illinois Institute of Technology will be host to the ninth national conference on industrial hydraulics October 8 - 9, 1953, at the Hotel Sheraton in Chicago.

Conference director will be O. E. Teichmann of Armour Research Foundation, Illinois Institute of Technology. Carl E. Schmitz, vice-president of the Crane Packing Co., will be associate director.

More than 100 industrial organizations and several professional societies help Illinois Tech stage the Conference on Industrial Hydraulics each year.

The American Society for Testing Materials (1916 Race Street, Philadelphia 3, Pa.) has announced some details of the program of the annual meeting to be held June 29 to July 3, at Atlantic City, N.J. The H. W. Gillett Lecture will be delivered by Jerome Strauss, whose subject is "Micrometallurgy"; and the Edgar Marburg Lecture, on the subject "An Excursion in Petroleum Chemistry" will be given by Dr. Frederick D. Rossini.

The sixth national plastics exposition will be held the week of June 6, 1954 at Cleveland, Ohio, in the Cleveland Auditorium. This plastics exposition is sponsored by **The Society of the Plastics Industry, Inc.**, (67 West 44th St., New York 26, N.Y.).

The twenty-sixth international congress of industrial chemistry will take place in Paris, June 21 - 27, 1953.

Information can be obtained from the **Society of Industrial Chemistry**, 28 rue St. Dominique, Paris (VII).

Correspondence

January 4, 1953.

Mr. Editor,
The Engineering Journal,
Montreal, Quebec.

I should like to put forward two suggestions regarding the form of the *Journal*.

As the *Journal* is now made up, the annual bound volume is a somewhat bulky affair including many advertisements and other items of transient interest such as employment service, business and industrial briefs, news of the branches, etc. I believe that most members would prefer to have only the papers together with the library notes included in the consecutively-numbered pages. Possible other features deserve inclusion, but it would seem desirable, in general, to include items of permanent interest.

My other comment concerns the editorial which is usually concealed in "From Month to Month". These excellent editorials deserve more prominence and could very well be placed immediately after "Contents".

I do not wish to close without thanking you for providing a most attractive and informative journal for the engineers of Canada.

Yours very truly,

(*Signed*) WILLIAM SHELSON, JR. E.I.C.

Toronto, Ont.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, April 24, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

P. Bousquet, *Quebec.*
E. J. Brick, *Montreal.*
A. N. Campbell, *Montreal.*
W. Czerwinski, *Montreal.*
G. R. Dance, *Kingston.*
R. E. David, *Montreal.*
A. A. Eldridge, *Sudbury.*
H. G. Farish, *Montreal.*
L. K. Hart, *Guelph.*
J. O. Holt, *Peterborough.*
R. B. Howland, *Philadelphia.*
R. G. Huggett, *Montreal.*
W. A. H. Humphries, *Copper Cliff.*
F. Klein, *Montreal.*
A. A. Laughlin, *Winnipeg.*
S. McCune, *Toronto.*
B. P. McDonough, *Sudbury.*
R. C. March, *Montreal.*
F. W. Martin, *Montreal.*
R. G. K. Morrison, *Montreal.*
F. A. Price, *Quebec.*
T. B. O'Neill, *Montreal.*
A. Rawson, *Montreal.*
T. C. Robertson, *Copper Cliff.*
F. S. Rogers, *Quebec.*
W. H. Roxburgh, *Atikokan.*
A. E. Salter, *Toronto.*
G. T. G. Scott, *Toronto.*
A. B. Sexstone, *Sorel.*
H. I. Stricker, *Toronto.*
N. Tchartorisky, *Montreal.*
H. Tetu, *Montreal.*
M. D. Tims, *Quebec.*
G. L. Williams, *Montreal.*

Juniors:

N. O. Andersen, *Clinton.*
S. Bonk, *Sudbury.*
J. Chmielinski, *Shawinigan Falls.*
J. D. Cumming, *Maitland.*
E. D. Evans, *Sudbury.*
C. N. Kirby, *Ottawa.*
D. M. McDonald, *Glasgow.*
C. Markopoulos, *Montreal.*
S. Rabin, *Montreal.*
P. Smits, *Shawinigan Falls.*
W. A. Thompson, *Montreal.*
G. A. Walker, *Ft. William.*
R. G. Wolff, *Montreal.*
J. C. Wood, *Kingston.*

Transferred from the class of Junior to that of Member:

K. L. Broe, *Trail.*
P. A. Charest, *Montreal.*
K. L. Hall, *Vancouver.*
E. S. Rhodes, *Vancouver.*

Transferred from the class of Student to that of Junior:

S. P. Fox, *Vancouver.*
N. J. Frenette, *Montreal.*

The following Students were admitted:

R. Akister, *Manitoba.*
J. D. Belanger, *N.S.T.C.*
W. V. Boyles, *Memorial.*
W. S. Budgell, *N.S.T.C.*
A. Buzzer, *McGill.*
M. M. J. Chagnon, *Royal Military.*
J. G. Davidson, *New Brunswick.*
R. J. Davies, *Royal Military.*
J. L. Holman, *Alberta.*
D. G. Jeans, *Memorial.*
R. McWhinnie, *Toronto.*
R. C. Miller, *Alberta.*
J. W. K. Moores, *N.S.T.C.*
T. G. Phelan, *Royal Military.*
W. D. Sharpe, *Memorial.*
D. M. Simmons, *Alberta.*
G. J. Staples, *Memorial.*
J. P. Steinhauer, *Memorial.*
W. A. Weir, *Alberta.*

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Student to Junior:

R. Z. Zachary

SASKATCHEWAN

Members:

K. C. Coulter
K. D. Kirkham
D. E. Powley
G. H. Wilks

Student:

C. L. Ellard

Junior to Member:

R. L. Moyer
G. T. Stanger

NOVA SCOTIA

Members:

W. M. Rice
P. Wendt

Junior to Member:

K. G. Thompson

NEW BRUNSWICK

Member:

J. G. Fitzpatrick

Junior to Member:

G. E. Franklin
J. F. Graham
L. Harriott
O. I. Logue
G. C. Mouland
J. W. G. Scott.

QUEBEC

Member:

K. J. Miller

Headquarters Records

Each time the *Journal* or other Institute mail is dispatched we are advised of undeliverable items due to incorrect addresses. Our records staff must follow up these changes and the regular service to members suffers thereby. *Please* advise headquarters when your address or occupation changes. The form below can be completed, clipped, and mailed to headquarters in a few moments.

Please Print

Name .....
Surname Given names

Home Address ..... ☐

Employer .....

Employer's Address ..... ☐
(Check address to be used for Institute mail.)

Product or Service .....

Position or Title .....

Degree, Year & College .....
Advise Headquarters Promptly of Changes

Personals

News of the Personal Activities of Members of the Institute

Randolphe William Diamond, M.E.I.C., of Trail, B.C., executive vice-president of the Consolidated Mining and Smelting Company's western region, has been presented with the Institute of Metals' Platinum Medal, thus becoming the first Canadian to receive the award of the British organization whose branches exist in all parts of the world.

The presentation was made by Dr. Gerard Letendre of Quebec at a dinner on April 20, 1953, in recognition of Mr. Diamond's "outstanding service to the nonferrous metallurgical industries."

R. W. Diamond, M.E.I.C.

In making the presentation Dr. Letendre said that Mr. Diamond's wide scientific and technical knowledge, which forms the basis on which metallurgical industries must be built, is allied with executive abilities of the highest order.

"If he has partaken of the qualities of the materials with which he has worked all his life," said Dr. Letendre, "the qualities of metals reflected in him are shown not in any hardness of disposition, but rather in fineness of temper."

Wide recognition of the high quality and value of Mr. Diamond's work is evidenced by the numerous honours already conferred upon him. These have included the McCharles Medal and Award, the Leonard Medal, the Selwyn G. Blaylock Medal, the Julian C. Smith Medal, honorary degrees, and the presidency of the Canadian Institute of Mining and Metallurgy.

Mr. Diamond was born in Campbellford, Ont., in 1891, and has been connected with Consolidated Mining and Smelting Company since 1917.

He has received recognition for new methods introduced in the extraction of ore. In 1948 he was chosen as the first recipient of the Selwyn G. Blaylock Medal "for distinguished service to Canada through exceptional achievement in the field of metallurgy, and for his contributions to the eminent position of the Consolidated Mining and Smelting Company of Canada Limited.

Leaders of many Canadian industries were on hand to see Mr. Diamond receive his new award. The guests included R. E. Stavert, M.E.I.C., president of Consolidated Mining and Smelting Company; Jules Timmins, president of Hollinger; O. A. Dufresne, M.E.I.C., Quebec Deputy Minister of Mines; C. Gerow, secretary-treasurer of the Canadian Institute of Mining and Metallurgy; H. J. Roast, M.E.I.C., former vice-president of Canadian Bronze; R. F. Shaw, M.E.I.C., vice-president of Foundation Company of Canada; Dr. J. B. Stirling, M.E.I.C., president of the Engineering Institute of Canada, and W. H. Durrell, general manager of the Iron Ore Company of Canada.

W. F. Mainguy, M.E.I.C.

W. F. Mainguy, M.E.I.C., executive vice-president of the Shawinigan Water and Power Company, was elected a director of the Company at the annual general meeting held recently.

Mr. Mainguy graduated with honours in electrical engineering from Queen's University and joined the Shawinigan organization in 1938 as a junior engineer with the Power Engineering Company, now Shawinigan Engineering Company Limited. Four years later he was transferred to the commercial and distribution department of the Shawinigan Water and Power Company as power sales engineer.

In 1943 Mr. Mainguy was appointed personnel manager and was made vice-president in charge of distribution in 1947. He was appointed executive vice-president in March, 1952.

H. S. Van Patter, M.E.I.C.

H. S. Van Patter, M.E.I.C., vice-president and director of Dominion Engineering Works Limited, was elected a director of Dominion Bridge Company Limited at the Company's recent annual meeting.

He is a 1912 M.A. graduate in mathematics of Queen's University, and a 1915 civil engineering graduate from the same university.

After overseas service during World War I with the Third and Fifth Divisions of the Canadian Field Artillery, and a year's lecturing in mathematics

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* THE ONLY INTEGRAL FINNED TUBE. Patented in Canada and patents pending.

at Queen's University, he joined the engineering staff of Dominion Engineering in 1920. Shortly after this the Company embarked in the hydraulic turbine business.

In 1925 Mr. Van Patter was placed in charge of the hydraulic division of the Company as hydraulic engineer and chief engineer.

W. A. Williamson, M.E.I.C., has been appointed manager of the western region of Reliance Electric and Engineering (Canada) Limited.

A graduate of the University of Toronto in 1934 in electrical engineering, Mr. Williamson was associated with the International Nickel Company Limited and Canadian General Electric Company Limited before joining Reliance. With Canadian General Electric Company Limited he held positions as manager of that Company's New Brunswick and British Columbia divisions respectively, and finally as manager of the Sales Apparatus Division in Toronto.

W. A. Williamson, M.E.I.C.

In his new position Mr. Williamson will be in charge of sales of all Reliance products in British Columbia, Alberta, Saskatchewan and Manitoba. His headquarters will be located in Calgary, Alberta, when the new Reliance office opens there in June.

Mr. Williamson is a director of the Saint John, N.B., Board of Trade, a member of the Wholesale Bureau, Vancouver Board of Trade, and has been a member of the branch executive of the Engineering Institute of Canada in both Saint John and Vancouver.

Rear-Admiral (E) G. L. Stephens, C.B.E., R.C.N., M.E.I.C., of Ottawa, who is retired from active service, was re-elected president of the Canadian Naval Service Benevolent Trust Fund for the sixth consecutive term at the annual meeting of the Fund at Naval Headquarters in Ottawa.

Rear-Admiral Stephens was the first Canadian to hold the rank of Engineer Rear-Admiral.

He joined the Canadian Naval Force in 1910 as engineer-room artificer. His advancement to the commissioned rank came during World War I and he served, prior to his retirement, as senior engineer on both Canadian coasts. In 1941 he was appointed engineer in chief of the Royal Canadian Navy and was stationed at Naval Service headquarters in Ottawa.

H. W. L. Doane, M.E.I.C., has been re-elected representative of the Association of Professional Engineers of Nova Scotia on the Institute Council.

Manager and director of the Standard Paving Maritime Limited in Halifax, N.S., Mr. Doane received his early

H. W. L. Doane, M.E.I.C.

education at the public and high schools of Halifax. He attended Dalhousie University and the Nova Scotia Technical College.

Mr. Doane served with the Canadian Artillery and with the Imperial Forces in Egypt, Palestine and France during the first war with the rank of major. Upon his return to Canada he organized the Ninth Siege Battery.

He practised as consulting engineer previous to becoming assistant city engineer for Halifax during 1919 to 1928. In 1928 he was appointed manager of Argyle Motor Services in Halifax and continued in this capacity until 1931 when he became manager of Standard Paving Maritime Limited. He was appointed in 1944 manager of the Halifax Utilities Commission.

Mr. Doane joined the Engineering Institute in 1919. He has been most active in Halifax Branch work.

Air Commodore M. M. Hendrick, O.B.E., R.C.A.F., M.E.I.C., has returned to Canada having attended the latest course of the Imperial Defence College in London. He is now stationed at R.C.A.F. headquarters in Ottawa as chief of telecommunications.

Air Commodore Hendrick was named air attache in Washington, D.C., in 1950. He was previously senior staff officer at North West Air Command headquarters in Edmonton, and earlier, commanding officer of the R.C.A.F. station in Edmonton.

John W. Demcoe, M.E.I.C., has been appointed superintendent of Canadian National Railways Montreal Terminals and St. Jerome Division in Montreal.

He has been with the Company since graduation from the University of Manitoba in 1939.

Colonel K. H. McKibbin, M.E.I.C., has been promoted from the rank of lieutenant-colonel. He is presently stationed in Ottawa.

Colonel McKibbin is a graduate of the Royal Military College, class of 1936, and of Queen's University in mechanical engineering, class of 1938.

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Captain J. M. Elliott, R.C.E.M.E., M.E.I.C., is presently stationed at R.C.E.M.E. headquarters in Kingston, Ont.

He was formerly with John Bertram and Sons Company Limited in Dundas, Ont.

Captain Elliott is a mechanical engineering graduate of Queen's University, class of 1939.

Henryk J. Walocha, M.E.I.C., has opened private consulting offices in civil and structural engineering in Windsor, Ont. He is specializing in reinforced concrete structures including heavy foundations, river and harbour works, industrial and municipal buildings, oil refineries, cylindrical shell roofs, domes and prestressed concrete.

Mr. Walocha was formerly with Giffels and Vallee Company in Detroit, Mich.

He received his B.Sc. degree in engineering technology from Krakow Technical College in 1933, and his M.Sc. degree from the Polish Technical University in London, England, in 1945.

Mr. Walocha is an associate member of the Institute of Civil Engineers of Great Britain and a member of the Association of Professional Engineers of Ontario.

J. M. Wardle, C.B.E., M.E.I.C., who retired last year from the Public Service of Canada as director of the Engineering and Water Resources Branch of the Department of Resources and Development in Ottawa after 30 years of activity, has accepted consulting engineering work with two companies.

J. M. Wardle, M.E.I.C.

He is now serving as consultant with Ventures Limited and with Sir Alexander Gibb and Partners of London, England, who have recently opened a Canadian branch in Toronto.

Mr. Wardle is a life member of the Engineering Institute and a member of the Association of Professional Engineers of Ontario. He was created a Commander of the British Empire by the late King George VI in 1945 and he has served a 6-year term as councillor of the Village of Rockcliffe Park in Ottawa.

Keith W. Mitchell, M.E.I.C., distribution engineer with Canadian Western Gas Company Limited in Calgary, Alta., has been elected chairman of the Calgary Branch of the Engineering Institute.

Mr. Mitchell was born in Edmonton, Alta., and received his early education at the Connaught Public and the Central High School in Calgary. He completed a course in architectural draughting at the Provincial Institute of Technology in Calgary and from 1926 until 1930 he served his apprenticeship as a bricklayer.

Mr. Mitchell entered Queen's University in 1930 and graduated with a B.Sc. degree in civil engineering in 1934.

Upon graduation he served as rodman for the Ontario Department of High-

K. W. Mitchell, M.E.I.C.

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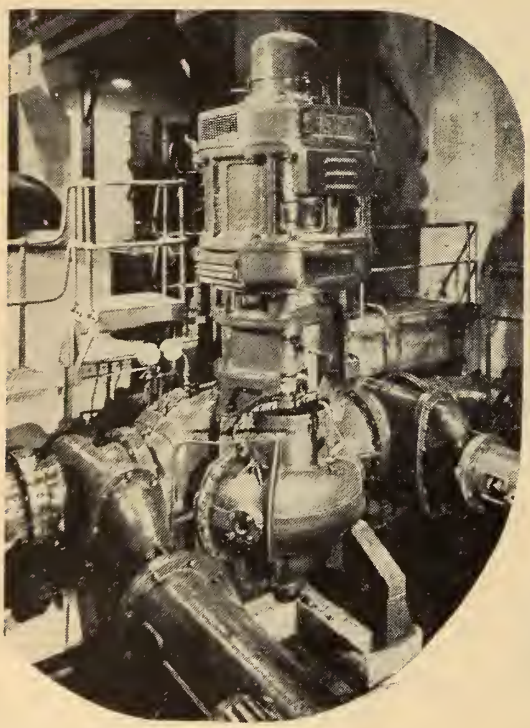

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ways. He entered the Western Natural Gas, Light, Heat and Power Company in Calgary in 1935.

G. R. McMillin, M.E.I.C., has been elected chairman of the Sarnia Branch of the Engineering Institute.

Mr. McMillin was born at Barrie, Ont. After completing his early education at the Barrie Collegiate Institute, he entered the University of Toronto in 1929, graduating with a B.A.Sc. degree in chemical engineering in 1933.

Upon graduation Mr. McMillin joined Imperial Oil Limited as assistant in the inspection department at the Sarnia Refinery. In 1938 he was transferred to the Toronto office as assistant in the manufacturing department. Later that same year he was moved to Talara, Peru, where he became acting chief engineer in the inspection department of the International Petroleum Company. He returned to Canada in 1939 as chief engineer in the Company's inspection department at the Imperial Refinery at Dartmouth, N.S.

At present he is supervisor of the production control section of the Company's Engineering and Development Division in Sarnia, Ont.

G. R. McMillin, M.E.I.C.

L. J. Barron, M.E.I.C., has been appointed district manager of construction for Foundation Maritime Limited in Halifax.

Mr. Barron was born in St. John's, Newfoundland. After completing high school in Antigonish, N.S., he worked for the Newfoundland Government on surveys throughout the Island and spent two years on engineering work in the paper mills of the Anglo-Newfoundland Development Company at Grand Falls.

He entered the Nova Scotia Technical College in 1938 and graduated with a civil engineering degree in 1941.

A year later he joined the Foundation Maritime Limited in Pictou, N.S., later transferring to the engineering construction department in Montreal. He has worked as engineer on the salvage of the *S.S. Lady Grey* in Montreal, as superintendent of the construction of wharves in Glace Bay, N.S., and Trinity Bay on the North Shore of the St. Lawrence River.

Other projects supervised by him from the Montreal office were the construction of water intakes for paper mills at Hawkesbury, Ont., and Cap-de-la-Madeleine, Que. For three years he acted as supervisor from Montreal of the Canadian Johns-Manville Company Limited construction program at Asbestos, Que.

Prior to his appointment in Halifax, Mr. Barron was resident program manager for the past two years of the Foundation Company project on construction in Churchill, Man., for the Department of National Defence.

W. E. Ohrner, M.E.I.C., has joined the staff of Hub Equipment Limited in Moncton, N.B. He was formerly with Fraser-Brace-Terminal Constructors in St. John's, Nfld.

Mr. Ohrner is a graduate in electrical engineering from the University of Manitoba, class of 1943. Following service with the R.C.N.V.R. he joined the staff of the Ontario Hydro-Electric Commission.

Zavie Miller, M.E.I.C., has been appointed supervisor of the quality control engineering department of Canadian General Electric Co. Ltd. in Montreal.

He was formerly with the Northern Electric Company Limited in Montreal.

Mr. Miller is a mechanical engineering graduate of McGill University, class of 1943.

M. N. McEwen, M.E.I.C., division engineer for the Ontario Department of Highways has been transferred from Cochrane, Ont., to Kenora, Ont.

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Mr. McEwen has been with the Department since graduation from the University of Manitoba in civil engineering in 1932.

James Lundie, M.E.I.C., has been transferred as division engineer by the Canadian Pacific Railway Company from London, Ont., to Toronto, Ont.

Mr. Lundie has been with the Canadian Pacific Railway since graduation in civil engineering from the University of Saskatchewan in 1930.

James H. Murton, M.E.I.C., is with the E. & D. Division of Imperial Oil Limited in Sarnia, Ont.

He was previously office engineer with the Company in Calgary, Alta.

Mr. Murton graduated in 1941 as petroleum engineer from the Colorado School of Mines.

W. L. Hutchison, M.E.I.C., has been transferred by Remington-Rand Limited to Glasgow, Scotland. He was previously Company plant manager in Hamilton, Ont.

Mr. Hutchison graduated in electrical engineering from McGill University in 1934.

Francis D. Begley, M.E.I.C., is employed with Tatti Construction Company in Kingston, Ont.

He was previously with Stone and Webster Engineering Corporation in Toronto.

Mr. Begley is a graduate in civil engineering from Belfast University, class of 1950.

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J. R. Wallace, M.E.I.C.

J. R. Wallace, M.E.I.C., has been elected 1953 chairman of the Cape Breton Branch of the Institute.

Mr. Wallace was born in Westville, N.S., and received his education at the New Glasgow High School and McGill University where he graduated in metallurgical engineering in 1940.

He joined the staff of the Dominion Steel and Coal Corporation in Sydney, N.S., in 1940 and was employed successively as metallurgical observer in the open hearth department, engineer-in-training, assistant superintendent of the coke oven department, and assistant director of research and development, until his appointment as director of research and development.

A. E. Pare, M.E.I.C., has been elected chairman of the Quebec Branch of the Institute. He is a graduate of Ecole Polytechnique, class of 1931, and is now chief engineer of the Department of Hydraulic Resources for the Province of Quebec.

Mr. Pare has served on the executive of the Quebec Branch as vice-chairman and also on the Graduates' Society of Polytechnique for the Branch. He is an observer for the Province of Quebec on the working group of the International Joint Commission for the St. John's River Basin Study.

A. E. Pare, M.E.I.C.

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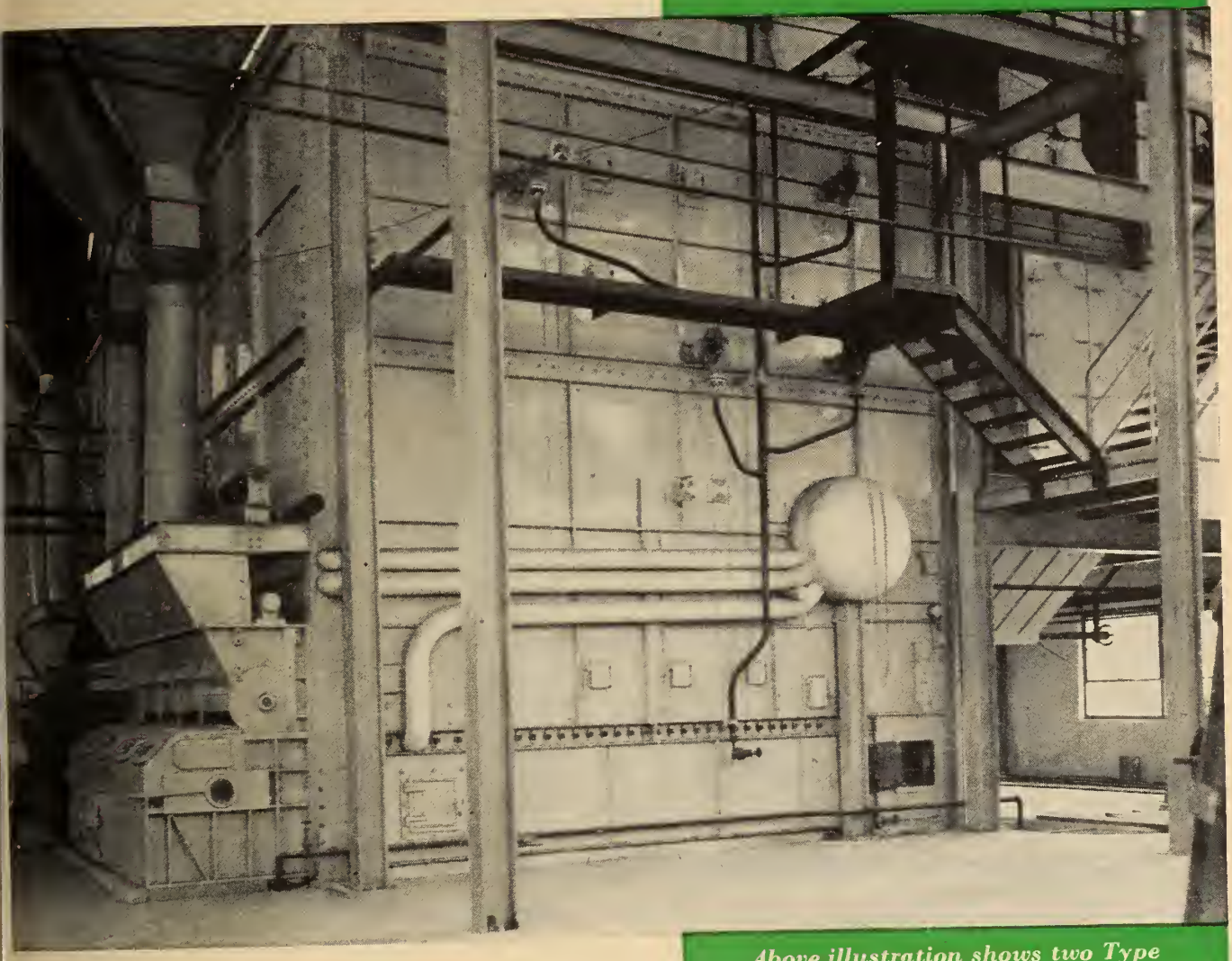

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G. E. Sarault, M.E.I.C.

G. E. Sarault, M.E.I.C., has been elected vice-chairman of the Quebec Branch of the Institute. He is a 1934 graduate of McGill University, and is associated with the firm of Tasse, Sarault and Associates, consulting engineers in Quebec City.

Before becoming head of the electrical engineering department of Laval University, he was a member of the engineering staff for the Canadian Broadcasting Corporation.

Mr. Sarault has served on the executive of the Quebec Branch for many years, and at the 1944 Annual Meeting of the Institute held in Quebec City, he was in charge of registration for the convention.

D. M. Venton, M.E.I.C., has resigned his position as city engineer of Woodstock, Ont., to become engineer of the streets and sanitation branch of the City of Ottawa engineering department.

Previous to his position as Woodstock city engineer, Mr. Venton was engineer and road superintendent of the Township of East Whitby, Ont., and assistant city engineer for Owen Sound.

Mr. Venton is a civil engineering graduate from the University of Toronto, class of 1945.

E. J. Ollerton, M.E.I.C., is with the Lee Wilson Contracting Company in Cleveland, Ohio.

He was formerly mechanical engineer in charge of design in the engineering department of Dominion Foundries and Steel Limited in Toronto, Ont.

F. S. Heeley, M.E.I.C., has returned to the Hydro Electric System of the City of Winnipeg after completing almost two years with Brazilian Traction Light and Power Company Limited in Sao Paulo, Brazil.

Mr. Heeley is a graduate of the Royal Technical College at Salford, England, class of 1947.

Slaw Kotyk, M.E.I.C., formerly with the Department of Agriculture in Regina, Sask., has joined the staff of Royalite Oil Company Ltd. in Kindersley, Sask.

Mr. Kotyk is a graduate in civil engineering from the University of Saskatchewan, class of 1950.

Robert M. Powell, M.E.I.C., has been transferred by Canadian Industries Limited from Shawinigan Falls, Que., to Maitland, Ont.

Mr. Powell served as lieutenant in the Royal Canadian Navy during the war and entered Canadian Industries Limited upon his discharge in 1945.

He is a graduate of the Royal Military College, class of 1935, and of the University of Toronto in chemical engineering, class of 1937.

W. D. Laird, M.E.I.C., has been appointed head of the new Montreal industrial division of Canadian Copco Limited. He assumed his new duties upon his return to Canada last month after inspecting manufacturing and research operations in Europe.

Graduating from the University of Manitoba in 1940, Mr. Laird was commissioned in the R.C.A.F. during the same year and acquired considerable experience in the field of internal combustion engines.

Following the war he served as assistant general secretary of the Engineering Institute of Canada, and before joining Canadian Copco Limited, he was sales manager of the Diesel Engine Division of Consolidated Engines and Machines Co. Ltd. in Montreal.

W. D. Laird, M.E.I.C.

Richard G. Radley, M.E.I.C., has been transferred to the office of the Directorate of Installations for N.E.A.C. in St. John's, Nfld. He was previously with Wiggs, Walford, Frost & Lindsay, consulting engineers in Montreal.

Mr. Radley is a graduate in electrical engineering from Coventry Technical College, class of 1952.

G. M. Kernahan, M.E.I.C., is employed by the McCullough Tool Company in Edmonton, Alta.

Mr. Kernahan is a 1949 graduate in mechanical engineering from the University of Manitoba.

J. S. Sugiyama, M.E.I.C., has joined the staff of McCarter, Nairne and Partners, architects and engineers in Vancouver, B.C. He was formerly chief design engineer with Rule, Wynn and Rule, architects in Calgary, Alta.

Mr. Sugiyama is a graduate in civil engineering from the University of Manitoba, class of 1947.

R. B. Wotherspoon, M.E.I.C., has joined the Aerocrete Construction Company Limited, as engineer in charge of operations. He was formerly project engineer with Dominion Textile Company Ltd., in Montreal, for six years.

Mr. Wotherspoon is a graduate of the Royal Military College, class of 1935.

L. MacKay, M.E.I.C., has joined the staff of Fraser-Brace Terminal Constructors in Saint John, N.B., as assistant engineer. He was previously estimator with Darling Bros. in Montreal.

Mr. MacKay is a 1948 mechanical engineering graduate of the Royal Technical College in Salford, England.

R. B. Wotherspoon, M.E.I.C.

John L. Foreman, M.E.I.C., has retired from the Civil Service of Canada with which he has been associated since graduation from the University of Toronto in 1914, apart from service as a lieutenant in the R.N.V.R.

H. D. Walford, JR.E.I.C., is presently associated with the Northern Aluminum Company in Banbury, England. This company, employing about 9,000 people, is a subsidiary of the Aluminum Company of Canada, Limited. It comprises three works located in Banbury, Birmingham, and at Rogerstone, not far from Cardiff in South Wales. The company turns out a wide range of semi-fabricated aluminum products including sheet, circles, extrusions, powder, castings and forgings.

Mr. Walford has been assigned to the cost accounting department temporarily where he has had the opportunity of studying sheet and strip rolling, extrusion, powder and paste production.

He is a 1949 graduate in civil engineering from McGill University. After post-graduate work at Cambridge University, Mr. Walford attended the Centre d'Etudes Industrielles in Geneva, founded by the Aluminum Company in 1947 to meet the increasing demand for a post-graduate school which would advance industrial aspects of international business administration.

W. J. C. Gall, JR.E.I.C., has joined the staff of the Aluminum Company of Canada, Limited.

Dr. Gall was previously scientific officer with UNESCO Science Co-operation Office for South East Asia in Djakarta, Indonesia.

He received his chemical engineering degree from the University of Toronto in 1946, and was awarded the degree of Doctor of Natural Sciences by the Swiss Federal Institute of Technology in 1950.

John L. Pulford, JR.E.I.C., formerly manager of communications equipment and overhead and underground for the Northern Electric Company, has been named western sales manager of the Company's Communications Equipment Division, with headquarters at the Northern Electric Shearer Street Plant in Montreal.

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Mr. Pulford joined the Northern Electric Company in Hamilton in 1937 as an installer. He remained on installation work in eastern and western areas except for his war service years and while on leave of absence to attend university. While at Queen's University and later at the University of Toronto where he graduated in 1950 with a B.A.Sc. degree in engineering and business, he spent his summers as assistant installation supervisor with the Company at various locations. After an engineering sales training course in the Communications Equipment Division, he was transferred to the Alberta-British Columbia district to take over duties as telephone sales engineer.

On April 1, 1951 he was named Alberta district manager of communications equipment and overhead and underground, a position he held until his recent appointment.

J. W. McLellan, Jr.E.I.C.

J. W. McLellan, Jr.E.I.C., has recently been transferred from Canadian Industries Limited to E. I. DuPont de Nemours and Company, Inc. He will be in charge of a polyethylene film plant which is currently under construction in Mexico City.

For the past five years Mr. McLellan has been located in Shawinigan Falls, where he was employed in the cellophane and polythylene film processes in both the production and development fields.

Mr. McLellan is a 1948 chemical engineering graduate of the University of British Columbia.

R. J. Trafford, Jr.E.I.C., has joined Francis Hankin & Company, Limited, consulting engineers in Montreal. He was previously with Dominion Textile Company Limited in Magog, Que., since 1951.

Mr. Trafford graduated in chemical engineering from the Nova Scotia Technical College in 1950.

Bruce G. Fraser, Jr.E.I.C., has been appointed assistant quality control supervisor of the film processing department of Canadian Kodak Company Limited. He has been with the Company since 1949 when he graduated in chemical engineering from the University of Toronto.

W. N. Plumb, Jr.E.I.C., is presently employed by Giant Mascot Mines Limited, in Spillimacheen, B.C. He was previous-

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ly with Torbrit Silver Mines Limited, at Alice Arm, B.C.

Mr. Plumb is a graduate mining engineer of the University of British Columbia, class of 1950.

Rosaire Begin, JR.E.I.C., is employed by H. Roberge of Quebec City.

He was previously with Canadian General Electric Company Limited.

Mr. Begin is a graduate of Laval University, class of 1949.

D. S. Moyer, JR.E.I.C., formerly with International Resistance in Toronto, is now employed with Canadian Radio Manufacturing Corp. Ltd. in Toronto.

Mr. Moyer is a 1951 graduate in engineering physics from Queen's University.

G. T. Alexander, JR.E.I.C., has joined the staff of Calgary Power Ltd. in Cochrane, Alta. He was formerly with Montreal Engineering Company Limited.

Mr. Alexander had been associated earlier with the Canadian Pacific Railway Company in Woodstock, N.B., and with the Calgary Power Company in Cochrane, Alta.

F/L A. E. Sutherland, R.C.A.F., JR.E.I.C., has been appointed aircraft maintenance officer with 3 Fighter Wing Headquarters at Zweibruecken, Germany.

He was formerly unit engineer officer with 103 Rescue Unit in Greenwood, N.S.

F/L Sutherland is a 1950 graduate in aeronautical engineering from the University of Toronto.

John S. Nelles, JR.E.I.C., is employed with the Specialloid Company in St. Eustache, Que. He was previously production engineer and supervisor with Dominion Engineering Works in Lachine, Que.

Mr. Nelles is a graduate in mechanical engineering from the University of Saskatchewan, class of 1949.

Jan Gieysztor, JR.E.I.C., has been appointed assistant manager of the engine, pump and electrical department of Canadian Fairbanks-Morse Co. Ltd. in Ottawa.

He was formerly mechanical engineer in the Company's Electrical Equipment Division in Montreal.

He is a graduate of the Wandsworth Technical College, London, England, in mechanical engineering, class of 1950.

G. Granek, JR.E.I.C., is employed as mechanical engineer with Meschino and Associates in Toronto.

He is a 1948 mechanical engineering graduate of the University of Toronto.

D. J. L. Kennedy, JR.E.I.C., is now employed by the Foundation Company of Canada in Montreal.

He was previously with the National Research Council in Ottawa.

Mr. Kennedy graduated in civil engineering from the University of Toronto in 1951.

T. G. Lynch, JR.E.I.C., has joined Canadian General Electric Company, Ltd., in Vancouver, B.C.

He graduated in 1951 from the University of British Columbia in electrical engineering.

L. Bookbinder, JR.E.I.C., is now employed as a supervisor by John Somerville, architect, in Green Bay, Wisconsin.

He graduated in civil engineering from the University of Manitoba in 1951.

Capt. W. J. Dickson, JR.E.I.C., has been promoted to the rank of captain.

He is presently stationed with the R.C.S.M.E. in Chilliwack, B.C.

Captain Dickson is a 1949 graduate in civil engineering from McGill University.

Andre Michaud, JR.E.I.C., is employed by the Quebec North Shore & Labrador Railway Company in Montreal.

He was previously with the Quebec Telephone Corporation in Rimouski, Que.

Mr. Michaud is a graduate in electrical engineering from McGill University, class of 1950.

Gordon E. Smith, JR.E.I.C., has been transferred by the Ontario Department of Highways from Toronto to Bancroft, Ont.

Mr. Smith graduated in civil engineering from Queen's University, class of 1950.

T. D. Johannson, JR.E.I.C., has joined the California Standard Company in Edmonton, Alta. He was formerly with Canadian Ingersoll-Rand Company Limited in Winnipeg, Man.

Mr. Johannson is a 1950 graduate in mechanical engineering from the University of Manitoba.

Angus J. McDonald, JR.E.I.C., has joined C. D. Howe Company, Limited in Montreal.

He is a graduate in mechanical engineering from McGill University, class of 1951.

Jan Murer, JR.E.I.C., is presently employed by Canadair Limited as liaison engineer for the F-86 Sabre-jet production. He was previously with Aluminum

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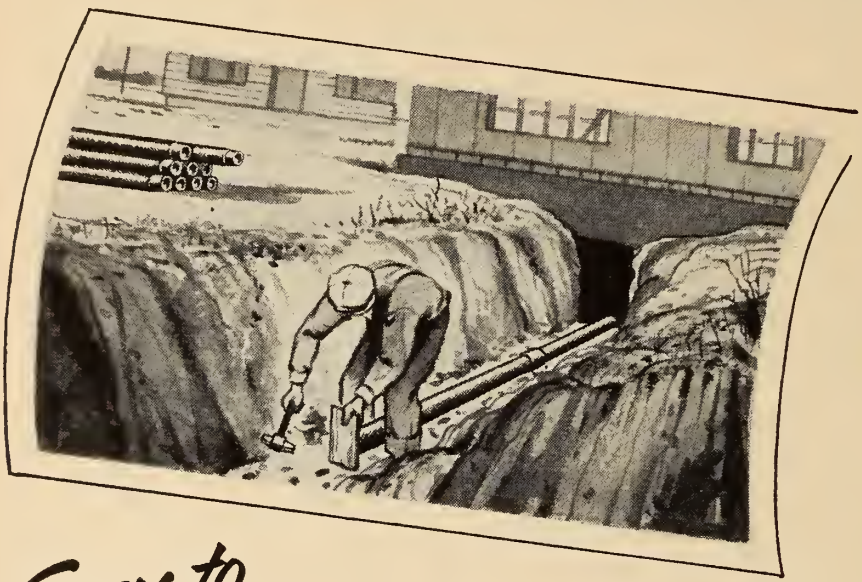

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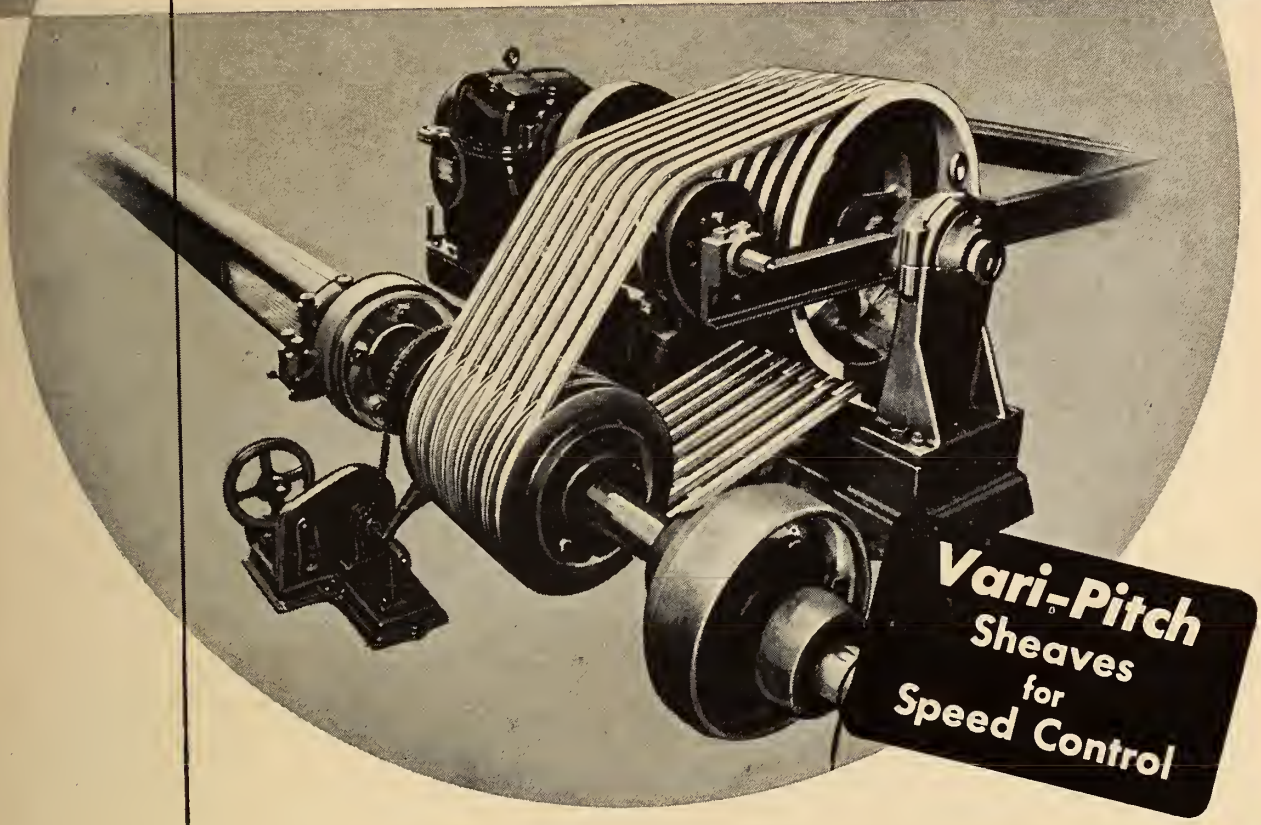

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Company of Canada, Limited in Montreal.

Mr. Murer is a McGill University graduate in mechanical engineering, class of 1951.

Capt. R. A. McKay-Keenan, JR.E.I.C., has been promoted from the rank of lieutenant. He is at present stationed at the Military College of Science at Shrivenham, Wiltshire, England.

Captain McKay-Keenan is a graduate in mechanical engineering from McGill University, class of 1950.

J. G. Ouellette, JR.E.I.C., is construction engineer with Champlain Oil Products Limited in Montreal.

Mr. Ouellette is a graduate in civil engineering from Ecole Polytechnique, class of 1951.

Donald W. Quinlan, JR.E.I.C., has joined the staff of the Department of Public Works in Ottawa, Ont.

Mr. Quinlan graduated in civil engineering from the Nova Scotia Technical College in 1951.

P. L. Burgess, JR.E.I.C., has been transferred by Foundation Company of Canada Limited to Gaspe, Que. He was formerly in Hull, Que.

Mr. Burgess has been with the company since graduation in civil engineering from the University of Toronto in 1948.

Wm. George Greene, JR.E.I.C., is now with the engineering department of the Bell Telephone Company of Canada in Quebec City. He was previously engineering assistant with the Company in Montreal.

Mr. Greene is a graduate in electrical engineering from Queen's University, class of 1949.

D. St.E. Cameron, JR.E.I.C., is with Fraser-Brace Terminal Constructors in Saint John, N.B. He was previously with the Johns-Manville Company in Asbestos, Que.

Mr. Cameron is a graduate in civil engineering from the University of Saskatchewan, class of 1949.

M. A. Nelson, JR.E.I.C., is now employed with the Saskatchewan Department of Highways. He was previously technical instructor at the Swift Current Collegiate, Sask.

Mr. Nelson graduated in mechanical engineering from the University of Saskatchewan in 1947.

D. R. Patchell, JR.E.I.C., is assistant superintendent of maintenance at Molson Brewery Company Limited in Montreal.

Mr. Patchell is a 1951 graduate in mechanical engineering from McGill University.

F. R. Mullen, JR.E.I.C., has joined the staff of Canadian Aviation Electronics in Montreal. He was previously equipment engineer with the Northern Electric Company in Montreal.

Mr. Mullen is a graduate in electrical engineering from the University of British Columbia, class of 1950.

J. Emile Collin, JR.E.I.C., has joined the staff of the Quebec Telephone Corporation at Rimouski, Que.

Mr. Collin is a graduate in electrical engineering from Laval University class of 1951.

M. S. Wakely, JR.E.I.C., has recently been appointed roadmaster of the Canadian Pacific Railway's Taber Subdivision with headquarters at Lethbridge, Alta. He was previously division engineer at Edmonton, Alta.

Mr. Wakely is a graduate in civil engineering from the University of British Columbia, class of 1951.

John A. Linney, JR.E.I.C., has returned to the office of the chief architect of Canadian National Railways in Montreal. During the past two and a half years he has supervised the electrical installation of the MacDonald Hotel extension in Edmonton, Alta.

Mr. Linney is a 1946 graduate in electrical engineering from the University of Alberta and has been with Canadian National Railways since graduation.

L. E. Hardman, JR.E.I.C., is presently employed with the Canadian International Paper Company in Dalhousie, N.B. He was formerly junior engineer with Abitibi Power & Paper Company, Ltd. in Smooth Rock Falls, Ont.

Mr. Hardman is a graduate in mechanical engineering from McGill University, class of 1948.

C. M. Douglas, JR.E.I.C., is now with Sandwell and Company, Ltd., consulting engineers in Vancouver, B.C. He was formerly with Trottier and Morton Ltd. in Calgary, Alta.

He is a 1947 graduate in mechanical engineering from the University of British Columbia.

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Brian McCaffrey, JR.E.I.C., is plant engineer with Babcock-Wilcox & Goldie-McCulloch Limited in Galt, Ont.

He was formerly with the export division of the Ford Motor Company in Windsor, Ont.

Mr. McCaffrey graduated in mechanical engineering from Queen's University in 1948.

R. O. Lafond, JR.E.I.C., president of North-East Developments Limited, is now located in Montreal. He was previously in Quebec.

Mr. Lafond is a graduate of Ecole Polytechnique in civil engineering, class of 1941.

Donald E. Doxsee, JR.E.I.C., has joined the staff of Brown & Root Limited, engineers and constructors in Edmonton, as mechanical engineer in the petrochemical area.

He was formerly design engineer in Calgary, Alta.

Mr. Doxsee is a B.A.Sc. graduate of the University of British Columbia, class of 1951.

G. B. MacDonald, JR.E.I.C., is employed as resident engineer and acting superintendent at the Cape Breton Highlands National Park headquarters at Ingonish Beach, N.S.

Mr. MacDonald is a 1950 graduate in civil engineering from the University of New Brunswick.

F. A. McIntosh, JR.E.I.C., is presently with the Canadian General Electric Company in Toronto.

Mr. McIntosh is a 1951 graduate in electrical engineering from the University of Manitoba.

G. C. Rathwell, JR.E.I.C., is now job engineer with George Hardy Limited of Toronto.

He was formerly with Foundation Company of Canada Limited in Gaspe, Que.

Mr. Rathwell is a graduate in civil engineering from McGill University, class of 1950.

R. Koncohrada, JR.E.I.C., has joined the staff of Chemical & Geology Laboratories Ltd. in Edmonton, Alta.

Mr. Koncohrada is a 1950 graduate in chemical engineering from the University of Alberta.

Ralph M. Johnson, JR.E.I.C., has joined Canada Cement Company Limited in Ottawa as district sales manager.

Mr. Johnson is a 1949 McGill University engineering graduate.

E. B. Lindsay, JR.E.I.C., has joined the staff of Canadair Limited, Montreal, in the manufacturing engineering department. He was previously with Fleet Manufacturing Limited in Fort Erie, Ont.

Mr. Lindsay is a graduate in mechanical engineering from McGill University, class of 1951.

James K. Maitland, S.E.I.C., has joined the staff of Underwood, McLellan & Associates Limited in Saskatoon, Sask.

Mr. Maitland is a civil engineering graduate of the University of Manitoba, class of 1952.

R. Tardif, S.E.I.C., has joined the staff of Saguenay Electric Company in Chicoutimi, Que.

Mr. Tardif is a 1952 McGill University graduate in electrical engineering.

Kenneth R. Bullock, S.E.I.C., has joined the staff of Phillips Electrical Works in Brockville, Ont.

Mr. Bullock is a 1952 McGill University electrical engineering graduate.

Georges H. Lachance, S.E.I.C., has accepted the position of industrial engineer with the Quebec Iron & Titanium Corporation in Sorel, Que.

He was previously development engineer with the Canadian Armament Research & Development Establishment at Valcartier, Que.

Visitors to Headquarters

Brigadier A. G. Bonn, London, England, April 2, 1953.

A. E. Parkinson, London, England, April 2, 1953.

A. W. Skene, JR.E.I.C., Sarnia, Ontario, April 9, 1953.

Roger Neave, M.E.I.C., Sarnia, Ontario, April 9, 1953.

C. L. Fisher, M.E.I.C., Winnipeg, Manitoba, April 10, 1953.

Wm. Macdonald, London, England, April 17, 1953.

H. C. Fitz-James, M.E.I.C., Vancouver, British Columbia, April 17, 1953.

N. S. Bubbis, M.E.I.C., Winnipeg, Manitoba, May 1, 1953.

Paul Dilworth, M.E.I.C., Toronto, Ontario, May 1, 1953.

P. R. Boon, London, England, May 1, 1953.

J. B. Schepers, Harlem, Holland, May 1, 1953.

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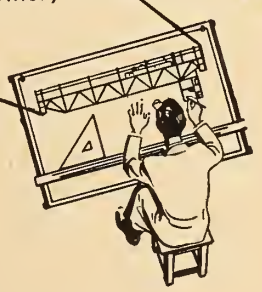

REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL P.Q. (Walter M. Smith—President). Telephone: WEllington 7742. Telegram: "Marquipco". Montreal.

MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. Telephones: 37-187; 37-188; 37-189; 37-180. Telegram: "Manden".

BRITISH COLUMBIA: Vancouver Machinery Depot Ltd., 1155 West Sixth Avenue, VANCOUVER, B.C. Telephone: Bayview 1112. Telegram: "Vanmacdep".

ONTARIO: Dugald Cameron Associates Limited, MALTON, Ont. Telephone: Toronto Cherry 1-4311. Telegram: "Dugald".

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Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

George Harrison Burbidge, M.E.I.C., former district engineer for the Ontario Department of Public Works in Port Arthur, Ont., died suddenly on April 6, 1953.

Mr. Burbidge was born in Ottawa, Ont., on February 11, 1883. After obtaining his elementary education he entered the University of Toronto where he received his B.A. degree in 1905. That same year he enrolled in the civil engineering course at McGill University and graduated with a B.Sc. degree in 1909.

During the summer of 1908 Mr. Burbidge was in charge of survey work at Camp Petawawa for the Department of National Defence. The following summer he was engaged in planetable work as assistant topographer for the Geological Survey Department of Canada. In 1910 he joined the staff of McGill University as demonstrator in the surveying department.

Mr. Burbidge went west in 1911 to subdivide townsites for a Manitoba land surveyor, and in 1912 he entered the Department of Public Works in the Manitoba district as assistant engineer.

In 1916 and 1917 he served with the rank of lieutenant in the Canadian Expeditionary Force, first with the 120th Battalion, and latterly with the Canadian Engineers.

In June, 1917 he was appointed district engineer in the Manitoba Department of Public Works. He continued in this capacity until 1921 when he went to Port Arthur, Ont., to become senior assistant engineer. He was appointed district engineer of the Department in 1940 and retired from active work three years ago.

Mr. Burbidge was a member of the Port Arthur Town Planning Committee, and of the Thunder Bay Historical Society. He was also on the executive of the Port Arthur branch of the Canadian Red Cross. Mr. Burbidge was particularly fond of skating and was instrumental in organizing the Thunder Bay Figure Skating Club of which he was an honorary member. He was chairman of the building committee in charge of construction of the new Youth Memorial Centre in Port Arthur and he had devoted a tremendous amount of work to the centre.

He joined the Engineering Institute of Canada as a Student in 1908, transferring to Associate Member in 1912 and to Member in 1919. He assisted in organizing the Lakehead Branch of the Institute, and he was granted Life Membership in the Institute in May, 1943.

John Fenwick Fraser MacKenzie, M.E.I.C., director and general manager of Robb Engineering Works Limited, died in the Highland View Hospital in Amherst, N.S., on March 22, 1953, following a brief illness.

Mr. MacKenzie was born in New Glasgow, N.S., in 1893. After graduating from the New Glasgow High School in 1911, he joined the draughting and engineering staff of William P. MacNeil Company Limited, structural engineers and bridge builders. A year later this Company was taken over by the Dominion Bridge Company of Montreal and its name was changed to the Maritime Bridge Company.

J. F. F. MacKenzie, M.E.I.C.

In 1920 Mr. MacKenzie went to Sydney Mines on the Jubilee "B" bank head construction project for the Company. After spending a year in Cape Breton on the completion of the bank head, he was transferred to the Dominion Bridge Company engineering staff in Lachine, Que., where he was connected with many large and important engineering contracts.

Mr. MacKenzie was a member on the special engineering staff of the Company in 1925 on the construction of the Montreal Harbour Bridge. He was engaged in this project until the spring of 1928 when he was transferred to the sales and contracting department.

In the summer of 1928 he was transferred to Amherst, N.S., to undertake the layout of a structural steel and bridge shop at the Robb Engineering Company plant. He was appointed manager of this department in October of the same year, and in 1940 he became general manager of the Robb plant, a position he held until the time of his death. In 1942 he was elected a director of the Company.

During his years of managership he showed himself alert to all developments in the engineering field and the plant was always kept ready to meet new conditions. Its work was notable in both world wars. In World War II the plant not only turned out shells, but also constructed equipment for the Navy and Army and aided in the erection of hangars for the Air Force.

Mr. MacKenzie was a member of the Association of Professional Engineers of Nova Scotia, the Canadian Welding Bureau, and the Canadian Manufacturers Association.

He joined the Engineering Institute of Canada as a Junior in 1920, transferring to Associate Member in 1928 and to Member in 1940.

Wilfred Rowland Mount, M.C., M.E.I.C., superintendent of the Waterworks Department for the City of Edmonton Alta., died suddenly in hospital on March 18, 1953.

Mr. Mount was born at Reading, England, on December 5, 1888. He received his early education at Marlborough House in Reading and at Bradfield College in Berkshire, and entered Camborne School of Metaliferous Mining in Cornwall in 1905, graduating in 1908.

W. R. Mount, M.E.I.C.

For three years after graduation he was engaged in various mining projects in Cornwall, England, and in the Gold Coast, West Africa. In 1911 he arrived in Canada and proceeded west to Alberta. He served as district engineer with the Canadian Northern Railway and was also engaged in land-survey work in Northern Alberta until 1913 when he entered the engineering department of the City of Edmonton.

At the outbreak of war in 1914 he joined the 101st Battalion in Edmonton, and later, the Ninth Battalion of the Canadian Expeditionary Force. Overseas, he transferred to the Royal Engineers Railway Troop. In July, 1919, he was discharged with the rank of major having been awarded the Military Cross for distinguished service.

He then returned to Canada to resume his duties in the city engineer's department in Edmonton. He was appointed assistant city engineer in 1936 and three years later he became superintendent of waterworks, a position he held until his death.

Mr. Mount joined the Association of Professional Engineers of Alberta when it was formed in 1921. He maintained an interest in all its affairs which he attended regularly.

He entered the Engineering Institute of Canada as a Member in 1921 and took an active part in the meetings of the Edmonton Branch, serving for some years as Branch secretary and on the

Branch executive. He was elected councillor of the Institute in 1939. Mr. Mount was particularly interested in the younger members of the engineering profession and was seldom absent from any of their group activities.

Harold Linscott Clifford, M.E.I.C., vice-president and general manager of Dufresne Engineering Company Limited, died at the General Hospital Western Division in Montreal on April 16, 1953, after a prolonged illness.

He was born in Brunswick, Maine, on May 1, 1887. Upon graduation from high school he entered the University of Maine, graduating with a B.Sc. degree in civil engineering in 1910.

Mr. Clifford came to Canada that same year to join the headquarters staff of the National Transcontinental Railway, now Canadian National Railways, in Ottawa. Four years later he became assistant engineer in the Department of Railways and Canals in the construction of the Welland Ship Canal, Section 3, at Thorold, Ont.

From 1916 until 1920 Mr. Clifford was works manager of the National Shipbuilding Corporation at Three Rivers, Que., which was engaged in building cargo vessels for the Imperial Munitions Board and for the Republic of France.

In 1920 he joined W. I. Bishop Limited in Montreal, Que., as superintendent of industrial building construction, and two years later he served as general contractor in Three Rivers, Que. In 1927 he entered the Robertson and Janin Company in Montreal, Que., as general superintendent, engaging in general construction in Montreal and in the development of harbour works in Chicoutimi, Que. He remained with this firm until joining Dufresne Engineering Company Limited in 1932.

During his 21 years with Dufresne Engineering, Mr. Clifford was in charge of the construction of the Wellington Street tunnel, harbour improvements in the Port of Montreal, and many highways in Montreal, Three Rivers, Quebec, Valleyfield and other districts. He also took charge of the building of the hydro-electric development on the Ottawa River, as well as the storage dam at La Passe Dangereuse for the Aluminum Company of Canada Limited.

During World War II he was on loan to the Federal Department of Munitions and Supply and was general manager of Quebec Shipyards Limited, a Crown corporation building naval vessels. He was also in charge of the enlargement of the power plant of the Beauharnois Light, Heat and Power Company.

Mr. Clifford was a keen sportsman, participating in fishing, curling and golf. He was one of the organizers of the Ki-8-Eb Country Club in Three Rivers, Que. In his youth he was a prominent athlete especially in football and track.

He was a member of the Association of Professional Engineers of Quebec.

Mr. Clifford joined the Engineering Institute of Canada as a Member in 1944.

Edward Hugh Manley, M.E.I.C., construction superintendent of Anglin-Norcross Corporation Limited in London, Ont., died suddenly on February 1, 1953, following a heart attack which occurred while walking with his wife.

Mr. Manley was born at Thorold, Ont., on May 17, 1903. He completed his elementary education at Thorold High School in 1920 and studied arts for two years at Niagara University. During the summers of 1922 and 1923 he served as rodman in the construction of the Welland Canal. In the summer of 1926 he was employed as rodman in the layout of Arvida, Que., and continued on as material engineer in Arvida until 1927.

He entered Syracuse University in 1927 and graduated with a B.Sc. degree in civil engineering in 1931. He then became general foreman in the construction of the Beauharnois Canal until 1935 when he was appointed resident engineer in charge of construction of the Postal Terminal Building in Montreal. Two years later he entered Aluminum Company of Canada Limited as engineer in charge of construction of the ore plant extension in Arvida, Que.

Mr. Manley joined the Anglin-Norcross Corporation Limited in 1937 and since that time had been in charge of numerous construction projects in Eastern Canada. These included the construction of the Supreme Court Building in Ottawa, the Naval centre in Halifax during the war, the bridge at Jonquere, Que., and the mental hospital at Smiths Falls, Ont. At the time of his death he was in charge of the construction of the Mother House Administrative Building for the Sisters of St. Joseph in the Diocese of London, Ont.

Mr. Manley was a member of the Association of Professional Engineers of Quebec.

He joined the Engineering Institute of Canada as a Member in 1945.

William Eric Crommelin Irwin, M.E.I.C., passed away at his home in Westmount, Quebec, on March 3, 1953.

He was born in Ottawa on January 24, 1890. Upon graduation from Ashbury College in Ottawa he entered McGill University in 1907 and received his B.Sc. degree in electrical engineering in 1911.

Mr. Irwin then entered the engineering office of Northern Electric Company Limited in Montreal. In 1912 he joined the engineering staff of the Montreal Light, Heat and Power Company with which he was associated for three years.

At the outbreak of World War I Mr. Irwin joined the first contingent of the McGill Canadian Officers' Training Corps and in 1915 was posted overseas with the rank of lieutenant in the Princess Patricia's Canadian Light Infantry. He was discharged at the war's end with the rank of major.

Upon his return to Canada he reentered the engineering department of Northern Electric Company Limited and continued with the firm until 1921.

Mr. Irwin was appointed sales engineer with Mack Trucks of Canada Limited in 1937, a position he held until 1941 when he accepted the position of civil assistant inspector of naval ordnance for the British Admiralty Technical Mission in Ottawa. In this capacity he was responsible for the inspection of some 250 contracts ranging from four-inch and 12-pounder guns to the manufacture and filling of shells and fuses. He was also responsible for the manufacture and proving of depth charge throwers, and instrumental in the design of a new model. As BATM inspection officer he was vested with much authority in interpreting specifications to local conditions and he received a testimony of appreciation from the British Admiralty Technical Mission as well as a letter from Admiral Croker, R.N., for his work on torpedo warheads.

In 1946 Mr. Irwin became electrical processor in the Mechanical Division of War Assets Corporation in Montreal.

At the time of his death he had already retired from active business.

Mr. Irwin joined the Engineering Institute of Canada as a Member in 1947.

F/O Edward James Couchman, R.C.A.F., Jr.E.I.C., has been reported missing following the crash of an R.C.A.F. Dakota aircraft in the Strait of Georgia off the coast of British Columbia on January 28, 1953.

F/O E. J. Couchman, Jr.E.I.C.

F/O Couchman was born in Toronto on October 22, 1924. As a youth he worked hard to overcome a slight limp left by poliomyelitis. Upon completion of elementary studies at the Bowmore Road Public School, he attended the Malvern Collegiate for three years after which he joined the Royal Canadian Air Force. He undertook his initial training at Belleville, Ont., and was transferred to St. John, Que., where he graduated as one of the youngest air navigators at the age of 18.

He then served overseas with the "Lion Squadron" operating Lancaster bombers. F/O Couchman volunteered with the rest of his squadron for Pacific duty and had just returned to Canada when war ended in the East.

After his discharge from the Air Force he studied for his senior matriculation and entered the University of Toronto in 1947, graduating with a B.A.Sc. degree in civil engineering in 1951.

In the summer of 1952, F/O Couchman was posted to R.C.A.F. Edmonton headquarters to undertake construction work on airfields in the western provinces. In the course of his duties in January, 1953, he embarked in a Dakota aircraft from Sea Island Airport, north of Vancouver, to fly inland. Icing conditions plunged the aircraft into the Strait of Georgia from which wreckage has been found.

F/O Couchman joined the Engineering Institute as a Student in February, 1951, and transferred to Junior Member on January 1, 1953.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

YOUNG GRADUATE CHEMICAL engineer required to take full charge of laboratory and quality control work by manufacturers located in Montreal of adhesives and asphalt tile. File No. 4559-V

CHEMICAL ENGINEER required for Modern plant in medium sized town in central Ontario. Must have at least three years production and supervisory experience. Knowledge of machine maintenance desirable. Good opportunity with a growing industry. Reply giving complete details of education and experience and salary expected to File No. 4560-V.

CIVIL

TWO CIVIL ENGINEERS for structural design by large organization in Ontario. Graduates should have minimum of three years experience. Applicants should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

CIVIL ENGINEER, for permanent position with experience in the design and construction of sewers and other municipal works. Salary range $400.00 to $480.00 per month, plus cost of living bonus of approximately $30.00 per month. Apply giving full particulars of education and experience. File No. 4554-V.

INSPECTIONS ENGINEER required by City in Western Canada to administer the Inspections Department and to coordinate varied civic inspections for public safety programs and to supervise subordinate technicians and inspectors engaged in construction and trade inspections and related tasks. University graduates in Civil Engineering, supplemented by extensive related experience in building construction engineering. Preference will be given to applicants of mature years who have had municipal engineering positions of an administrative nature. File No. 4563-V.

PROJECTS ENGINEER required by City in Western Canada to work under general administrative direction to supervise design and construction of varied municipal works and to interpret plans and specifications to employees and contractors; to make technical studies and maintain related cost and other records. University graduation in civil engineering, supplemented by some related experience in design and in projects supervising. File No. 4563-V.

ELECTRICAL

ELECTRICAL ENGINEER, experience necessary, capable of laying out power stations and all electrical work for the construction of a pulp mill at Saint John, N.B. Permanent employment to qualified person. Salary is open depending upon experience and qualifications. File No. 4548-V.

ELECTRICAL ENGINEER for electrical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience and should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

RECENT ELECTRICAL engineering graduate required by Montreal firm for sales and engineering work in Montreal and district. Good opportunity for advancement. File No. 4557-V.

ELECTRICAL ENGINEER required by city in Western Canada to perform a variety of technical tasks in surveying system facilities, developing standards of electrical utility distribution, preparing reports concerning wholesale power supply to consumers, maintaining technical records, assisting in layout and design and related engineering tasks as assigned. University graduate in Electrical Engineering, supplemented by some related experience, preferably in an electrical distributing system. File No. 4563-V.

MECHANICAL

MECHANICAL ENGINEER with 3 or 4 years experience in production planning required by large organization in department concerned with plate fabrication, welding, punch press and sheer forging and normal machine shop practice. File No. 4546-V.

MECHANICAL ENGINEER required by manufacturer of hardware for all types of industrial doors. Duties would be to take complete charge of engineering, designing, production and cost and to accept full responsibility. Age not to exceed 40 years. Salary plus bonus and liberal car allowance. File No. 4549-V.

TWO OR THREE 1953 graduates, preferably mechanical required by large size industry in Ontario. File No. 4551-V.

TWO MECHANICAL ENGINEERS required for mechanical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience. Applicants should state complete particulars and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

MECHANICAL ENGINEER for internationally known metal fabricating plant in the Niagara district, employing approximately 350 people. Must be experienced in plant layout, modern foundry and machine shop practice, tool design and industrial engineering. After a brief training period will be appointed to senior engineering position, age limit approximately 35 years. Reply stating age, qualifications, complete history of experience, marital status and salary expected. All replies confidential. File No. 4553-V.

RESEARCH MINDED YOUNG textile company in Granby, Quebec, wishes to add a mechanical engineer to its staff. Attractive opportunity for right man interested in production and development work. Recent graduate with some working experience preferred, but exact nature of work not important. All communications will be treated strictly confidential and interviews will be arranged with applicants having suitable qualifications. Address reply to File No. 4562-V and please include telephone number.

MISCELLANEOUS

SALES ENGINEER required for transmission equipment. Man with good technical qualifications and with high voltage transmission line design and operating experience required to advise on the use and sell insulators and transmission line equipment to power supply companies. Well known firm located in Toronto. File No. 4545-V.

THREE DRAUGHTSMEN, required by automotive industry located in Toronto area. Applicants must be capable of making detailed drawings or sketches from designs made by either a mechanical or an electrical engineer, also required to initiate sketches or drawings of miscellaneous minor equipment in connection with plant maintenance. File No. 4547-V.

JUNIOR ENGINEER, required in Montreal for the construction of underground conduits, with an electrical degree, having two or more years experience, preferably bilingual. Age 25 to 38 years. Salary depending on experience and qualifications. Apply in own handwriting. File No. 4555-V.

SALES ENGINEER 22-30 years of age. Woodworking, box making and pulp and paper making machinery and supplies. Location eventually Western Canada. File No. 4556-V.

SALES ENGINEER or manufacturers agents required to sell American automatic boilers (package type) already in operation from coast to coast in Canada, as agents representatives for Quebec City and surroundings, further for

Mechanical Engineer

Research-minded young textile company in Granby, Quebec, wishes to add a Mechanical Engineer to its staff. Attractive opportunity for right man interested in production and development work. Recent graduate with some working experience preferred, but exact nature of previous work not important. All communications will be treated strictly confidential and interviews will be arranged with applicants having suitable qualifications. Address reply to File No. 4562-V and please include telephone number.

Toronto, London, Hamilton, Windsor, North Bay, Abitibi District, etc. Mechanical or electrical engineers with experience in the combustion and heating line would be an asset. File No. 4558-V.

OPPORTUNITY FOR AN architect or civil engineer, 25 to 35 years of age, who has had 1-2 years experience in the building construction industry, preferably sales. Training salary $3,900.00 per year. File No. 4561-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

TWO CANADIAN GRADUATES in Chemical Engineering required by organization in Ontario. Primarily interested in 1952 graduates with interest in process and supervisory work. Salary depends on qualifications. File No. 4501-V.

GRADUATE ENGINEER required in Quebec City to be employed in air-conditioning and refrigeration department. Applicant must be bilingual and conversant with the application, selection, sales, administration and service of such equipment and to act as manager of the department. Salary is open depending on the experience and capabilities of the applicant. Age range between 27 to 40 years of age. File No. 4509-V.

CHEMICAL ENGINEERING, recent graduate required by water treatment company for sales and service. Location Easern Canada. Applicants must be free to travel. File No. 4550-V.

CIVIL

CIVIL ENGINEER required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

STRUCTURAL DESIGN ENGINEERS an assistant chief engineer and a design engineer are required for a recently organized bridge design section of a Government department which is to be responsible for the complete design and construction of a number of special bridge projects. Applicants must be graduates in engineering from a university of recognized standing with a number of years of experience in the design and construction of engineering structures, particularly bridges of all types in both reinforced concrete and steel. Please state experience, references and salary expected. Application forms which may be obtained from Post Offices in major cities, district offices of the Civil Service Commission, University Placement Bureaux and offices of the National Employment Service, should be filed with the Civil Service Commission, Ottawa, not later than March 20, 1953. File No. 4506-V.

CITY IN WESTERN CANADA has a permanent position open for civil engineer for valuation and assessment work in the assessment department. Several years practical experience in commercial building estimating and construction essential. Salary according to qualifications. Excellent opportunity for advancement. General Pension plan. File No. 4529-V.

CIVIL ENGINEER required by the Federal District Comm. for the position of resident engineer on construction. Applicants should be under 45 and should have a broad experience in the construction field and must be capable of taking responsible charge of some new highway construction in Ottawa area. Salary will depend on qualifications and experience. Position may lead to permanent employment. File No. 4530-V.

EXPERIENCED STRUCTURAL DESIGN engineer. Must be Canadian citizen, graduate in engineering from a university of recognized standing and with a number of years of experience in the design and construction of engineering structures in both reinforced concrete and steel. Applicants should state age and qualifications and give full particulars of experience. Salary open depending on experience. File No. 4536-V

CIVIL ENGINEER with three or four years experience since graduation required in Ontario. It is desirable that at least a portion of this time should have been on steel and concrete design work. File No. 4540-V.

ELECTRICAL

ELECTRICAL ENGINEERS required by large organization with head offices in Montreal. Applicants should be electrical engineers, who are preferably air force veterans about 30 years of age. Duties include the supervision of the installation and maintenance of specialized equipment in RCAF aircraft, and also the instruction of air crews. Candidates must be free to travel. Salary will be negotiated on the basis of experience and qualifications. File No. 4491-V.

A LARGE PUBLIC organization requires a design engineer with an electrical engineering degree, or its equivalent plus at least three years or more practical experience in electrical construction work, and preferably training with a contractor. Duties would be design and layout of electrical power and lighting circuits, equipment, substations, etc. Salary dependent on experience. Location Toronto. Applicants are requested to apply in their own handwriting. File No. 4507-V.

ELECTRONIC DEVELOPMENT ENGINEERS, Test Engineers, installation engineers, required by organization located in the Maritimes. Salaries commensurate with ability. Five-day week, group insurance. File No. 4515-V.

LIGHTING ENGINEER required by manufacturing company in Toronto. Applicant should be experienced in both sales and layout of interior lighting schemes in hot/cold cathode lighting. Some experience in street and flood lighting an advantage. File No. 4516-V.

COMPONENTS ENGINEER with at least 5 years experience in general electronics devices such as radar, radio and television etc. Will probably have a design background with sound knowledge of procurement problem and supply resources on components. Familiar with military and industrial specifications. Location Ontario. File No. 4518-V.

ELECTRONICS ENGINEER required by national research council to carry out research on electronic telecommunications equipment; to design and develop specialized electronic equipment as required; to carry out technical liaison duties. Honours degree in physics engineering physics or electrical engineering with specialized training in electronics required. Must have interest and ability in circuit design; must have interest in or experience with electronic computers. Research experience in circuit work would be useful. File No. 4519-V.

ELECTRICAL ENGINEER with electric utility experience to assume post of general superintendent or to work into this position. The vacancy is with a hydroelectric utility having 40,000 customers and comprises high voltage transmission, substations, underground and overhead distribution. Location La Paz, Bolivia, population 410,000. Salary open depending on experience and qualifications. File No. 4521-V.

SERVO MECHANISMS engineer required to carry out research and development on guided missiles. Experience with electrical and electro hydraulic servo system and with navigation equipment desirable. File No. 4522-V.

ELECTRONIC INSTRUMENTATION engineer to carry out instrumentation work on guided missiles, telemetering and range instrumentation experience desirable. The applicant must be capable of planning and directing the work of junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER required by pulp mill located in P.Q. Applicant would be primarily in charge of all mill electrical maintenance and electrical repair installations. Prepared to consider applicants who have had a few years experience or those with many years experience in this type of work. Salary open. Good opportunity for advancement. File No. 4535-V.

MECHANICAL

MECHANICAL ENGINEER required for the position of service supervisor. Applicant must have at least 5 years experience on or associated with steam power house equipment particularly boilers, have a good personality and be capable of meeting people and possess the ability to organize and operate a service department. The work will be chiefly in the Head Office in Ontario, but will entail travelling. Salary open. File No. 4497-V.

MECHANICAL DRAUGHTSMAN, wanted for piping and equipment layouts for small steam plant, factory buildings, and town water supply and sewage disposal to work in our Montreal Head office. Apply in writing giving full details of experience, qualifications, age and references. File No. 4512-V.

MANUFACTURING ENGINEER required with 2-10 years experience in manufacturing design methods and tooling. Should be mechanical engineer with considerable electrical experience. Location Ontario. File No. 4518-V.

MECHANICAL ENGINEERS with six to 10 years experience to carry out design and development on armament systems.

CHEMICAL ENGINEER

Required for modern plant in medium sized town in Central Ontario.

Must have at least three years production and supervisory experience. Knowledge of machine maintenance desirable. Good opportunity with a growing industry. Reply, giving complete details of education and experience and salary expected to File No. 4560-V.

The applicants must have experience in planning and directing the work of junior scientists. File No. 4522-V.

MECHANICAL ENGINEER required to act as sales engineer for company specializing in the solution of manufacturing problems involving materials handling, dust and fume disposal, and the processing of materials. Man required must be maintaining active personal contact with industry. He should be preferably mechanical engineer with a knowledge of plant layout, and the application of materials handling equipment. Duties would be to follow up inquiries contact prospective customers. This work could be undertaken in conjunction with present activities. File No. 4523-V.

MANUFACTURER OF STELLITE AND PRECISION CASTINGS requires a production works manager who has proven managerial capabilities. Preferance will be given to a mechanical or metallurgical graduate who has experience in machine and tool manufacturing and foundry operation. Familiarity with high temperature alloys an asset. Salary commensurate with qualifications and experience. Location. Ontario. File No. 4525-V.

RECENT MECHANICAL ENGINEER with evidence of interest in mechanical or technical problems and with experience or aptitude for sales. He should be completely bilingual and able to deal with all levels of personnel and management. The work involves study of actual conditions related to the use and formulation of procedure and policies which must be sold at the level of top management. File No. 4527-V.

UNIVERSITY LOCATED in Western Canada invites applications for the post of professor and chairman of the department of mechanical engineering and also for the post of assistant professor of mechanical engineering. Appropriate academic qualifications, broad experience in mechanical engineering with special interest in thermodynamics and power plant design are desirable. Starting salaries depend upon qualifications and experience. Generous retirement plan, group insurance and other benefits are available. Duties commence Sept. 1st 1953. Applications should be accompanied by a curriculum vitae, a recent photo and submitted not later than June 1st 1953. File No. 4531-V.

DESIGN ENGINEER a good opportunity with a sound future for a graduate mechanical engineer who has had practical experience in structural designing for commercial vehicle production. In reply state age, experience, references and salary expected. File No. 4533-V.

GRADUATE MECHANICAL ENGINEER required for design of power plants; heating and ventilating; to take charge of drafting room for firm of consultants — location Ottawa. Replies should state minimum salary expected and all other pertinent information including age, marital status. File No. 4544-V.

MISCELLANEOUS

ESTIMATOR FOR SPECIAL machine tools, fixtures, dies, etc. Position requires a knowledge of design and modern production methods. Location Western Ontario. File No. 4490-V.

THE RESEARCH COUNCIL of Alberta requires an industrial engineer, preferably with mechanical or metallurgical experience, to assist in making industrial surveys, to prepare reports on processes and developments and to provide liaison between science and industry. Position available immediately. The salary will depend on academic attainments and experience. File No. 4492-V.

ELECTRICAL ENGINEERS or physicists with an interest or experience in radar or electronics required by leading electronic organization located in Southern California. After successful training period applicants would become Canadian representatives with Canadian companies where equipment is being installed Applicants should be under thirty-five years of age, a Canadian citizen. Write giving full resume of experience etc. File No. 4493-V.

RUBBER CHEMIST required by progressive manufacturer of rubber footwear has an opening for a rubber chemist experienced in compounding development and process control. Must have complete knowledge of formulating compounds, factory processing and laboratory control. Should be able to express himself in French. Salary commensurate with experience. File No. 4494-V.

JUNIOR ENGINEER required in Montreal by manufacturer of plumbing and heating materials to work in the estimating department. File No. 4495-V.

ENGINEER REQUIRED for intermediate position in Ontario by organization with head offices in Montreal. Applicant should have some experience in time study and have good engineering background. File No. 4495-V.

AIR CONDITIONING AND refrigeration engineer required by Canadian representative for outstanding line of American equipment, to carry out engineering sales work in Ontario and Quebec. Applicant must have several years experience in this or related field and have successful sales record. File No. 4496-V.

ENGINEER REQUIRED by manufacturer located in Ontario for estimating and scheduling department. Applicant must have experience in the field of mechanical assembly and/or architectural drawing, practical shop and some general contracting experience, estimating experience is very desirable. Age 30 to 40. The starting salary would be commensurate with the man's experience. File No. 4498-V.

SUPERVISOR REQUIRED for a large Western Canadian Warehouse containing varied types of merchandise as well as workshop and assembly areas. Qualifications: age preferably 30 to 40, education, University degree with emphasis on engineering. Must have had at least five years of supervisory experience and must know how to deal with people. Prefer someone with experience in bulk handling methods. Salary will be in accordance with qualifications. File No. 4500-V.

CHIEF ENGINEER required by a well established Western Canadian organization, engaged in both the repair of R.C.A.F. aircraft and industrial manufacturing wishes to enlarge its operation in the sheet metal, plate work, and mechanical fields, particularly with regard to fabricating equipment for the petroleum and petro-chemical industry. A chief engineer with proven record of extensive experience in one of the following fields is required to head the industrial engineering department: structural steel, sheet metal, plate work, pressure vessels, boilers, heat exchangers or mechanical equipment. File No. 4503-V.

INSTRUMENT ENGINEER required with University degree in engineering. Experience in instrument work a requirement. Preference given to engineers with refinery experience. This is an excellent opportunity with a progressive and expanding oil company located in Western Ontario. Reply giving details of education, experience and background. File No. 4505-V.

CHEMICAL SALES ENGINEER required to work in Central Ontario. Employment would be employed in marine department this season and would work from Toronto to Port Colborne and would be eventually taken into industrial department. File No. 4508-V.

INSTRUMENT ENGINEER REQUIRED by large firm of consulting engineers in Montreal. Must have several years experience on interpretation of flow sheets, flaw calculations. industrial measuring and control instruments. File No. 4511-V.

ENGINEER CIVIL OR MECHANICAL required by Toronto manufacturers of ceramic and concrete products. Applicants must hold degree in one, and have general aptitude for both civil and mechanical or industrial engineering. Age under forty will be preferred. Must be prepared to work plant hours and rapid promotion and responsibility will be assured to the right man. Interviews can be arranged either in Montreal or Toronto. File No. 4514-V.

APPLICATIONS ARE invited for the position of instructor in the department of engineering, Mount Allison University, Sackville, N.B. A candidate for this position must be a graduate in engineering and preferably, although not necessarily, have some teaching experience. Candidates will please submit applications, stating qualifications and salary expected to Dean of Science

CITY OF CALGARY

ALBERTA, CANADA

requires

ENGINEERS

INSPECTIONS ENGINEER

DUTIES:

To administer the Inspections Department and to co-ordinate varied civic inspections for public safety programs and to supervise subordinate technicians and inspectors engaged in construction and trade inspections and related tasks.

QUALIFICATIONS:

University graduation in Civil Engineering, supplemented by extensive related experience in building construction engineering. Preference will be given to applicants of mature years who have held municipal engineering positions of an administrative nature.

ELECTRICAL ENGINEER

DUTIES:

Under direction to perform a variety of technical tasks in surveying system facilities, developing standards of electrical utility distribution, preparing reports concerning wholesale power supply to consumers, maintaining technical records, assisting in layout and design and related engineering tasks as assigned.

QUALIFICATIONS:

University graduation in Electrical Engineering, supplemented by some related experience, preferably in an electrical distributing system.

PROJECTS ENGINEER

DUTIES:

Under general administrative direction to supervise design and construction of varied municipal works and to interpret plans and specifications to employees and contractors; to make technical studies and maintain related cost and other records

QUALIFICATIONS:

University graduation in Civil Engineering, supplemented by some related experience in design and in projects supervising.

APPLY in writing to Personnel Director, City Hall, Calgary, Alberta, not later than June 10th. Applicants will please indicate position applied for and salary required.

Mount Allison University, Sackville, N.B. File No. 4517-V.

DESIGN ENGINEER required with experience in radar VHF and UHF equipments, servo-mechanisms and general electronic devices for air borne radar projects. Location Ontario. File No. 4518-V.

TELECOMMUNICATIONS engineer required with 2-10 years experience in the design and development of small transformers. File No. 4518-V.

SENIOR PRODUCTION control planner with 2-10 years experience in either production control planning, factory supervision, methods or time study capable of supervising small staff. Location Ontario. File No. 4518-V.

COMMUNICATIONS ENGINEER required by national research council to study and report on new and existing communications systems and on development in ancillary equipment; to act as liaison officers on radio propagation matters. Honours degree in engineering physics or electrical engineering and knowledge of multiplex and telegraphic equipment required. Post graduate training or experience desirable. File No. 4519-V.

MECHANICAL OR FORESTRY ENGINEER required by Montreal branch of well known Eastern Canada manufacturer to handle sales and installation of specialized line of machinery for pulp and saw mills. Candidate should be bilingual, ready to travel and have at least 2 years experience in either of the above industries. File No. 4520-V.

ELECTRICAL ENGINEER or engineering physicist to direct electronic design and electronic systems production engineering for guided missile development. The applicant must have experience in electronic component testing and subminiaturization techniques, and must be capable of directing the work of junior scientists. File No. 4522-V.

MICROWAVE AND ELECTRONICS engineer or physicist with six to 10 years experience to carry out research and development on guided missiles. The applicant must have experience in planning and directing the work of junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER or engineering physicist with experience in electronic computation to carry out development work on aircraft fire control computors basic knowledge of microwave and servo mechanisms desirable. File No. 4522-V.

ENGINEERING OR SCIENCE graduates for general training designed to equip suitable persons for future responsibility. Eventual job assignment, after completion of general training course, will depend upon personal aptitude. Preference given to single applicants not over 25 years of age. File No. 4524-V.

ASSISTANT OR ASSOCIATE professor mechanical engineering required in Halifax, N.S. Duties to instruct undergraduate students and develop post graduate work. Time and facilities for research. QUALIFICATIONS: university graduate preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Classification of appointee will depend upon qualifications of successful applicant. File No. 4528-V.

MECHANICAL OR CHEMICAL ENGINEER around 30 years of age to act as sales representative in Eastern Canada, from Ottawa to Halifax, with headquarters either in Montreal or Quebec City by manufacturers of water treatment equipment for all process industrial and municipal service. Applicant selected would be sent to head office and plant at Paterson, N.Jersey for a number of weeks to gather first hand information. Head office of Canadian Company in Montreal with offices in Ottawa, Toronto and Calgary. File No. 4532-V.

ASSISTANT SUPERINTENDENT for open-pit mine and terminal operations on St. Lawrence north shore. Mechanical or electrical engineer preferred, with at least three years experience in maintenance work. Candidate should speak French. New 6-room house available. Salary open. File No. 4534-V.

DRAUGHTSMEN REQUIRED for work in Victoria, B.C. Structural, experienced in designing and detailing, reinforced concrete structures; bar lists, bills of material, quantities, small buildings, check engineering drawings. Electrical: general and detailed arrangement, conduit drawings, wiring diagrams and material lists for generating and transformer stations in all sizes, voltages up to 138 KV. File No. 4537-V.

THE FACULTY OF ENGINEERS of the Syrian University, at Aleppo, is seeking candidates for the posts of professors and assistant professors in the following fields.

1. Mathematics, (analysis, analytical and mechanical geometry).
2. Applied Chemistry (also elements of Geology).
3. Hydraulics and hydraulic machines.
4. Mechanical Engineers (workshop, tools, foundry forge).
5. Communications (bridges, highways, marine constructions).
6. Civil Engineering.
7. Thermal Engines.
8. Metallic Construction.
9. Electrical Engineering.

Teaching in the French language, age over 30 and engineer's diploma from a recognized university. Applications should be received not later than May 31, 1953. File No. 4538-V.

TIME STUDY MAN or industrial engineer required in Montreal. Must have general knowledge of foundry practice and be capable of doing time study work under direction of consulting engineer. Specialized training will be given to a man with foundry background and necessary personal qualifications. Apply with full information. File No. 4539-V.

EXPERIENCED SALES ENGINEER with at least 4 or 5 years of selling experience. This work calls for an experienced mature sales engineer with capabilities for doing direct selling of industrial instruments. File No. 4541-V.

PRODUCTION ENGINEER required in Montreal. Engineer experienced in supervisory work in production and plant organization. Capable of handling projects for shop production as well as giving assistance to plant manager on personnel work. Would also have occasion to work with the American plant and must be able to get along with people. File No. 4541-V.

JUNIOR ENGINEER required in Montreal to work in shop production. Capable of working on projects with a minimum of supervision. Work would involve occasional trips to American plant to study new equipment and to help bring them into production in Canada. Practical knowledge of machine operations gained outside of the regular university course would be helpful but not essential. File No. 4541-V.

GRADUATE ENGINEER required to act as Western sales man for large organization with head offices in Montreal. Qualifications: 25 to 35 years of age preferably single due to amount of travelling required. Candidates should have proven sales experience preferably in plumbing, electrical or building supply fields. Salary, plus travelling expenses and company car. File No. 4542-V.

A YOUNG ENGINEER with experience in gas properties, flows, pressure regulation and combustion plus a knowledge of mechanical design. Work will involve the design and development of gas equipment including customer promotional work. Salary will be commensurate with experience and qualifications. File No. 4543-V.

Require qualified engineer with good all round experience in general machinery and machine construction to solicit main and sub-contract work for large new machine plant. Able to discuss at top management level throughout Canada. Salary according to qualifications. Writing first instance giving fullest details to File No. 4575-V. All applications treated in strictest confidence.

Situations Wanted

CIVIL ENGINEER AND LAND SURVEYOR, M.E.I.C., 26 years of varied experience abroad and in Canada, in: Railroad, airport, road, dam, water-supply, irrigation, building, factory construction and related survey of layouts and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

PLANT ENGINEER with civil and mechanical background 1936 graduate, M.E.I.C., P.Eng., (Ont.) 17 years experience in design, construction, maintenance, supervision, purchasing and operations in leading Canadian paper Mills desires change. Interested in engineering, purchasing, or engineering sales. Picture, details of experience, references on request. File No. 619-W.

GRADUATE MECHANICAL AND INDUSTRIAL engineer, P.Eng., M.E.I.C., bilingual, knows how to get along with people, experienced in production control, machine manufacture, foundry operation, methods installation, first class references, desires responsible position. File No. 1730-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., McGill, age 32, married, bilingual, 9 years diversified experience — structural and municipal engineering, field supervision, estimating, preparation of specifications, project administration; presently employed with consulting firm. Seeks further opportunity as project engineer or equivalent administrative position. Location immaterial. Minimum salary $7500. File No. 2817-W.

MECHANICAL ENGINEER, Sask. '46. Jr.E.I.C., P.Eng. (Que.) with some experience in design of steel and reinforced concrete structures desires a position with consulting engineers. Experience since graduation includes 18 months drafting in plant expansion program, 3½ years on project work for plant expansion and modernization and 18 months on plant maintenance and new equipment installation. The last two positions are with the same firm. File No. 2909-W.

MECHANICAL ENGINEER P.Eng., 9 years industrial experience in staff and supervisory positions in production, maintenance, and plant engineering. Wage incentives contract estimating and control for manufacture of heavy equipment, methods study, production eng., purchasing, for volume production. Sound business background. Desire plant or production management or technical sales. Presently employed. File No. 2920-W.

CIVIL ENGINEER M.E.I.C., P.Eng.N.S. graduate of U.N.B. 49, age 36, married, 53 car. Experienced in construction work, estimating, field engineer, concrete inspection, and etc., on wharf

RESEARCH ENGINEER

required by

Saskatchewan Department of Mineral Resources

$273 - $348 per month

(a variable cost of living bonus presently $6.40 is paid in addition to above stated basic salary)

Recent graduate in ceramic, chemical, or geological engineering; to carry out laboratory and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metallic or industrial minerals of the province.

Good pension plan and conditions of employment.

Write for application forms to the

Public Service Commission, 328 Legislative Bldgs., Regina.

Position to be filled as soon as suitable applicant obtained.

Lighting Sales Engineer

required by leading manufacturer of lighting and switchgear. Actual sales experience in commercial and industrial lighting in Ontario, contacts with architects, consulting engineers and contractors would be an asset. Unusual opportunity with better than average earnings to right man. Good salary and commission. New car supplied, plus car allowance and expenses. Apply File No. 4577-V.

and building construction. Interested in a change to sales engineering. Willing to travel one month's notice or less. File No. 3182-W.

MECHANICAL ENGINEER 1947 graduate with 6 years industrial experience in design, maintenance and some production. Single. Also has Arts Degree. Ready to become sales engineer with Montreal firm. File No. 3208-W.

WORKS MANAGER, 19 years diversified experience in heavy industry including, maintenance, inspection, design, production, administration and over five years as works manager of large mechanical plant. Graduate mechanical engineer presently employed, but interested in more responsible position offering scope to introduce improvements, including cost reduction and the promotion of sound employer-employee relations. Location preferably Quebec Province, but would go elsewhere in Canada dependent on nature of position offered. File No. 3355-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 28, B.Eng., 1948. Desires position with advancement possibilities preference for pulp and paper industry. Experience: 2 summers with a pulp and paper industry. 2½ years as project engineer of a hydro power development, 2½ years with large production firm on liaison work. File No. 3358-W.

CONSTRUCTION ENGINEER seeks administrative position with a construction firm. P.Eng., M.E.I.C., B.Sc., in civil engineering from U.N.B. in 1949. Age 33, married. Six years experience in construction as labourer, tradesman, field engineer, office engineer, and cost engineer on large projects. Experienced in office procedures, estimating, scheduling, job control, material control, cost accounting, field layout and supervision of all trades on construction of industrial, housing and petro-chemical processing plants. File No. 3386-W.

ENGINEER CIVIL/STRUCTURAL, 15 years experience design and construction of buildings, industrial and chemical plant structures and foundations. Trained in England, field and office. Sound theoretical background. Four years senior design engineer with large Canadian Company engaged on hydro-electric development work. Member E.I.C., A.S.C.E., etc. Interested in senior positions only. File No. 3702-W.

MECHANICAL ENGINEER. Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 24, single. Presently employed in propane gas, have had six months experience in building construction. Desire permanent position with good opportunities for the right man, no preference to job location, available at reasonably short notice. File No. 3903-W.

LAND SURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of a land-surveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. File No. 3908-W.

CIVIL ENGINEER, age 28, 1st class honours B.E. degree, National University of Ireland (1950), D.I.C. for post graduate course in the theory and design of structures at the Imperial College, London, England. P.Eng. (Ontario). Some experience in surveying. Presently employed (since July, 1951) at the design of buildings and other structures required for mining plants. Desires position which would give some experience in reinforced concrete or steel design or construction. Location preferably southern Ontario or Montreal, but will also consider others. File No. 3927-W.

GRADUATED ELECTRICAL and mechanical engineer. Jr.E.I.C., Vienna Technical University, 1½ years in Canada, fluent in English, and French, seeks responsible position in design, project or plant engineering with consulting or contracting firm, oil, chemical, paper or related industry. 4 years experience as: draftsman, checker, designer, estimator, field engineer and project engineer in: heating, air conditioning, drying, thermo electric power stations; piping, steel, instrumentation, etc. File No. 3945-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companes of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

ELECTRICAL ENGINEER 27 years of age, veteran, graduate of Manitoba 1950, completed Canadian Westinghouse Test Course. Desires job of technical aspect in Western Ontario or Western Canada. File No. 4021-W.

EXECUTIVE AVAILABLE. Has 15 years top plant management and engineering in mechanical and electrical manufacturing. Extensive background in plant organization, labour relations, production and plant engineering, design and engineering. Has top level contracts, meets people easily, used to dealing with sales engineering problems, customer and public relations. Seeks position where organizing ability can be put to full use and has a strong future . . . such as Asst. to top executive, plant management, engineering, sales engineering or administrative. Professional engineer, age 41, has earned hign salary but is of secondary importance to an interesting position. Has good personality, enthusiastic, keen business acumen, highest references. Resume on request. File No. 4088-W.

MECHANICAL ENGINEER Jr.E.I.C., P.Eng. B.Sc., Sask. 1949, age 25 single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting, design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

FULLY QUALIFIED ELECTRICAL, mechanical and patent engineer and lecturer, 22 years experience in power stations, transmission and distribution, installation of electrical and mechanical plant. Energetic, reliable and can undertake variety of responsible positions. File No. 4139-W.

JUNIOR E.I.C., 1947 graduate, offers 5 years of quality control and production supervision experience in non-metallic processing industry. Desires supervisory or administrative position in industrial minerals, pulp and paper or chemical industry, preferably located in Western Canada. Age 27, married, 1 child. Available on reasonable notice to present employer. File No. 4142-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.E. (Sask.) 1949, D.L.S. age 29, married. 4 years experience electronic surveying. Army veteran with radar technical training. Desires position in field of engineering or surveying. File No. 4146-W.

METALLURGICAL ENGINEER — 1951 McGill graduate, S.E.I.C., age 29, married, bilingual. R.C.A.F. commissioned service. Desires employment leading to the production and supervision fields. Summer experience in copper and nickel production. 2 years experience in steel plant operations. Wish location in southern Ontario, but preferably in Quebec (Montreal area). File No. 4148-W.

ENGLISHMAN DESIRES post in Canada. B.Sc. (Eng.Lond.) M.I.E.E. A.M.Inst. C.E. At present employed in hydro-electric projecting department of world-renowned European Continental electrical firm. Specialist in traction from tramcars to diesel and gasturbine locomotives, long operational experience. Practically bilingual (French mother). 52 but healthy and active. File No. 4149-W.

Jr.E.I.C., P.Eng., B.Sc. in civil engineering U.N.B. '48, desires responsible position with construction firm. Age 29, veteran, married, two children, five years experience in construction in estimating, purchasing materials and job supervision on building projects. Desires position in Ontario or Western Canada with progressive company having good opportunity for advancement. Available on two weeks notice. File No. 4150-W.

ELECTRICAL ENGINEER, B.A.Sc., U.B.C. 1950, age 28, married, 2 children. Completed Westinghouse's 2 year graduate training course. Desires position in plant

The University of Manitoba

Faculty of Engineering and Architecture
Winnipeg, Manitoba

PROFESSOR and CHAIRMAN

Department of Mechanical Engineering

as well as an

ASSISTANT PROFESSOR OF

Mechanical Engineering

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2. **Assistant Professor of Mechanical Engineering.**

Appropriate academic qualificatians, broad experience in Mechanical Engineering with special interest in thermodynamics and power plant design are desirable.

Starting salaries depend upon qualifications and experience.

Generous retirement plan, group insurance and other benefits are available.

Duties commence September 1st, 1953.

Applications should be accompanied by a curriculum vitae, a recent photographic likeness and be submitted to the Dean of the Faculty of Engineering and Architecture not later than June 1st, 1953.

Further information may be obtained by writing to:

A. E. MACDONALD, *Dean.*

engineering, manufacturing engineering, or electrical design. File No. 4153-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., University Graduate, over 20 years diversified plant engineering experience in process industries and steam power plants seeks responsible position in pulp-and-paper industry or allied fields. Experience includes design, construction, maintenance, planning and administration. File No. 4155-W.

GRADUATE METALLURGICAL ENGINEER, age 41, seeks a progressive and responsible post. Intimate knowledge of the steel industry fits him for an operating or research post. Married with children, home-owner and financially solvent. Presently employed. Willing to consider anywhere in Canada. File No. 4156-W.

CIVIL ENGINEER, A.M.I.C.E. (qualified 1949), age 31, married (2 children); at present Deputy Engineer of a town (population 11,000) in England; seeks any appointment in Canada offering scope for his capabilities. Particularly experienced: roads and sewers; house design, housing layouts and planning. Used to writing specifications; taking-off quantities, preparing estimates, drawing up of contracts and supervising construction. 4½ years war service R.A.F. File No. 4157-W.

GRADUATE MECHANICAL ENGINEER, age 39 (15 years diversified experience in heavy industry, including maintenance, plant layout, erection, production and administration.) Special knowledge of steel plant machinery, operation and production of rolling mills, electric welded pipe plants, pipe galvanizing and steam power plants. Knowledge of technical correspondence in English, French, German and Portuguese. Presently employed and interested in more responsible position with a company that can offer incentive and advancement to an ambitious engineer. Willing to locate anywhere if position suitable. Available on reasonable notice. File No. 4158-W.

DESIGN ENGINEER, M.E.I.C., fully experienced in reinforced concrete design and water works engineering available for part time work in Montreal. Designing, drafting or detailing. File No. 4159-W.

ENGINEERING PHYSICIST, B.Sc., 1948, M.Sc., 1950, P.Eng. Two years university teaching in physics, two years research in X-Ray deffraction and electron microscopy in government laboratory. Age 31, married. Seeks position in industry offering opportunity for advancement. Willing to take training course. File No. 4160-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 31, bilingual, with some teaching experience at leading university and production experience in a nationally known sewing machine company, etc., seeks position in a well established peace time mass production industry (automotive, chemical, oil, etc.). Interested in working on development of new processes or machines or preferably an extensive period of training leading eventually to an executive opening. Services available May 15, or possibly before if employer offers an attractive long term future. File No. 4161-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 32, veteran, 1949 graduate. Experience consisting of production supervision, process development and control work including supervision of engineering graduates in this work. Desire position providing experience in another manufacturing field. File No. 4166-W.

CIVIL ENGINEER, unmarried, 28, bachelor's degree Cornell University, master of science degree Cornell University in engineering materials and highway engineering. Interested in research or teaching position in soil mechanics, concrete, highway materials, highway engineering; or working with a well established engineering firm. Available July 1, 1953. File No. 4167-W.

CHEMICAL ENGINEER, P.Eng. Ont. Jr.E.I.C. 1949 graduate, (Queens) age 25, single. One and a half years experience in production supervision in chemical extraction plant and two years experience in process development and production supervision in chemical plant producing cellulose and thermoplastic films. Interested in a position in supervision, process development or technical service offering a good opportunity for advancement. Location, Ontario or Western Canada preferred. Presently employed but available on reasonable notice. File No. 4168-W.

CIVIL ENGINEER, B.Sc. (Hons.), Edinburgh, A.M.I.C.E., A.M.I.E. (Aust.), veteran R.E. officer, aged 32, married with two children recently district engineer, Colonial Engineering Service, seeks employment with contractor, consultant or municipality, preferable in B.C., or Ontario. Arriving in Canada late April 1953. Experienced in construction and maintenance of roads, bridges, airfields, light buildings, waterworks. Accustomed to executive responsibility, office administration, preparation of plans and specifications and supervision of contracts. Experience administration of small town boards. Prepared to work hard to establish himself firmly in Canada. File No. 4169-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in industrial planning of major expansions, and plant improvements including investigation, reports, estimates, and design (civil and some mechanical). During 4 years in pulp and paper industry, reaching supervisory capacity, have obtained broad field and office experience in diversified structural design and plant engineering. Spent 1 year structural design of power plants with consulting engineer. Seek responsible position with industrial organization. Locate anywhere in Canada. File No. 4171-W.

SHELL STRUCTURAL SPECIALIST AVAILABLE, M.Sc., M.E.I.C., graduated 1947. File No. 4173-W.

MECHANICAL ENGINEER, married, with three years experience in production supervision quality improvement, cost reduction, and maintenance in a large basic industry. Worked as an undergraduate with the Dominion Government in charge of a field crew. Will consider a position with any organization that presents opportunity and challenge. Will work anywhere in Canada including the N.W.T. and will consider a foreign assignment. File No. 4174-W.

GRADUATES IN BOTH mechanical and electrical engineering (B.Sc. Queen's Belfast, 1946) P.Eng. M.E.I.C., age 29, single. Experience comprises two years manufacture of marine and land diesel engines, diesel alterations, steam turbines, six months manufacture and repair of electrical machinery, eight months diesel drawing office work, and two years steam power station operations. Canadian experience — ten months electrical distribution, four months electrical protection. Seeks position in Alberta, British Columbia, or Western U.S.A. File No. 4175-W.

GRADUATE CHEMICAL ENGINEER M.E.I.C., honours, family, multilingual, high invention record, imaginative, resourceful, 20 years diversified experience in heavy chemicals and management (pilot plant experiments, research, production, economic studies, estimation, plant design). Conversant with fluid-mechanics, thermodynamics, fluidization, heat exchange, drying, air conditioning. Extensively travelled. Presently employed but interested in more responsible position offering scope to introduce improvements, consultant or assistant to senior executive. Location preferably Montreal area, but would consider going elsewhere depending on nature of position offered. File No. 4176-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc. (mathematics and chemistry), B.E. from Nova Scotia Technical College 1952. Desires a position offering more scope for learning and advancement. Presently employed in transmission and distribution department of utility. Interested in learning design. Age 25. File No. 4177-W.

STATISTICAL ENGINEER, graduate engineer, Jr.E.I.C., qualified in mathematical statistics and quality control, desires position in the applied statistics, engineering research, or quality control fields. File No. 4178-W.

CIVIL ENGINEER and architect, graduated in Germany, Danzig and Munich Universities, seeks position anywhere in Canada. Polish immigrant, fluent in English and French, age 39, married, no children. 17 years varied experience in Europe and Near East, in design of residential, industrial and hospital buildings, supervising and directing construction (concrete), town planning (received 2nd place in the town planning competition for lower part of the town Haifa), municipal work. Willing to start in junior position with the possibility of advancement. File No. 4182-W.

MECHANICAL - CHEMICAL ENGINEER (M.Eng. Dresden, Karlruhe), M.E.I.C., P.Eng. At present lecturer at McGill. 15 years experience as Plant engineer and assistant manager in heavy industrial and chemical plants process and design for chemical plants. Bilingual. Single. Location anywhere. Available end of April. File No. 4183-W.

BRITISH ELECTRICAL ENGINEER, Whitworth Scholar, First class honours (1949), emigrating in September wants job in computing, servo-mechanisms or process control. Four years apprenticeship in naval dockyard, one year test course in Metropolitan-Vickers, one year on design of electrical computers, eight months on liaison work with U.S.N. in Washington, D.C., one year on machinery control. File No. 4186-W.

1950 U. of A. E.E., P.Eng., M.E.I.C., veteran of R.C.N.V.R., married, requires employment, preferably in Western Canada, commencing around July 1st. Experience includes heating, ventilating and electrical design, limited well head production equipment sales, and field supervision of construction of power plant equipment and steam distribution system. Desires employment on sales or construction supervision of heavy machinery or power plant equipment. File No. 4187-W.

ELECTRICAL ENGINEER (BRITISH) visiting Canada in May view to emigration. Graduate London University. Member of Institution of Electrical engineers. Age 43 married. 23 years experience electrical manufacturing and distribution industries. Last 14 years managing district containing 60,000 consumers, mainly urban: responsible for planning, construction and maintenance of networks and provision of supply

Sales Engineer

Opportunity for an architect or civil engineer, 25 to 35 years of age, who has had 1-2 years experience in the building construction industry, preferably sales. Training salary, $3,900.00 per year. File No. 4561-V.

MECHANICAL ENGINEER

University graduate with two or three years experience in mechanical or metallurgical fields and above-average literary ability. Permanent employment in Ottawa with well-known industrial association. Pension plan. File No. 4578-V.

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Excellent opportunity for right man to take a big part in a fast growing aggressive organization and earn an excellent salary. Free medical services and company profit sharing plan. Please send complete résumé to File No. 4576-V.

to industrial, commercial and domestic premises. File No. 4188-W.

METALLURGICAL ENGINEER, Jr.E.I.C., B.Eng., McGill 1951, age 31. Married, one child: two years experience as project engineer in steel industry and milling experience in mining industry. Desires responsible position which offers interesting and diversified work with definite possibilites for advancement to executive position. Willing to travel. Available on reasonable notice to present employer. File No. 4189-W.

CIVIL ENGINEER, Jr.E.I.C., 4 years experience, desires part time employment, reinforced concrete or steel designing and detailing in Montreal. File No. 4190-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.A.Sc., (Honours) Toronto 1949. Post-graduate training and knowledge of prestressed concrete. Age 25, single. Presently employed as design engineer in mechanical field. Experience includes harbour work planning, design, maintenance, and administration; structural steel and concrete design, and construction supervision. Seeking position with either consulting civil engineer or contractor where capabilities and training will be used. Available on reasonable notice. File No. 4191-W.

GRADUATE ELECTRICAL ENGINEER, age 28, single presently employed as electrical draughtsman in Montreal. Seeks position as junior engineer preferably in Ontario. File No. 4192-W.

AVAILABLE OCTOBER 15, 1953, young Dutch civil engineer graduate Delft Technological University, Holland. Age 25, married, no children. In full command of the English language. Special interests and some experience in concrete and prestressed concrete structures. Wanted: work in a first class construction company, with possibilities for advancement. Location anywhere in Canada with preference for Ontario or British Columbia. File No. 4193-W.

MECHANICAL ENGINEER British, A.M.I. Mech.E., A.M.I. Prod.E., seeks executive position or position with prospects. Wide experience in production methods, production control, tooling etc. several years experience in development projects. Structural experience gained during service with H.M. Forces. Age 37. File No. 4194-W.

COULD YOUR FIRM use a young civil engineer P.Eng., (Ont.), B.Sc. Queen's 1950 Jr.E.I.C., age 24 single. Desires to change from present job to something new. Will make up in enthusiasm what I lack in experience in your line of work. Type of work or location not governing. File No. 4203-W.

MECHANICAL ENGINEER, under 35, 8 years diversified industrial experience in production control, layout, development, design, purchasing, maintenance and machine shop practice. Extensive supervisory experience and sound business training. Cost and production minded. Presently employed. Seeks production or plant management. Will also consider technical sales. Location, preferably Ontario or Montreal area. File No. 4204-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., B.Eng. 1942, age 32, married, 3 children. Experience includes layout and supervision of all types of industrial electrical construction and installations, heat-treating, standards committees, specification writing and presently on management of small manufacturing concern. Located in Ontario at present but desire opportunity in Western Canada, preferably Alberta. Available on reasonable notice. File No. 4205-W.

CIVIL ENGINEER, B.Sc. 1949 single, age 25, Jr.E.I.C., railway experience, consisting of location survey, construction, track work, design and supervision of frame and reinforced concrete structures, estimating and administration. Particularly interested in work in the north or foreign assignment. Available on short notice. File No. 4206-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., Ass. Mem. A.I.E.E., B.A.Sc., University of Toronto, 1951, age 28, Test Course graduate of a prominent electrical firm with experience in design and related production problems. Previous experience in maintenance of electronic equipment. Interested in servomechanisms. Desires position of increased responsibility with progressive organization. Married, one small child. File No. 4210-W.

MECHANICAL ENGINEER, graduated, over 20 years engineering experience in heating, plumbing, ventilating, air conditioning, refrigeration, waterworks and sewer installation, experience in process industries steam power plant, boilers, pumps, valves, seeks adequate occupation. Experience includes design, construction, maintenance and planning. File No. 4211-W.

CIVIL ENGINEERING GRADUATE (B.Sc., St. Andrews University Scotland) 1952, at present studying for honours, wishes post with structural engineering firm, preferably in West or Mid-West. Some experience of steelwork design and detailing, interested in reinforced concrete. (age 25). File No. 4212-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. graduate of Alberta 1950, age 29, married, no children. Completed 2 years training course with internationally known electrical industry. Presently residing in Montreal — sales department for industrial apparatus. Interested in sales and construction industry. Previous experience city engineering department, Naval Petty Officer. File No. 4213-W.

MECHANICAL AND CHEMICAL ENGINEER, M.E.I.C., P.Eng. age 37 — hold degree in Mechanical engineering, chem. Eng. also 1st class stationary engineers papers. Considerable experience in Plant Maintenance Engineering and personnel administration. No particular location preferred and willing for out of Canada position. Interested in plant maintenance installations, technical sales and engineering administration. Presently employed but looking for position where opportunities and advancement are available to one with initiative. File No. 4215-W.

CHEMICAL ENGINEER Jr.E.I.C., B.Eng. McGill 1947. Will obtain Ph.D. from Princeton in fall 1953. Age 23 single. Three years experience in production, tech. service to production, and development work (economic feasibility studies). Interested in process design or development, tech. service to production, or production. Available fall or winter of this year. File No. 4216-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill 1951, age 23, single. Presently completing 2 year graduate student training course offered by large electrical industry. Desires position with opportunity to demonstrate ability. Preferred location Montreal or Toronto area. Available in June. File No. 4217-W.

CIVIL ENGINEER Jr.E.I.C., P.Eng. 2 years heavy construction field work and supervision, desires work in Ontario or Western Canada. File No. 4218-W.

MANAGEMENT ENGINEER, age 38, family. Queen's 1936, B.Sc. Mechanical (honours) M.E.I.C., and volume sheet-metal industries. Thoroughly experienced all phases factory supervision, production and material control, industrial engineering, tool planning and manufacture, quality control, engineering design supervision and liaison, etc. Recent experience includes general management responsibilities in company organization, sales and contract administration, labour relations, and management control. Seeking position offering management career possibilities; Southern Ontario location preferred, but will consider others, including foreign. Available after May 1st. File No. 4219-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.Sc. 1942, M.Sc. 1946, P.Eng. age 30, married, with 7 years all round experience of physics applied to industry desires position with laboratory (electrical or other industry). Previous work includes super-sonics, electronics, magnetic materials, high-voltage testing, radio-active materials. Would prefer small city, if possible up North. File No. 4229-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.) 1949 graduate, age 37, married, no children. R.C.A.F. veteran (operational air navigator) 5 years teaching experience. 4 years varied experience in rural distribution including administration, consumer service, employee training, rate analysis, pole line construction and maintenance, tower line maintenance and some metering. Two summers surveying. Desires job with a definite opportunity for advancement and greater responsibility. Location of secondary importance if job suitable. Available on reasonable notice. File No. 4230-W.

FACTORY MANAGER available M.E.I.C., P.Eng., graduate civil engineering 1935, 13 years experience as factory manager in rubber and plastics molding plant employing over 600 persons. Experience covers production, plant layout and expansion, engineering and maintenance, standards (time-study, estimating, and specifications) labour negotiations and personnel, etc. References will show career of unqualified success to date — with necessary knowledge, experience, ability, and personal qualities required in factory management. Age 39, married with family, and in good health. File No. 4231-W.

CHEMICAL ENGINEER, M.A.Sc. (U.B.C., 1951) Jr.E.I.C., age 25, single, with 1½ years experience desires a position in an industry offering opportunity for advancement. Presently employed and available on reasonable notice. Location in Ontario or Western Canada preferred. File No. 4232-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 1951 graduate, age 28, married, without children. Desires position in electrical design with a power company or consulting engineers in Montreal. Experience includes one year with a large firm of contractors in England on design of substations and transmission lines. At present with a large manufacturer of electronic equipment. Available on one month's notice to present employer. File No. 4233-W.

News of the Branches

Activities of the Forty-four Branches of the Institute and abstracts of papers presented at their meetings

Central British Columbia

H. L. Topham, Jr.E.I.C.,
Secretary-Treasurer

Meeting with B.C. Engineering Society

The joint meeting of the two societies was held at the Allison Hotel, Vernon, B.C., March 13th, 1953, with 40 persons attending. Dinner was served at 7.15 p.m.

The first part of the after-dinner meeting was turned over to the Engineering Society, vice-president R. G. Harris presiding. Minutes of the annual meeting of the society, held at Kelowna, November 19, 1952, were read, as well as those of the January 23 meeting.

With regard to suggestions that the Society should attempt to lend assistance to those who are attempting to qualify for registration through exams given by the Association, a committee of five was appointed to take charge of this work. Representation on the committee is as follows: W. Ramsay for Kamloops, G. C. Tassie for Vernon, W. A. Ker for Kelowna, L. E. Willis for Penticton, and H. Parliament for Princeton.

A raffle of a sealed container of highly refined lubricating fluid donated to the meeting by the Finning Tractor Company was conducted, netting the sum of $14.25, which was donated to the Vernon Branch of the Canadian Red Cross Society for use in their work.

The meeting was then turned over to the E.I.C., Chairman Bob Bigg presiding. A count showed 30 E.I.C. members present. Minutes of last dinner meeting were read.

It was pointed out that the next dinner meeting was scheduled for May 15th in Kamloops and that probably the Golf Club headquarters would be used for the occasion. The E.I.C. would have charge of arrangements. Mr. McConnell, manager-director of Aero Surveys, Vancouver, would be in Kamloops on that date and had offered to present a paper, accompanied by films, on the subject of "Aerial Surveys in British Columbia".

The next meeting, with the Society in charge, is scheduled for July 10 in Penticton. It was not considered that sufficient representation could be had if the meeting was held at Williams Lake as originally proposed.

Paul Walker brought to the executive's attention that the September 18th meeting at Penticton might co-incide with the municipal engineers convention in Vancouver on that date and that this should receive attention.

A circular letter from the General Secretary regarding a suggested annual summer meeting for Zone "A" was read. It was the feeling of the meeting that because of the distances involved it would be impossible to get members of the four western provinces together for such a meeting. It was suggested instead, that consideration might be given to the holding of a provincial E.I.C. meeting in conjunction with the annual meeting of the professional engineers, held in Vancouver.

The speaker for the evening, Mr. Andy Stewart of the C.P.R., was unable to be present because of slide conditions in the vicinity of Golden. Paul Walker substituted for the occasion and presented a most interesting paper on wartime operations off the Cocos or Keeling Islands. The paper covered the history and description of the Cocos Islands and the work of the Air Force from the Islands. Their job consisted mainly in dropping vital supplies to guerilla forces in Malaya, some of these trips taking fourteen to sixteen hours flying time.

A vote of thanks was accorded the speaker by M. L. Wade on behalf of both groups.

After the paper, three short films were shown: "The Mineral Wealth of the Canadian Shield", "Steel", "Fabrics". The film on fabrics was thought the most interesting of the three, the one on steel being a non-technical film.

Fredericton

R. E. Tweeddale, M.E.I.C.,
Secretary-Treasurer

New Officers Elected

The Fredericton Branch held their annual meeting on April 21 at Colwell's Inn. A large group was on hand to enjoy the dinner, including many members from out of town.

The retiring chairman, D. J. Brewer, heard the annual reports of the various committee chairmen; discussed some new business and summarized the work of the Branch during his term of office. He pointed out that the Fredericton Branch had done much to advance the interests of engineers both in Fredericton and in the Province as a whole.

The new officers elected were: C. E. Weyman, chairman; R. E. Tweeddale, vice-chairman; I. M. Beattie, secretary; G. H. Loane, treasurer; D. C. Campbell, H. E. Marshall and D. A. Forbes, committeemen for a two-year term. Committeemen H. W. McFarlane, S. Cassidy and A. A. Albert will remain on the executive to complete their two-year term. The Institute councillor, H. G. Hughson, was also present at the meeting.

After the business meeting the group was addressed by Prof. H. W. McFarlane of the University of New Brunswick on soil mechanics.

A vote of thanks was extended to Prof. McFarlane by R. A. Malloy.

Eastern Townships

H. R. Blackmore, Jr.E.I.C.,
Secretary-Treasurer

Gaston Masse, M.E.I.C.,
Branch News Editor

Presidential Visit

The visit of the president of the Institute, Dr. John B. Stirling, highlighted the Annual Ladies Night of the Eastern Townships Branch held at the Tuque Rouge club house on April 23, 1953. Dr. Stirling was accompanied by Mrs. Stirling, and by Dr. L. Austin Wright, general secretary of the Institute, and Mrs. Wright, and by I. R. Tait, chairman of the Montreal Branch.

George M. Dick, chairman of the Eastern Townships Branch, presided at the dinner meeting.

Jacques Brisson welcomed the ladies to the meeting, and Mayor Emile Levesque extended a formal welcome to the guests of honor and presented Dr. Stirling with the keys to the city.

In his remarks, Mayor Levesque stressed the important role that engineers had played in the development of Sherbrooke and the Eastern Townships, and he congratulated the Branch on its splendid progress during its comparatively short history.

Dr. Stirling based his remarks on the need for a greater recognition of the engineer's place in public service. The Canadian engineer had gained recog-

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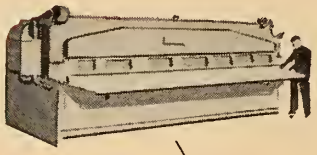

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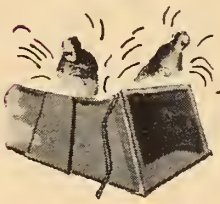

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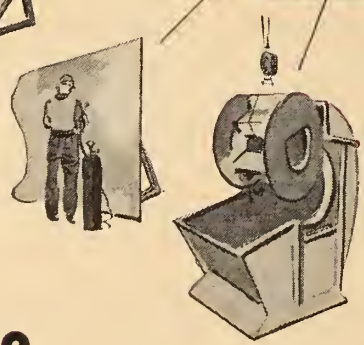

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nition on the international and national levels, he said, citing several honors conferred on Canadian engineers and Canadian engineering associations by foreign governments and organizations in recent years, as well as a number of key posts in the federal administration held by engineers. However, this recognition had not been carried down to the local level, he said, and he urged that the members of the profession take a keener interest in community affairs so that the public might gain a better insight into the part played by the engineer in the development of the country and the community.

Dr. Wright outlined the growth of the Engineering Institute of Canada which now has 45 branches with over 16,000 members. He also outlined the plans for the Annual Meeting to be held in Halifax in May.

The speakers were introduced by John Critchley of Magog, vice-president of the Eastern Townships Branch, and thanked by Ward Smyth.

I. R. Tait, vice-president of the Institute extended greetings to the Eastern Townships Branch.

The dinner meeting was followed by dancing.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.,
Branch News Editor

Junior and Student Competition

On Thursday evening, March 19, the Branch heard five papers presented in competition by Student and Junior branch members.

Three past-chairmens' prizes, of $50, $35, and $20 were awarded. First prize went to E. Evans for his paper, "Novel Features of Ore Dock Construction." Mr. Evans dealt with the problems faced by the Steel Company of Canada in enlarging and modernizing their ore handling and storage facilities. He stated that difficult foundation conditions, combined with the necessity of storing enough ore for year-round operations during the navigation season, resulted in an engineering solution which was not only novel but unique. His talk gave interesting technical insight into one of the now-familiar features of Hamilton's water-front skyline, the Stelco ore bridge.

Second prize was won by D. Williamson, with his paper, "Engineering a Broadcasting Station." Mr. Williamson dealt with the selection of a channel for a hypothetically new station, and the technical problems to be met in assuring that the location, power, and directivity of the transmitter comply with international conventions governing radio emissions.

F. Gue was awarded third prize for his paper entitled "Moral Responsibilities of the Engineer." Mr. Gue challenged his listeners to shift part of the emphasis in the solution of engineering problems from material to moral, aesthetic, and spiritual considerations.

Other papers presented were "Electrically Controlled Hydraulic Elevators" by P. Danciu, and "Job Evaluation" by R. Whittaker.

Ian MacDonald, speaking for himself and the other two judges, J. Hillgartner and J. Kelly, congratulated both J. A. Michell, chairman of the Students and Juniors Paper Committee, and the contestants. He emphasized that selection of three winners from among five excellent papers had been difficult.

R. M. Zabel Guest Speaker

Friday evening, April 17, the Branch heard Dr. R. M. Zabel, engineering manager, Bloomfield Lamp Division, Westinghouse Electric Corporation, discuss "Recent Developments in Light Sources." Well supported by slides, movies, and demonstration apparatus, Dr. Zabel outlined the great and rapid advances made over the past few years in increasing the efficiency and adaptability of various light sources.

One of the many interesting aspects of lamp manufacture dealt with was the experimental use of "float melting" of metals, in which small quantities of special alloys are suspended without mechanical support by a powerful magnetic field. The induced currents which react with the field to support the weight of the metal glob also serve to heat the metal until it melts. The molten metal, completely uncontaminated by contact with a crucible of any kind, is then "poured" by gradual reduction in the strength of the magnetic field, which allows the metal to flow in a thin stream through a gap in the lower magnetic coil.

Dr. Zabel also treated his audience to a pictorial travelogue of parts of Europe, with emphasis upon the various methods of lighting public places in use

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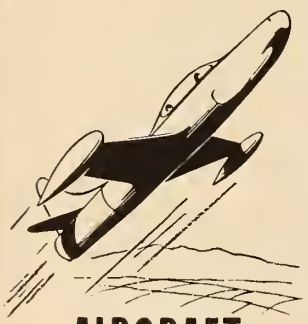

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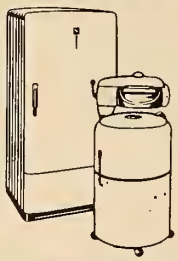

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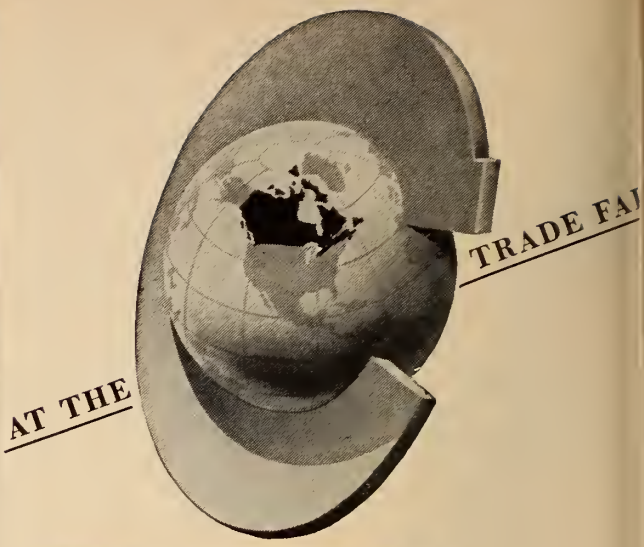

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there, and the contrasts in lighting methods between Europe and this continent.

The meeting, which was a joint one with the A.I.E.E., marked the passage of the Hamilton subsection of the A.I.E.E. into full section status. The congratulations and best wishes of the E.I.C. were conveyed to the sister society by W. A. Dawson, M.E.I.C., Branch chairman.

Hamilton

Engineers' Wives Association

MRS. DOROTHY M. NORTHRUP
Corresponding Secretary

Report of 1952 Activities

During 1952 four business meetings were held, which included interesting talks by J. A. Moradian, chairman of the Hamilton Branch of the National Unity Council; Miss M. Brown, publisher of "Marketing" magazine; L. F. Grant, field secretary of the E.I.C.; Thor Hansen, art director of British American Oil Company; and F. Fogwell, chairman of the Speakers' Bureau of the Hamilton Film Council. There were two parties, a picnic, a dinner meeting and a floral demonstration—the idea being to alternate business and social meetings throughout the year. Also, a most interesting tour was conducted through the Eaton Knitting Company. The association was honoured by the presence of Mrs. Ira P. Macnab, wife of the president of the E.I.C. The executive entertained Mrs. Macnab at dinner prior to the meeting.

In addition to the regular monthly meetings, there were meetings each month for several "interest groups"—a craft group which received instruction in smocking, needlepoint, glove making, glass etching, and china painting; a bridge group — consisting of seventeen members; a music appreciation group of ten members who, in addition to their regular meetings, attended three Toronto symphony orchestra concerts and the film version of Offenbach's "Tales of Hoffman"; a service group—formed in November, and currently doing work for the Mountain Sanatorium. It is felt that these smaller groups afford the members an opportunity of meeting and becoming better acquainted with one another.

Membership at the close of 1952 totalled seventy-nine, with an average attendance at regular meetings of forty-six. Through the secretary of the Hamilton Branch of the E.I.C., the group received the names of seventy-six engineers who had recently come to Hamilton, and an attempt was made to interest wives of these engineers in the group's activities.

Executive for 1953

The executive of the Hamilton Engineers' Wives Association for 1953 is as follows: president, Mrs. F. J. Veale; vice-president, Mrs. J. S. R. Beck; recording and corresponding secretaries, Mrs. P. J. MacNally and Mrs. R. G. Northrup; treasurer, Mrs. G. L. T. Vollmer, programme and social conveners, Mrs. W. H. Hendric and Mrs. J. M. Skinner; membership secretary, Mrs. W. Hindle, honorary president, Mrs. W. A. Dawson; past president, Mrs. G. L. Schneider.

Moncton Branch

V. C. BLACKETT, M.E.I.C.,
Secretary-Treasurer

Film Night

On January 27 a Branch meeting was held in the Department of Transport Office in the Northern Electric Building, at which a number of recently-issued sound films were shown. Titles of these films, all illustrative of Canadian scenes and activities were, "Bud-worm Spray Project", "Canada's Awakening North", "Newfoundland Scenes' and "Rendezvous on the Reef'. At the conclusion of the meeting, coffee and sandwiches were served.

Annual Dance

The annual dance of the Moncton Branch was held at Dunhams on February 6. Marked by informal sociability, the affair was easily the most enjoyable of the Branch season. Music for the evening was provided by the Patterson Quartette. Door prizes were won by Mrs. V. C. Blackett and H. L. Purdy. Following the supper, the evening was brought to a close with a sing-song. The

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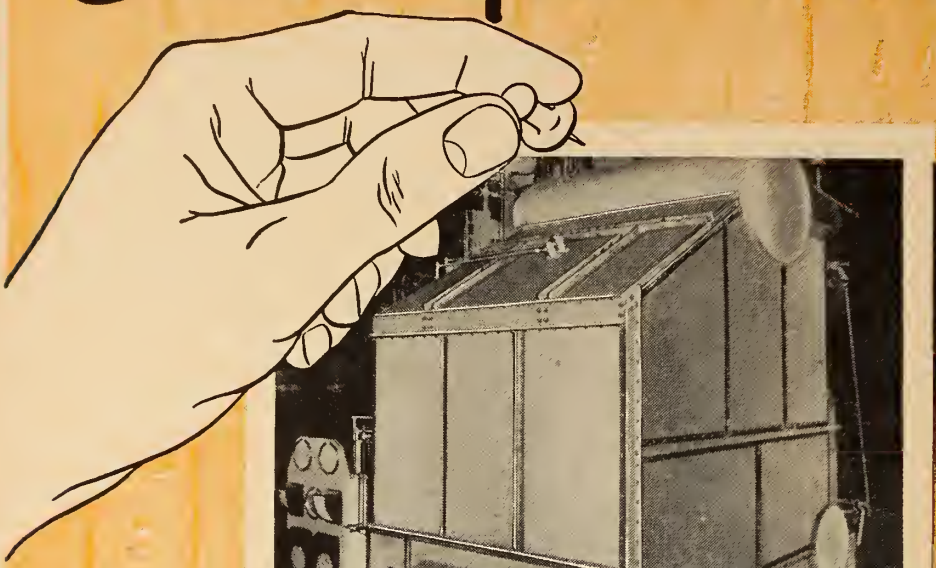

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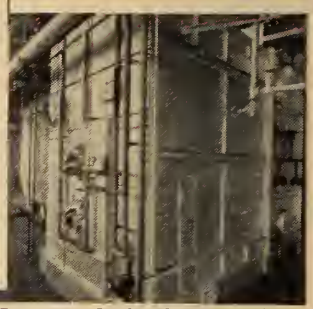

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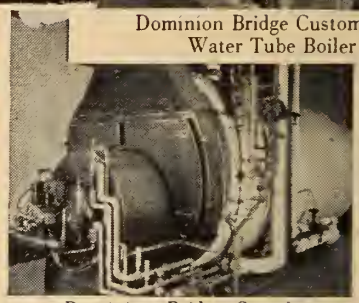

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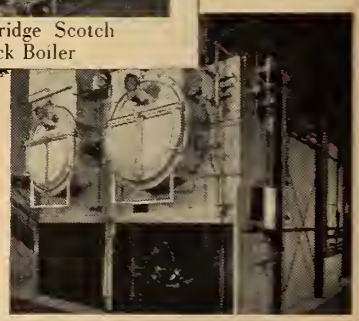

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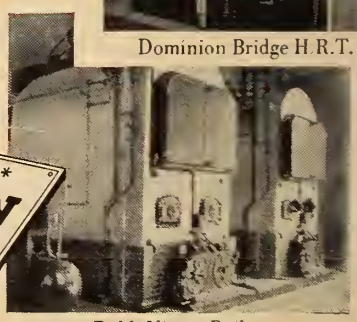

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Speakers for the Montreal Branch Chemical Section panel discussion on "Future Trends in the Canadian Chemical Industry", March 24, 1953. Left to right: Dr. A. F. G. Cadenhead, C. R. Graham, Dr. G. H. Guest, Dr. J. R. Donald, W. N. Hall, F. K. Rogers, Dr. H. H. Sanderson and L. D. Smithers.

committee in charge of arrangements consisted of L. E. Trynor, M. F. K. Leighton, W. D. G. Stratton and N. B. Eagles.

The President's Visit

On March 4, a dinner meeting, attended by members and their ladies, was held in the Brunswick Hotel. The occasion was the official visit to the Moncton Branch of Dr. J. B. Stirling, president of the Engineering Institute of Canada. Dr. Stirling was accompanied by Mrs. Stirling and the general secretary, Dr. L. Austin Wright. W. D. G. Stratton, chairman of the Branch, presided at the dinner meeting and introduced the president.

Community service was the theme of Dr. Stirling's address. Engineers, he said, held the confidence of the public to a degree not surpassed by any other profession. The respect which the public held for a profession was deepened when members of that profession rendered faithful and competent service not only in the line of duty but above and beyond it. He urged members of the Institute to enhance the prestige of their profession by taking a more active interest in community affairs.

The thanks of the meeting were extended to Dr. Stirling by W. A. Purdy.

Dr. Wright gave an interesting and comprehensive review of the state of the Institute and told what was planned in the way of improvement.

During the afternoon a tea was held at her home by Mrs. W. D. G. Stratton, for Mrs. J. B. Stirling and the wives of members of the Moncton Branch executive. Decorations consisted of chrysanthemums, daffodils and tulips. Mrs. V. C. Blackett poured and Mrs. R. L. Parsons served.

The following morning the president and general secretary met with the Branch executive. The feature of the meeting was a spirited discussion on matters relating to Branch finances.

Montreal

R. J. Harvey, M.E.I.C.,
Secretary-Treasurer

Chemical Section

W. H. Gauvin, M.E.I.C.,
News Editor

Panel Discussion on Canadian Chemical Industry

"Future Trends in the Canadian Chemical Industry" was the topic under discussion by a panel of seven engineers at the meeting of March 24, 1953. The chairman and moderator of the panel was Dr. J. R. Donald, president of J. T. Donald and Co. Ltd., until recently director of the Chemicals and Explosive Division of the Department of Defence Production.

The panel of speakers included Dr. A. F. G. Cadenhead, consultant, formerly director of plant research for Shawinigan Chemicals Co.; C. R. Graham, market analyst in the Market Research Section of Canadian Industries Ltd.; Dr. G. H. Guest, staff development consultant of Canadian Industries Ltd.; W. N. Hall, vice-president in charge of research, development, engineering and operations for Dominion Tar and Chemical Co. Ltd.; F. K. Rogers, assistant director of the Department of Chemical Development for Shawinigan Chemicals Ltd.; Dr. H. H. Saunderson, director of the Information Services Division of the National Research Council, and coordinator of materials for the Department of Defence Production; and L. D. Smithers, executive vice-president of Dow Chemical of Canada Ltd.

Dr. Cadenhead opened the meeting by discussing briefly the water power situation in Canada, stressing particularly the enormous reserves to be found in the Province of Quebec. He then discussed the sources of inorganic raw materials, particularly in the chemical and metallurgical fields.

F. K. Rogers followed by discussing the organic chemical resources of Canada, including wood, natural products, coal, petroleum and natural gas and commented on the competition among these raw materials which ensue.

Dr. Guest was then called upon to discuss the question of human resources. He confined his remarks to the needs of the chemical industry for university-trained personnel during the next four years. His data were largely based on a survey of 417 employers throughout Canada, recently made by the Economics and Research Branch of the Department of Labor. The estimated requirements predicted from this survey were then compared with the probable number of students graduating in both chemical engineering and chemistry during the next four years. His conclusions were that at the end of this period, a shortage of approximately 700 chemists and of a comparable number of chemical engineers will exist. Dr. Guest also predicted that by the end of this period the exodus of our trained specialists to the U.S. would be almost completely stopped. Little relief could be expected from European refugees, nor was a large number of technicians from the U.S. coming to Canada to fill the gap anticipated. Two solutions for this deficiency were proposed a)reversal of trained personnel presently engaged in non-engineering or non-technical work back to scientic careers, and b) active support by industry of any program designed to stimulate interest in chemistry and chemical engineering on the part of students, principally by means of scholarships.

C. R. Graham made predictions regarding the expansion of domestic markets for the Canadian chemical industry between the present and 1975. He considers that domestic markets are probably the most stable aspect of the industry and that all phases should experience marked increase during that period. Predictions of a 50% increase for the pulp

and paper industry, and increases ranging from 100% to 200% for most of the other industries were made.

L. D. Smithers agreed with Mr. Graham that the Canadian chemical industry will grow strongly only as the domestic markets strengthen. In his discussion of export markets for Canadian chemicals, he pointed out that while these markets are important to Canadian chemical producers, they are quite hazardous markets. While the "big three", agriculture, forest and non-ferrous resources, have grown to meet the export demand, the Canadian chemical industry in general still remains to establish itself. The speaker felt that it should be directed primarily to South America, from which countries imports could be effected to keep trade in balance. The speaker also pointed out that the currency question with these countries is daily improving and that most of them now have appreciable amounts of dollar currency for purchasing purposes.

Dr. Saunderson outlined the role of chemical industry in defence. He showed that it could contribute to our present defence arrangements in two ways. The first is by the production of those items which are directly defence-related, such as explosives, propellants, chemical warfare agents. Facilities for producing these items have been established or rehabilitated. The second results from the fact that any major defence effort involves a substantially increased supply of those chemicals which are basic to all industry, such as sulphuric acid, caustic and chlorine, ammonia, organic solvents, etc. A major part of the activity of the Chemicals and Explosives Division of the Dept. of Defence Production consists of encouraging the expansion of the general Canadian chemical industry to meet this second part of the defence preparedness.

The last topic of the panel discussion was that of tariffs and was covered by Mr. Hall. Mr. Hall pointed out the extreme difficulty of opening markets for Canadian chemicals in the U.S. Conversely, he showed that some protection is needed by the Canadian producer from the dumping of American surpluses on the domestic market at, or below, cost. He then proceeded to show by means of a few specific examples, that the existence of tariff barriers does not necessarily mean increased cost to the Canadian consumer. His main conclusions were that all Canadian producers would much prefer the complete lifting of all tariff barriers. He felt confident that Canada had enough technical know-how, skilled labour and administrative and organizational abilities to compete successfully on the free market. However, since this situation cannot be presently achieved, some intelligent measure of protection is needed; the need for which he hoped would gradually disappear.

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Newfoundland

R. W. Pike, M.E.I.C.,
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R. P. Hunt, Jr.E.I.C.,
Branch News Editor

February Meeting

The regular monthly meeting of the Newfoundland Branch was held at Memorial University on February 23.

S. Carew, the branch chairman, presided over the business portion of the meeting. Before the secretary read the minutes of the last meeting Mr. Carew welcomed the guests and congratulated the members on a good attendance. G. Knight, the chairman of the dance committee, made a financial report on the annual dance held at the Old Colony Club earlier in the month. The committee was thanked for the excellent manner in which the dance had been organized.

Then followed the election of a nominating committee, whose duties were to prepare a slate of officers for the year 1953-54. C. H. Conroy and C. W. Henry were elected by acclamation to act on this committee together with a member from the present executive.

The chairman announced that the visit of the president of the Institute would be some time after March 20. The Branch had been requested by headquarters to suggest some convenient date. The days of April 13 and 14 were suggested by the execu-

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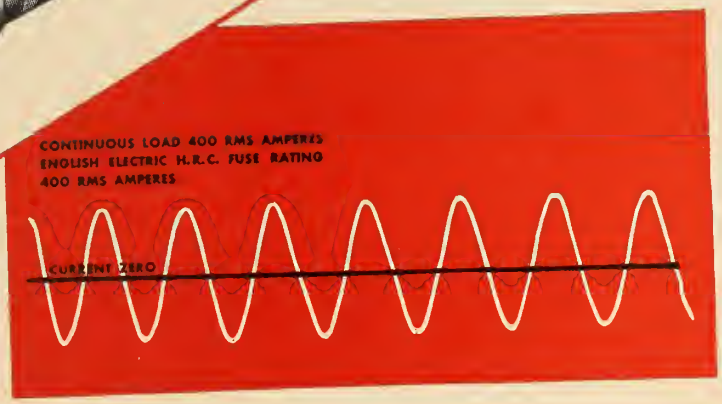

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tive. It was hoped that more information on the presidential visit would be available for the next meeting on March 16. It was announced that at the March meeting three engineering students from Memorial University would present papers. These students had been selected as the three best speakers of the weekly seminars held by the engineering students at the University. Three prizes of $20, $15 and $10 each would be awarded to the speakers that the meeting judges to be in first, second and third place, the presentation to take place at the annual meeting of the Branch in April.

The special speaker of the evening was Capt. M. Perkins, U.S.A.F. He was introduced by G. Knight. Capt. Perkins, whose hobby is colour photography, has served in many bases with the U.S.A.F. and at each has kept a photographic record of his impressions. By means of colour photographs the speaker took his audience on a tour of U.S.A.F. bases in Greenland with many excellent pictures of Greenland's fjords, glaciers and ice caps. He showed Greenland in midwinter and in an unexpected profusion of vegetation and colour in mid-summer. He took his audience from Greenland to an Arctic Survival Training Camp at Goose, then to a moose hunting trip in Newfoundland, and finally to Berlin and northern Germany. These latter pictures were taken while Capt. Perkins was a pilot in the Berlin airlift.

Fred Vivian expressed to the speaker the very sincere thanks of the meeting for the showing of his excellent pictures.

Following adjournment of the meeting the members and guests were served supper provided by members of the Engineers' Wives Club.

Student Engineers Present Papers in March

On Monday night, March 16, at Memorial University, at St. John's, the Newfoundland Branch held their regular monthly meeting, with Chairman Stan Carew presiding. The nominating committee presented its report and the slate of officers which it proposed for election was heartily endorsed by the meeting. The ballots for elections will be mailed to all members by the secretary early in April.

Chairman Carew reported that a joint meeting of the executive had been held with the wives' club to discuss arrangements for the visit of President J. B. Stirling and his party in April. A tentative program had been drawn up and was presented to the meeting for discussion and approval, and if the plans are carried out it should prove to be an interesting and enjoyable affair. The party is expected to arrive April 13 and leave for Corner Brook on April 15 there to inaugurate the new Corner Brook Branch with Eric Hinton as chairman.

The meeting was then turned over to Albert O'Reilly who acted as chairman, and who proceeded with the introduction of the three Student engineers who had been chosen by their classmates to compete for the Engineering Institute Prizes. The speakers were: A. Ryan, who spoke on "The Kitimat Power Development"; G. Staples, who discussed "Preparation of Wood Pulp"; and W. Tucker, who described "C.O.T.C., Summer Practical Training Phase".

These talks were both interesting and enjoyable, and the vote of thanks by C. Henry was heartily endorsed by the audience. The vote ballots were collected and the winners will be announced at the Annual Dinner meeting in April. The meeting adjourned to enjoy the delicious refreshments prepared by the wives' club.

Niagara Peninsula

G. W. T. Richardson, Jr.E.I.C.,
Secretary-Treasurer

P. A. Saldat, Jr.E.I.C.,
Branch News Editor

January Meeting

The Niagara Peninsula Branch held its monthly meeting in the Merrit Room of the Barclay Hotel, at Welland, January 22, 1953.

Branch members in attendance were privileged to hear an address by R. C. McGuire, superintendent of the International Nickel Co. refinery of Port Colborne. His subject was nickel refining, recent changes in mining and refining practices, and new uses of this metal.

Mr. McGuire illustrated his talk with two films. He spoke of the importance of nickel today as well as the important part it has played throughout the centuries. It was pointed out to the members that Canada has the largest nickel deposit in the world, approximately 85 per cent. Some of our ore deposits being mined around Sudbury, which held nickel deposits up to 3 per cent in previous years, now are only holding about 1¼ per cent nickel. It is expected that 13 million tons will be mined this year. Also, Canada is known to have the largest undermining operations in the world. Mr. McGuire described the refining of nickel and talked about the new process being developed at the University of British Columbia.

Speaking of some of the new uses of nickel, Mr. McGuire pointed out one of particular interest to the Branch members—a new product called "ductile iron". A one-inch square of this material bent double would show no sign of fracture and yet had a tensile strength equal to that of 80 per cent structural steel. The new product can be used in oil lines, molds and other various pieces of castings.

Mr. McGuire proceeded to answer questions concerning this wide industrial field.

A buffet luncheon was served after the meeting.

February Dinner Meeting

The speaker at a Branch dinner meeting at the Red Casque Inn, Niagara Falls, February 19, was Bruce Walker, production engineer of the Canadian Carborundum Co., Limited.

Mr. Walker showed films on "The Manufacture of Abrasives" and "Uses of Abrasives."

On the subject of manufacture of abrasives he pointed out the competitive relation between the abrasive industries and the others, such as milling machinery, and lathes. He demonstrated the importance of abrasives in the manufacturing world. He remarked that Niagara Falls is a most important centre for abrasive manufacture. One point he stressed was that a grinding wheel was commonly referred to mistakenly as an emery stone.

Mr. Walker discussed "bonded" and "coated" products of the Carborundum Co. The latter is a product such as sandpaper, where the abrasive is coated on a paper or cloth face. The abrasive wheel is classified as a bonded product. The abrasive wheel, in a sense, is a cutting tool in application and in mode of action. There are two kinds of abrasive wheel—the first is a cutting tool used to remove excess material from a casting or to generate a form. Another type of abrasive wheel is used for parting material, as in sawing and separating a mass. This is how the grinding wheel functions as a cutting tool.

Mr. Walker gave three reasons for the choice of grinding wheels. First the abrasive tool may be the only one to do a particular job, where no other tool could; or in another case the tool will produce a superior quality of job; and an abrasive tool will also be chosen when the job can be done at a lower cost, considering labour and overhead. This important reason is one which has made the abrasive industry grow.

Mr. Walker brought out two points of interest about the properties of the abrasive wheel. It is superior, in his opinion, in its ability to cut hard materials, such as hard cast iron and glass. Also, it is able to cut material to very close tolerances (less than one-thousandth of an inch) for production based on time element. Another property is its ability to produce fine surface finishes, also controlled finishes, as fine as a micro inch. Such uses might be found in the manufacture of engine cylinder bores and steel mill rolls. The fourth property is that of generating relatively complex surfaces, such as precise spherical surfaces and flat surfaces; ball bearings and screw threads are two examples.

Bringing his talk to a close for the evening, Mr. Walker dealt with the reasons why abrasive products compete so well with the cutting tools. He pointed out the great flexibility of the tool, where hands are commonly used to produce a fine product. One can get the tool to the job, where other tools may not be flexible enough, such as the final finish given on automobiles at the factory by hand abrasives. Where it may take two or three cuts on a surface to complete a job with a cutting tool, a battery of abrasive tools may be used for cutting and forming a vast variety of materials in one continuous process. Mr. Walker stressed the point again that the abrasive wheel is a cutting tool which does not rub or scrape, making for higher production and greater precision through grinding.

At the close of the talk Mr. Walker invited questions.

Nipissing and Upper Ottawa

D. Keith Campbell, Jr.E.I.C.,
Secretary-Treasurer

Stewart Bramah, Jr.E.I.C.,
Branch News Editor

April Dinner Meeting

J. G. A. Stevenson of the Canadian Longyear Company, diamond drilling contractors, gave an address on "Finding and developing a Successful Mining

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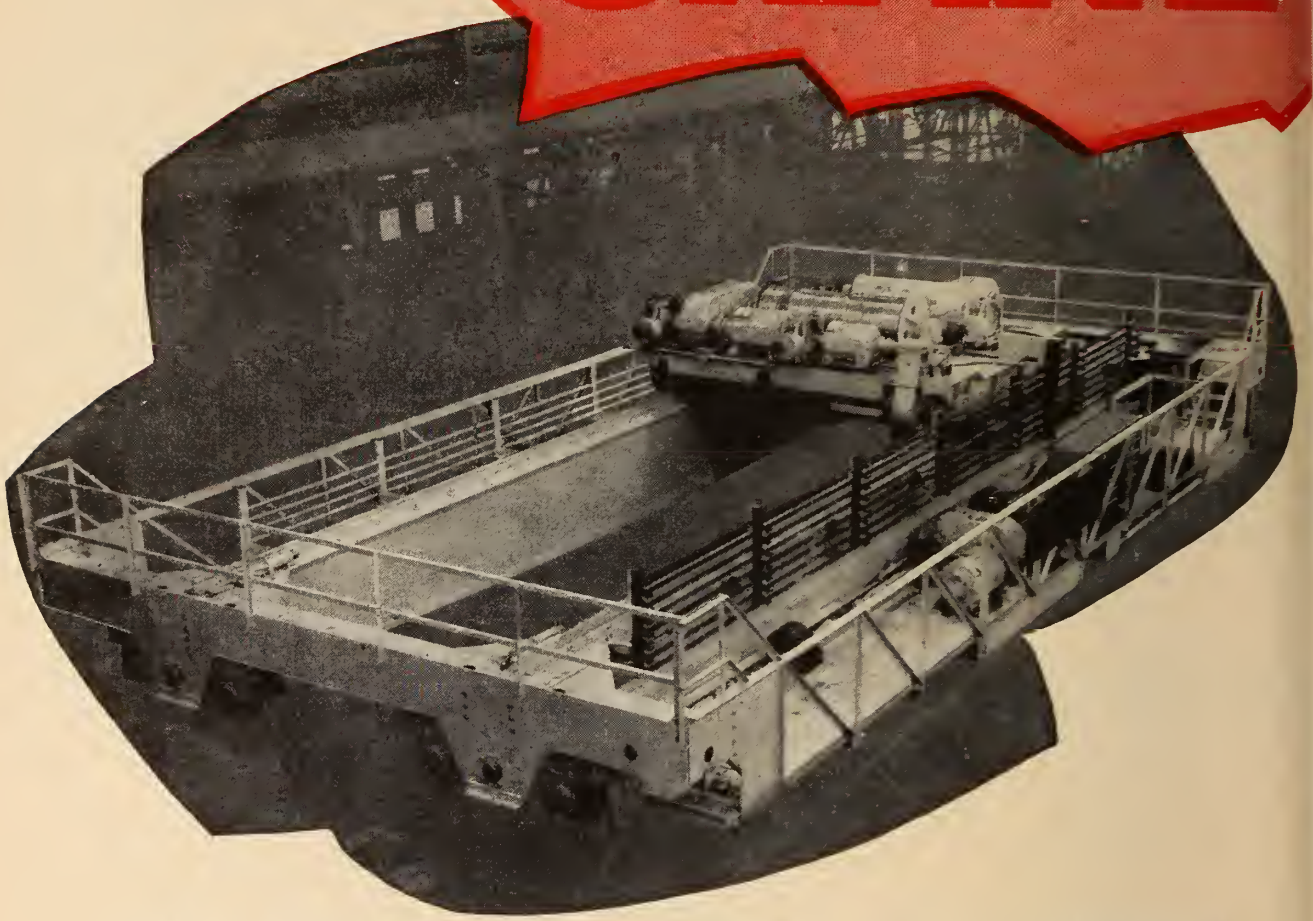

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)peration" to members and guests of he Branch at a dinner meeting on April) at the Marine Room in North Bay.

J. Albulet of North Bay introduced he speaker after business matters and oast beef dinner had been taken care of.

Aerial photography, Mr. Stevenson aid, is the modern means of locating prominent structural features. A geo-ogical survey of the more promising areas located from the aerial photo-graph maps is undertaken by the Gov-ernment and by large mining companies. Geophysical surveys are undertaken of these areas using technical instruments. Common instruments in this field are the magnetometer and the Geiger counter which are particularly valuable in areas of heavy overburden. Marmora and Simcoe magnetic iron ore bodies were located by use of the magnetometer and the North Bay Uranium ore body was located by use of the Geiger counter. Prospecting, test pitting and trenching are carried out at "finds" to get samples of the ore for assay. Diamond drilling to a depth of from 50 to 100 feet is also used to get samples for assay. Diamond core drilling follows if the assays are favourable. Finally, if a possible ore body of commercial value is indicated, a shaft is sunk and underground work begun. Once the ore body has been proved, ore passes, and stopes are developed. Then crushing equipment and a surface treatment plant are constructed.

A Swiss watchmaker, in 1862, was the first to use black diamonds as an abrasive. A French engineer, in 1864, used black diamonds for drilling purposes. Diamond drilling using black or industrial diamonds has grown into a big business since then.

A modern diamond drill setup consists of a twenty to sixty foot wooden pole tripod with a clevis and sheave wheel, with water pump and drilling machinery located in a shack under the tripod. In Canada a screw feed type of drill is more popular, whereas the hydraulic feed type is more popular in Europe. The drill consists of a bit, a reaming shell, a core barrel, and rods. During drilling operations water is forced down the rods and returns up between the outer surface of the rods and the wall of the hole. The sludge which is carried back in the water is usually kept for assay purposes. The drill crew is usually made up of an operator, a helper, and a pumpman.

P. A. Hermiston also from the Canadian Longyear Company, presented a coloured movie of a drilling operation of the company in Columbia, South America.

At the conclusion of the animated discussion which followed Mr. Stevenson's address, J. Cooper of North Bay expressed the appreciation of all present for the interesting address.

Peterborough

D. G. C. Donaldson, Jr.E.I.C.,
Secretary-Treasurer

G. T. Davis, M.E.I.C.,
Branch News Editor

Steel is Discussed

On March 25, 1953, the Peterborough Branch held a meeting at the Public Library. D. C. McCrady, superintendent of the electrical department, of the Steel Company of Canada was the guest speaker and his presentation took the form of coloured motion pictures showing the making of steel by the Steel Company of Canada in its Hamilton Works. The speaker was introduced by D. A. Lamont.

Mr. McCrady made a few preliminary comments about the operations of his company. The Steel Company of Canada is presently manufacturing nearly half of Canada's total steel production. The plant in Hamilton is the primary producer, making steel from the basic raw products—iron ore, coal, limestone, and scrap. This plant also performs rolling and shaping operations to produce basic forms such as plate, sheet, strip, tin plate, bars, rods, angles, channels and flats.

The Company is entirely Canadian owned and operated and owns coal mines in Pennsylvania and West Virginia, iron mines on the Mesabi Range in Minnesota and limestone quarries near London, Ontario. The Hamilton Works covers 370 acres of land, operates a railway on its property comprising 40 miles of track and employs about 7,500 people.

It was pointed out that a steel mill considers any delay in production as a very serious matter because of the tremendous investment required. Once this investment has been made, it is essential to obtain the last possible ton output from the equipment purchased.

Mr. McCrady mentioned that although the company is one of the largest in the City of Hamilton, it is also one of the safest. Although the present record is good, a safety program is being continually carried on and improved.

The Hamilton plant has presently installed 150,000 hp. of electric motors using alternating current and another 100,000 hp. using direct current. Purchased power amounts to nearly 50,000 kw. and 100,000 kw. are also available using steam turbo generators for emergency purposes and to make use of the available blast furnace gas which would otherwise be wasted. Motor ratings are from 7,000 hp. down to small fractional horsepower fan motors. As well as electrical distribution circuits throughout the plant, blast furnace gas, coke oven gas, water, oxygen, steam and compressed air are also required.

The plant produces a number of by-products, including coke, chemicals, such as tar, naphthaline, benzol, ammonia and various oils.

The picture that followed told the story about the man who operates the plant as well as about the plant itself. It was made by John Carey, a metallurgist at Hamilton Works, who is also a professional photographer. It took about a year to make, with more than 8,000 ft. of film produced of which 1,600 ft. were finally incorporated into the 40 minute presentation.

A short question period ensued, and the speaker was given a warm vote of thanks by G. J. Lucas.

Sudbury

G. W. Fleming, Jr.E.I.C.,
Secretary-Treasurer

H. M. Whittles, Jr.E.I.C.,
Branch News Editor

Ontario's Forest Resources Discussed

The Sudbury Branch held a dinner meeting at the Sudbury Granite Club on Thursday, April 9, 1953, with Walter Giles of the Ontario Department of Lands and Forests as guest speaker.

Introduced by Ernie Jones, Mr. Giles, a science graduate of Queen's University, gave a fine address entitled "Ontario's Forest Resources."

Using a detailed map of Ontario, Mr. Giles gave a complete description of the species of trees found in the various districts of the Province.

In outlining the importance of the forest resources to the economy of the Province, he stated that there were 35 licensed pulp mills and 1,400 licensed saw mills in Ontario, which produced in 1951 $406 million in goods and paying $250 million in wages and salaries.

Today three out of five newspapers throughout the world use Canadian newsprint, and the Toronto Star, which uses 1,600 tons of paper every week, can be supplied in perpetuity from 1,500 square miles of timber land; while nearer home, the International Nickel Company uses approximately 22 million board feet of timber each year.

Ontario's 412,604 square miles of land contain approximately 180,000 square miles of forest area, hardwood being more predominant than the coniferous type of trees. This situation is a disadvantage as it is the coniferous type of trees which is more desirable as far as the pulp and paper and the building industries are concerned.

It takes from 100 to 120 years for timberland to regenerate itself, and though it is very important to regenerate pine trees, this problem has not been solved as yet, but is receiving very close attention by the Forestry Department.

The Timagami section, which takes in land north of Sudbury, was originally pineland, but the regrowth has been poplar and white birch.

The Ottawa Valley section was, and still is, an important timber region, and the Huntsville area contains much maple, a large part of which is not of good quality.

The transition section, or Clay Belt area, contains tremendous quantities of black spruce which is best suitable for newsprint and as a result there are many large pulp mills in this region.

The north-western section of Ontario grows much black spruce, jack pine, and balsam, and supplies the district's many pulp and paper mills. The Lake Superior section produces mostly birch and poplar for the sawmills of that locality.

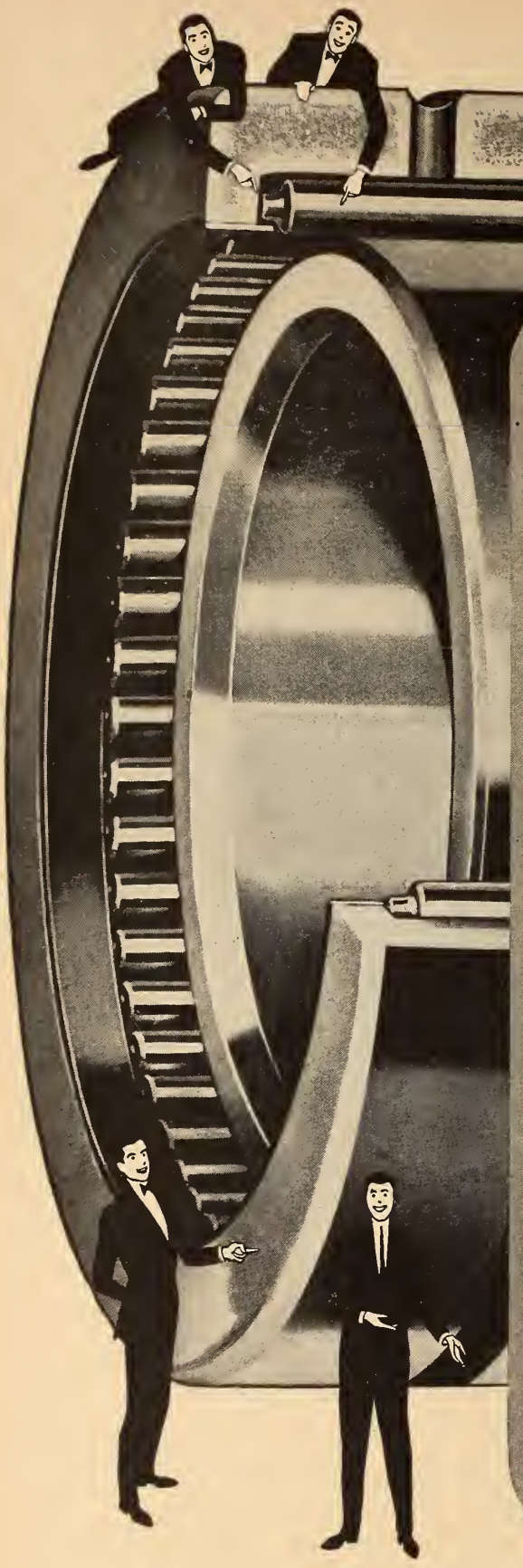
The Department has ten divisions to take care of its many tasks. These divisions are: accounts; air service, with headquarters at Sault Ste. Marie; fish and wildlife; forest protection; lands and recreation areas; surveys and engineering; reforestation; personnel; research; and timber management.

The Department has 22 districts and seven regional offices. The Sudbury office is both district and regional.

In closing, Mr. Giles stated that the Department's main objective was to place the forests of Ontario on a sustaining basis, and to do this much research must be carried on, especially with respect to forest regeneration.

At the close of an interesting question period, Mr. Giles was thanked by Alastair Finlayson for coming all the way from Toronto to give the local Branch a very good address which was enjoyed by all.

Bill Miller thanked John Quance for bringing Mr. Giles and many other good speakers to Sudbury during the fall and winter season. Mr. Miller also announced that the Annual Meeting and



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Ladies' Night would be held on Friday, May 8, 1953, at the Sudbury Granite Club.

Vancouver Island

P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer
Ronald E. Dyson, Jr.E.I.C.,
Branch News Editor

J. A. C. Carson Speaker March 20

The joint meeting of the Vancouver Island Branches of the Engineering Institute and the B.C. Professional Engineering Association held Friday, March 20, 1953, was attended by over 70 members. The attraction of the evening was the presentation of the International Nickel Co. of Canada film, "Corrosion in Action", which was presented by J. A. C. Carson from the Pacific Naval Laboratory, Esquimalt.

Mr. Carson's introduction dealt chiefly with the corrosion problem encountered in warships of the R.C.N. He also mentioned certain features of the film so that the audience might appreciate better the various factors causing corrosion of metals.

The film was in technicolour and dealt with the subject very methodically, beginning with the early observations of Sir Humphrey Davey and then dealing with such aspects of corrosion as metal ion concentrations, electromotive series, galvanic series, oxygen content in solution and anodic protection.

Field Trip to H.M.C. Dockyard Esquimalt

On March 25th a party of the Vancouver Island Branches of the Engineering Institute and the B.C. Professional Engineering Society participated in a field trip which took them through the various shops in *H.M.C. Dockyard*, Esquimalt, B.C., and for a short sea trip in *H.M.C.S. Sault Ste. Marie*, an Algerine Class Minesweeper.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer
W. V. Morris, M.E.I.C.,
Branch News Editor

Winnipeg's Economic History Traced

The regular meeting of the Winnipeg Branch was held on March 19. George R. Fanset, industrial commissioner for Greater Winnipeg, presented to the members a graphic account of the economic development of Winnipeg from its birth as a fur-trading post 80 years ago, to its present status as a rapidly-growing, modern city with a population of 354,000.

It was pointed out that, although Winnipeg's economy is made stable by being built upon an agricultural basis, it is not "tied to the apron strings of any industry". Rather, the city's expanding economy is due to many different factors. Besides being a transportation centre, and the financial nerve centre of much of Western Canada's business activities, its manufacturing industries have multiplied until today more than a thousand different articles are made in Greater Winnipeg plants.

Mr. Fanset's talk was accompanied by an excellent series of slides, illustrating many of Winnipeg's manufacturing plants, her upsurge of industrial development, and her recovery from an "industrial inferiority complex" which had in the past been all too prevalent. As was pointed out by the speaker, it has been repeatedly proven that plants which are sized to the prairie market, the area from the Lakehead to the Rockies, and properly managed, can successfully compete in that market, although he acknowledged that there has been no place in Winnipeg for the very large plant depending on an export market.

During the discussion period which followed the address, Mr. Fanset answered questions from the members on possible future industries in the Winnipeg area.

After Mr. Fanset's talk, the Engineering Institute thesis prizes were presented to the students from the University of Manitoba whose summer theses had been judged the best of those presented during the past year. Professor N. A. Williams, chairman of the Electrical Engineering Department of the University of Manitoba, introduced John M. Kyle, fourth-year electrical engineering student, who received a prize for his thesis on "A Supervisory Remote Control System"; and Professor R. D. Wood, of the Mechanical Engineering Department introduced Bernard A. Martz, fourth-year mechanical engineering student, who received a prize for his thesis on "The Design of Six-Inch Universal Tool Heads". The two students received their prizes from Major J. L. Charles, chairman of the Winnipeg Branch.

Electrical Section

L. E. Marrin, Jr.E.I.C.,
News Editor

R. Behan is Guest Speaker

E. M. Scott was chairman of the Electrical Section meeting on March 5 in the absence of C. D. Osterlant. Section business included a report of the nominating committee by Len Bateman, following which, Prof. Neville A. Williams, chairman of the electrical engineering department, University of Manitoba, was named vice-chairman of the section.

L. Macdonald introduced the guest speaker, R. Behan of the English Electric Co. Mr. Behan discussed the design and application of high rupturing capacity fuses, and outlined the basic requirements for such a fuse.

This fuse, Mr. Behan stated, had, in past years, been installed in many types of low voltage distribution circuits, but generally as a last line of protection Primarily for the reason that the types of fuses available had gradually become incapable of satisfactory protection against the increased concentrations of short circuit capacity, they had been replaced by other forms of circuit interrupting devices. However, recently, a radically new type of fuse had undergone development to overcome the limitations inherent in the older forms. Because this form of fuse is capable of handling short circuit currents far greater than was previously possible, it is specified as a high rupturing capacity fuse. The main body of the fuse is a ceramic of sufficient strength to withstand the temperature gradient, heat generated and mechanical stresses imposed when the elements rupture. The elements are silver fabricated, designed with weak sections, whose diameter and length, control the continuous current rating of the fuse and the points at which rupture takes place. Arc quenching is provided by properly consolidated clean granular quartz; being inert no gasses are generated, no pressure vent is necessary, and no external flashover can take place.

With the showing of characteristic curves and illustrations of various applications, Mr. Behan went on to discuss the factors that govern the use of the high rupturing capacity fuse in practical low voltage distribution circuits.

At the conclusion of Mr. Behan's fine paper, Len Bateman thanked the speaker on behalf of the section members.

Civil Section

K. R. Ebbern, Jr.E.I.C.,
News Editor

Civil Section Inaugurated in March

The inaugural meeting of the Civil Section of the Winnipeg Branch of the Engineering Institute was held on March 9, at the new United College Building. A large gathering was present to hear the guest speaker, Professor C. M. Hovey of the University of Manitoba, give a highly interesting talk entitled "The Behavior of Structural Steel in Service". Professor Hovey discussed the manner in which materials fracture under tension, compression, shear loads and continued with a description of brittle and ductile behaviour.

It was pointed out that although structural steel is normally regarded a ductile material, it fails in a brittle manner under repeated loads, (fatigue), low temperature, impact, and by creep at elevated temperatures.

The speaker mentioned that under certain conditions of ordinary loading brittle behaviour has occurred with disastrous consequences in such structures as bridges, ships, and pressure vessels. Most, but not all, of the failures have occurred in welded construction. The initial part of the fracture has usually been found at a point of high stress concentration and due to the large amount of stored energy in the structure, proceeded with great rapidity through the main plates.

The speed of cleavage fractures of this type has been found to be comparable in magnitude to the speed of sound. Such fractures do not occur unless there is a large amount of energy available for propagation of the crack.

It has been observed that the material in which these failures have occurred has had inferior charpy impact qualities. The use of killed steel rather than semi-killed or rimmed steel avoids the low impact values and is therefore recommended for future use in ships and bridges, etc.

Professor Hovey went on to say that in welded construction internal "locked in" stresses undoubtedly contribute to cleavage fractures. The lecture closed with a description and demonstration of S.R.4 electric resistance strain gauges which are used to measure these internal stresses. The versatility of these gauges in other engineering applications was illustrated by slides.

This meeting was attended by a group of 91 engineers who were unanimous in their thanks to Professor Hovey.

The newly elected executive of the Civil Section is as follows: chairman, N. S. Bubbis; vice-chairman, W. B. White; executive member, W. L. Wardrop; Papers Committee chairman, A. F. Thomson; executive delegate to Section, J. C. Trueman; executive member appointed, H. Brekke; Section secretary, E. H. Martin; Membership Committee chairman, S. J. Borgford; and Section News Editor, Keith Ebbern.

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ABOVE: Moto-Bug with tilting flotbed platform 4' long, co-pocity 1200 lb.

Ailing production schedules and materials handling bottlenecks never cure themselves. You know what is required — you could write the specifications yourself. It must be a machine with the strength to carry your loads . . . the manoeuvrability to pick its way through the plant . . . the compactness dictated by aisle width and door openings . . . the versatility to perform varied tasks. Well — MOTO-BUG gives you all these, and at a price you will concede to be moderate.

All MOTO-BUG attachments are interchangeable.
All MOTO-BUGS are 33 inches or less in width.

LEFT: Fork-lift Moto-Bug with hydraulic pump; 1000 lb capacity, 5' lift.

BELOW: Moto-Bug with 12 cu ft tilting materials hopper easily handles load of castings.

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SPEED: 1½ to 4 MPH (forward & reverse)
ENGINE: 6 HP Wisconsin
GRADEABILITY: 20%
WEIGHT: 615 lb. with hopper
LENGTH: Varies, 5' 9" approx.
RIDING STEP: Folding (optionol)
TIRES: Pneumatic
Front: 16 x 500
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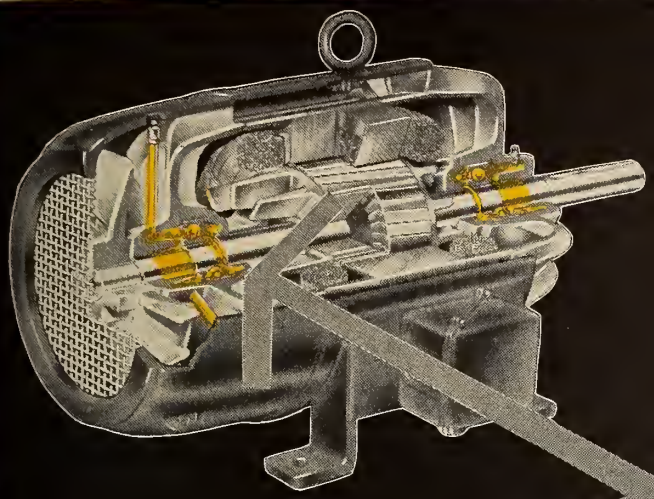

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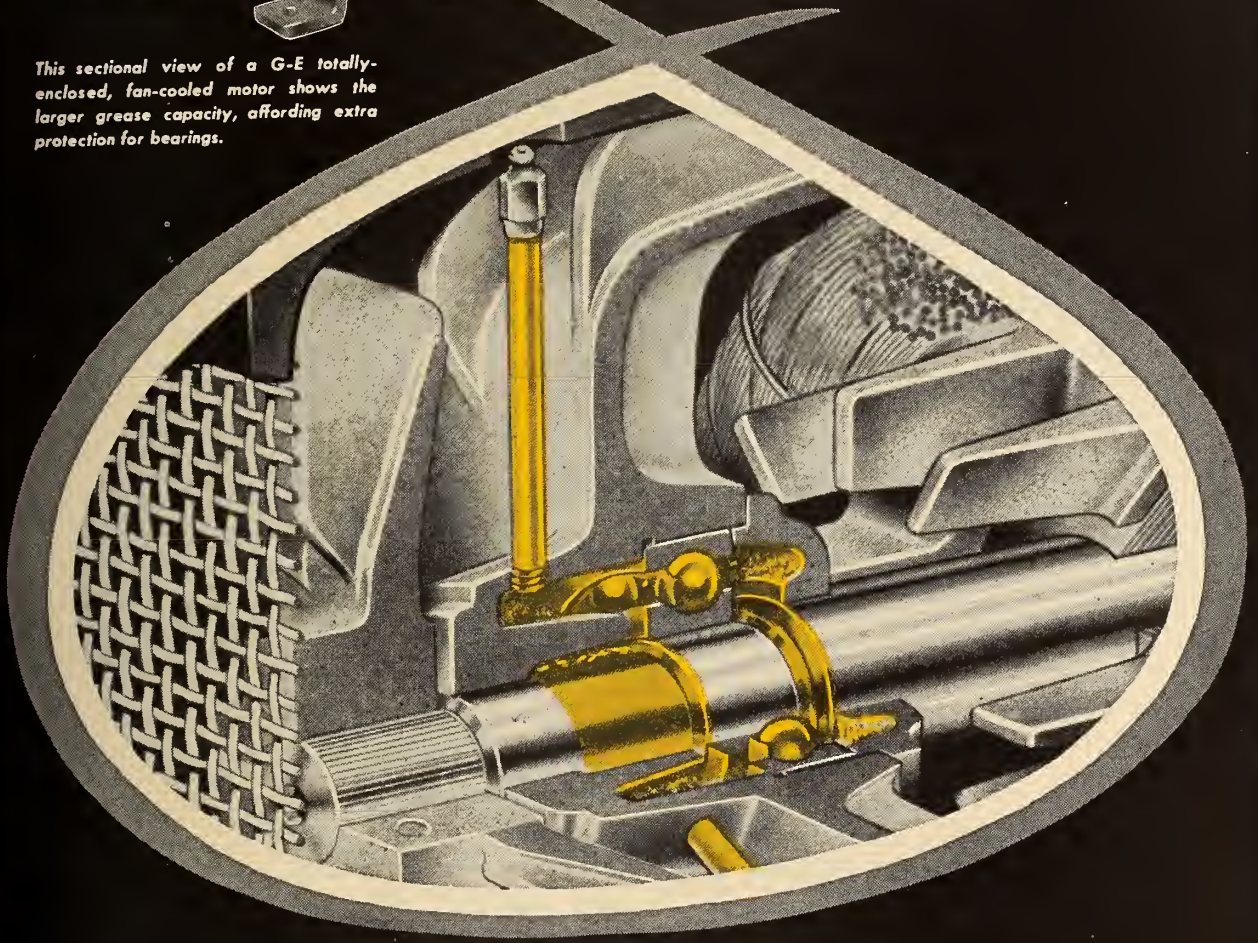

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APPARATUS DIVISION

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RE-HANDLING — as well as blooming, rolling, pickling nd other steel-mill operations — uses the G-E amplidyne to dvantage. Engineered into the drive for this ore bridge, it pro- ides more accurate bucket control, faster trolley travel.

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HEAD OFFICE: TORONTO — SALES OFFICES FROM COAST TO COAST

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Imperial Oil's remarkable efficiency report is echoed by many industrial railyards where G-E Diesel-Electric Switchers have replaced steam locomotives. Fuel savings plus lowered maintenance and labour costs mount to thousands of dollars yearly. The absence of open flame in the G-E Switcher is considered an additional safety factor in moving petroleum products at the Sarnia Refinery. And in any smoke-conscious community, smokeless G-E Diesel-Electrics contribute to excellent public relations.

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AAD-04

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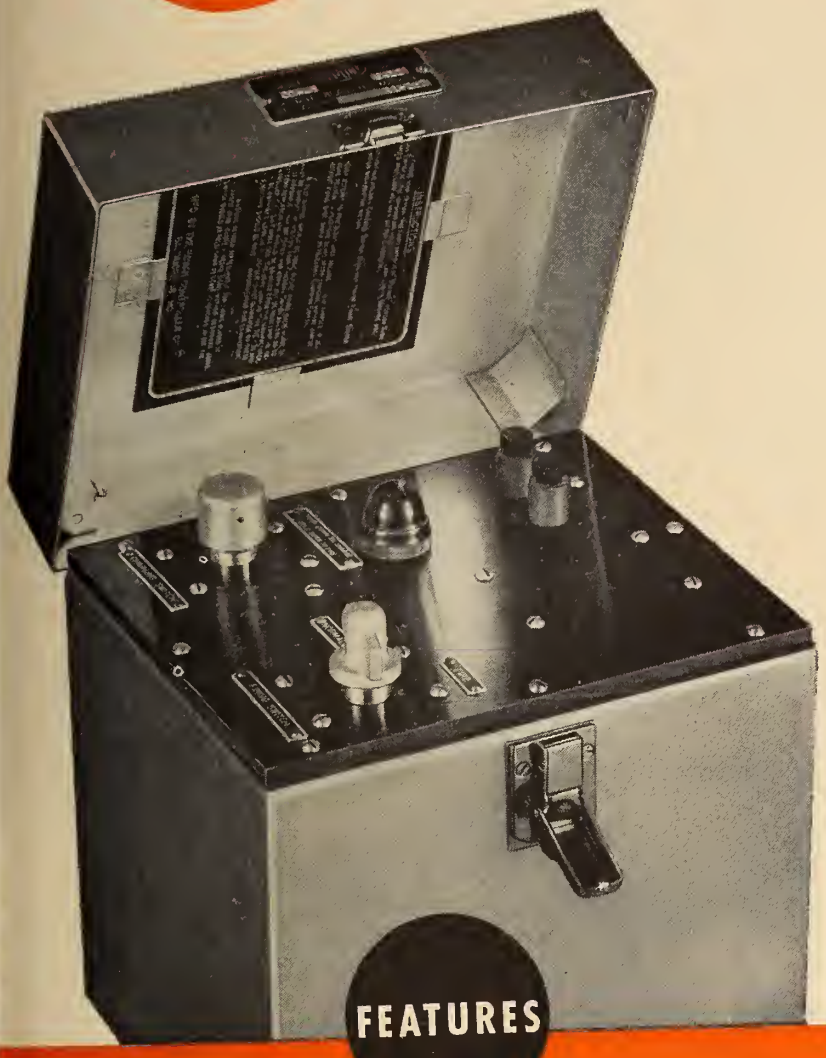
C-I-L ANNOUNCES

A New, Condenser Discharge Type BLASTING MACHINE



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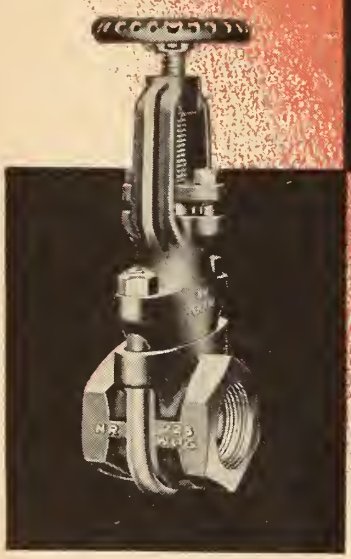

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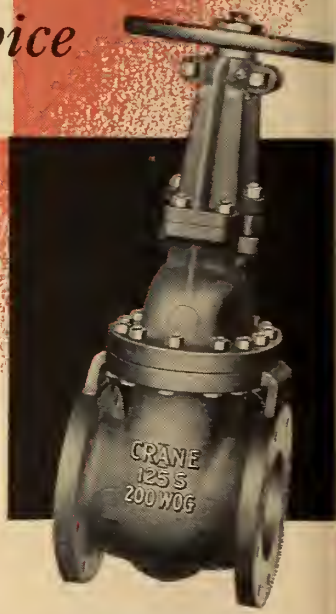

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Paper and paper making. F. H. Norris. Toronto, Oxford, 1952. 353 pp., illus., $6.50.

The author says that this book has been written in response to a demand for a modern, authoritative work on paper and paper making, and it certainly appears to fulfil that requirement, in a both interesting and fascinating manner.

The opening definition of paper sounds so simple: "Paper can be defined as an interwoven mat of vegetable fibres formed by their falling from suspension in water." But following this come three hundred and fifty pages, elaborating and enlarging on this simple statement, and giving the history and development of the various processes in the various countries.

The volume opens with a sketch history of paper making, and the nature of cellulose. This is followed by a chapter on the derivation and structure of the principle paper making fibres. Separately headed sections deal with each substance, and one hundred diameter magnification illustrations accompany them.

Following in natural sequence comes the treatment of those various materials for the actual production of paper, explaining the processes both chemical and mechanical, with the various types of machinery and their uses.

Sorting, finishing, sizing, cleaning and colouring follow along with many methods of testing.

Adding considerably to the book's usefulness is a twenty-one page glossary of paper and board qualities, a dictionary of trade terms, a glossary of paper board, book and stationery sizes, useful calculations and tables, and British paper trade customs, as of nineteen forty-nine.

The book is well indexed and also has a detailed table of contents. Excellent photographic illustrations accompany the text, along with diagram drawings to illustrate processes.—E.K.

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

The chemical revolution. Archibald and Nan Clow. London, Batchworth, Toronto, Ambassador, 1952. 680 pp., illus., $10.00.

Subtitled "a contribution to social technology", this book is a both unique and scholarly publication.

As a result of a study of original sources of contemporary material on the part of the two writers, the social and economic consequences of advancing science during the Industrial Revolution, and particularly the growth of chemical industry are presented.

A general introduction to minerals and manufacturers opens the book. This is followed by the extraction, or production, history and development of common salt, ashes and kelp, soap, vitriol, balloons, textiles, colour, paper, glass, pottery, lights, natural sweeteners, fermentation, and food preservation by canning, all this from a chemical and technological point of view.

Over one hundred illustrations are photographically reproduced, and all of them are taken from contemporary sources.

Short bibliographical references are given in footnotes. The volume also includes a "glossary of dead chemical language", "chemical chronology", and twenty-eight pages of bibliography, including the location of a number of the items. This is followed by a very detailed index.

In manuscript this work was awarded the Senior Hume-Brown prize by the University of Edinburgh.

Fault calculations. C. H. W. Lackey. Edinburgh, Oliver & Boyd, Toronto, Clarke, Irwin, c1951. 296 pp., illus., $6.50.

This book is specially directed towards the practical aspects of fault-calculations and provides a collection of basic methods and formulae set out in a convenient way. It covers such fundamentals of fault-calculations as vectors, vector-algebra, impedance-notations, network-reduction, balanced faults, symmetrical components and unbalanced faults. A chapter is devoted to data on impedances of plant and equipment, with additional material

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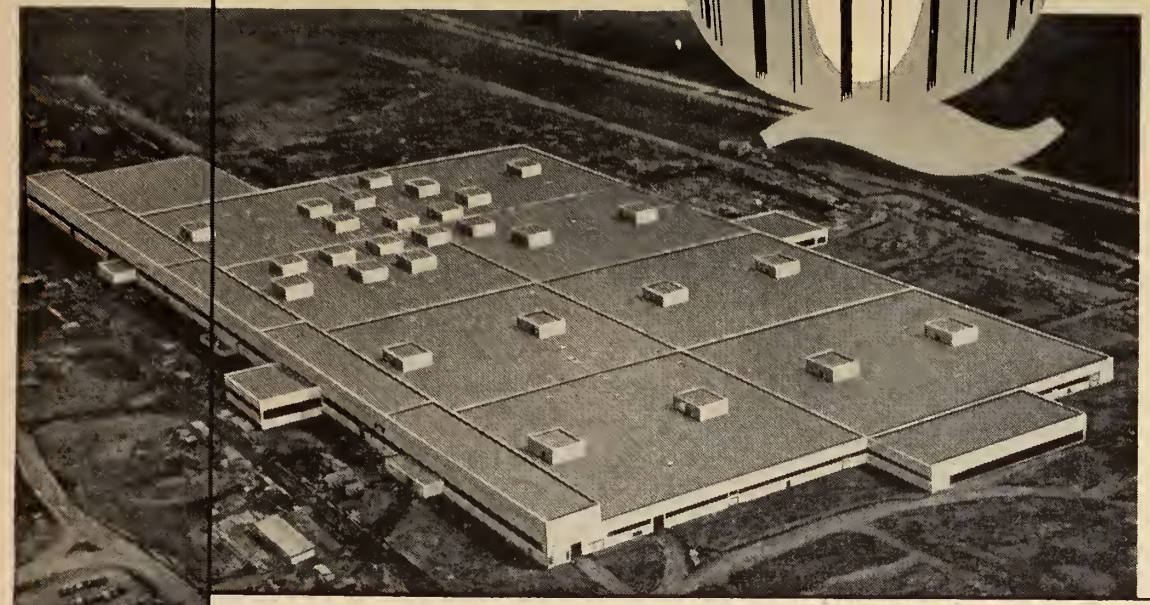

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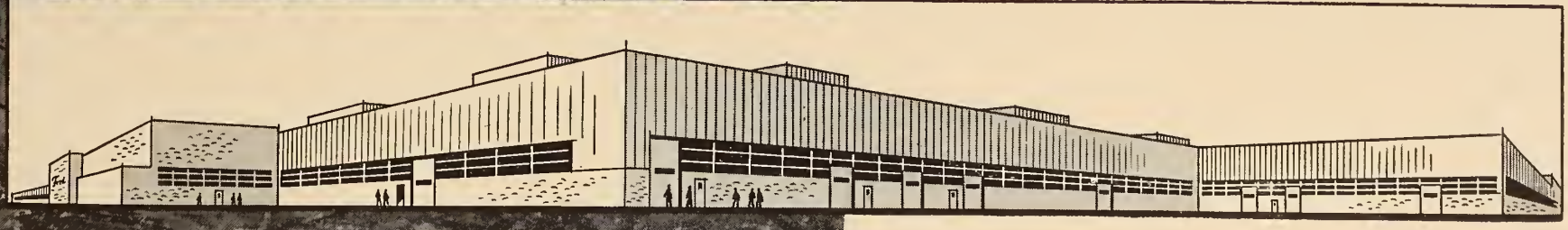

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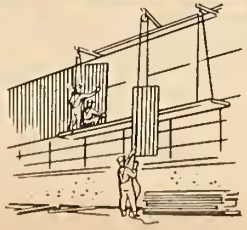

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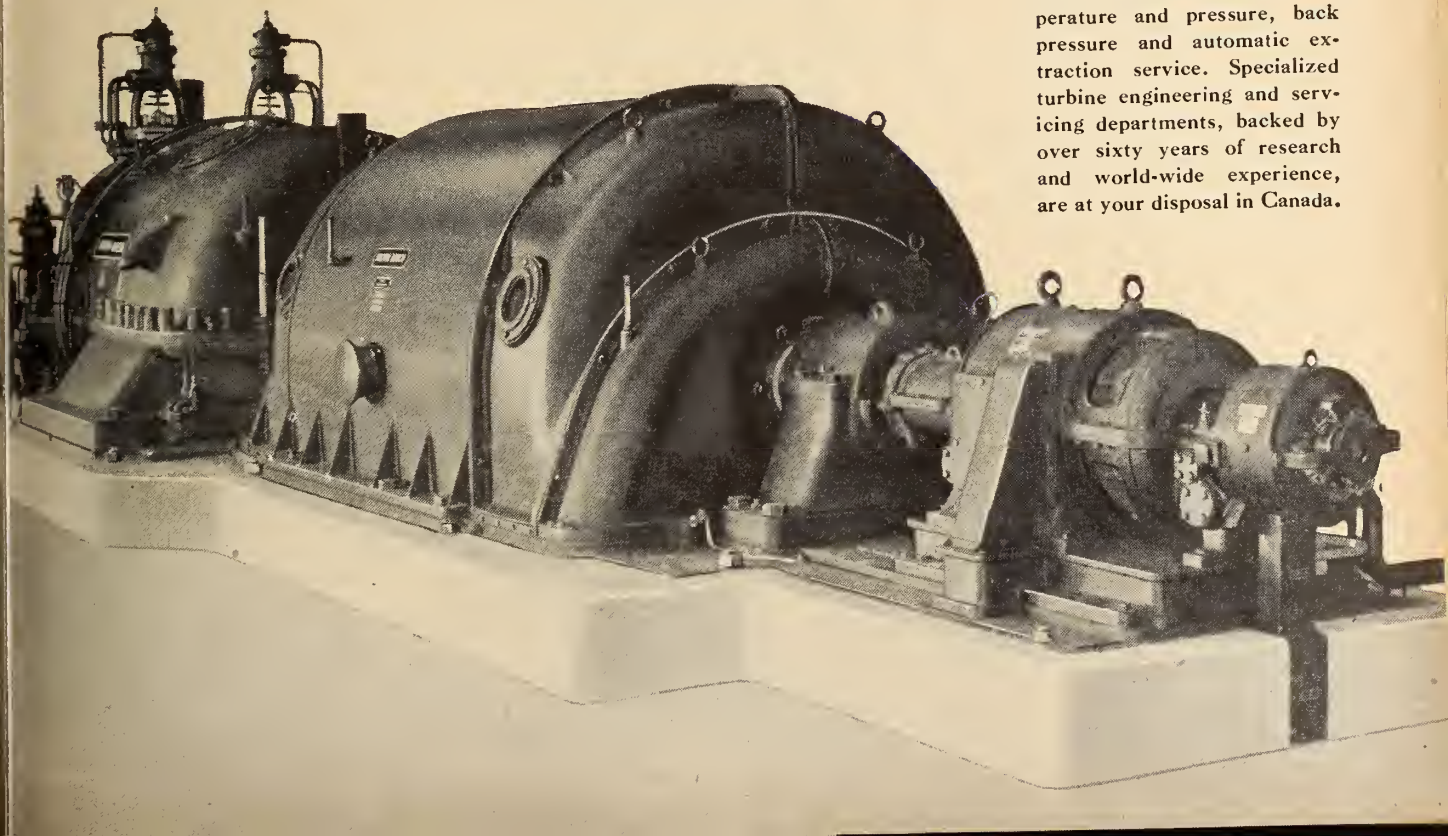

in the appendix. A variety of problems are presented, the solutions of some of which have not been published before. The book concludes with a chapter on fault-calculators and network-analysers, and with appendices summarizing the formulae and data. The illustrations, bibliography and index increase the value of the book.

High fidelity simplified. H. D. Weiler. New York, Rider, c1952. 208 pp., illus., $2.50 (U.S.).

Written for the layman, this book presents in a lucid and easy form what he needs to know in order to understand and enjoy the reproduction of superior music by the new process called "high fidelity". The author gives the reader a brief theoretical background of sound, acoustics and electronics. He then describes high-fidelity equipment, with advice on obtaining the most realistic rendition of the original music recorded with inexpensive and relatively uncomplicated speaker systems. The book is illustrated and indexed and contains a list of high fidelity component manufacturers.

High-voltage A-C. circuit-breakers. S. Gerszonowicz. Toronto, Longmans, 1953. 454 pp., illus., $12.50.

As most books on this subject usually treat the manufacturers point of view and problems, this volume has been written primarily for the user of circuit-breakers in high-voltage systems.

In addition to descriptions of presently manufactured breakers, obsolete apparatus is also included to complete the picture of the evolution of methods employed.

Basic components, types of circuit-breakers, breakers using oil insulation, and solid insulation, circuit-breakers control, standards, and selection, are all covered with all their related problems, in the fourteen chapters.

The index is somewhat sketchy, but the twenty-one page bibliography is the best we have seen for some time, and is a great asset to anyone interested in the subject of circuit-breakers as a whole, whether they are reading this particular book or not.

Mechanical world electrical year book, 1953, 46th ed. Manchester, Emmott. 360 pp., illus., 3/-.

Mechanical world year book, 1953, 66th ed. Manchester, Emmott. 268 pp., illus., 3/6.

These companion handbooks have the same general plan, but are directed to the separate fields of mechanical and electrical engineering. Tables of equivalents and other technical data are given in each, followed by a classified buyers' directory. A mass of information is found in each book on materials, equipment, processes, standards, etc. A new section on electric lifts and further material on control gear is contained in the Electrical year book. The new section in the Mechanical world year book is concerned with the design of springs. A general revision of each book is also noted.

National directory of the Canadian pulp and paper industries, 1952. J. N. Stephenson, ed. Gardenvale, Pulp and paper magazine of Canada, 1952. 473 pp., illus., $3.50.

This edition covers the industry during 1950, giving a resume of developments with statistical tables to show the number of pulp, paper, and integrated mills by kinds, the number of grinders, of machines and of digesters by kinds, location and capacity. It indexes pulp and paper mills by name and by geographical location, convertors, distributors, paper merchants, Canadian trade commissioners, and foreign commercial representatives. It also lists organizations connected with the industry, and lands and forests ministries in Canada.

The petroleum dictionary. L. P. Boone. Norman, University of Oklahoma press, 1952. 338 pp. $5.00 (U.S.).

Before the author seriously undertook the compiling and publishing of this book, he had "already recorded more than a thousand colourful oil field expressions as a hobby."

In this work he has included over six thousand words and expressions, both technical and non-technical, which represent the everyday language of the four major branches of the industry, namely: exploration, production, pipelining, and refining.

In addition to all of the aforementioned people to whom this volume will be useful in a business way, it will hold a fascination for hobbyists in language and folklore, as well as the general reader.

Road engineering. E. L. Leeming. London, Constable, Toronto, Longmans, 1952. 308 pp., illus., $6.00.

"The principles of road engineering begun so well by Telford and Macadam remain, and our need today is to amplify these principles to meet the requirements of modern traffic."

This is quoted from the author's preface to this third edition of Road Engineering, the first one having been published in nineteen twenty-four, and the second in nineteen thirty-three. Revisions are concerned almost wholly with basic principles and latest practices, including developments in American road construction. These latter, however, are concerned predominantly with clover leaf design, traffic circles, curves, turns and super elevation, grades, etc., and no treatment whatever is given to perhaps the greatest problems on this continent, namely, those arising from extremes of heat and cold, and the resultant heaving or melting of large sections of the road surface.

Except for one entry in the brief bibliography, the references are all undated. Appendices include Acts of Parliament of special importance for roads; index to General Conditions of Contract; quantity of mixing water required for concrete; and British Standards for cement. The book is well indexed, and contains nearly two hundred figures and folded maps.

Strength of materials, 10th edition. Arthur Morley. Toronto, Longmans, 1952. 583 pp., diagrams, $4.50.

First published in 1908, "Strength of Materials" is now in its tenth edition, and has reached a total of ninety thousand copies. The principal changes in this edition are in relation to helical springs, strain gauges, and strain analysis. Examples are included with each chapter, which are problems based on the information contained therein.

Some of the figure illustrations have obviously been re-used for more than one previous edition, making their reproduction rather fuzzy. Also, a four page index for five hundred and seventy-five pages of information leaves some detail to be desired.

However, the actual value of this book is in the basic textbook type of information it contains.

Appendices include various types of strain and tension, log tables and trigonometric functions and answers to the examples with each chapter.

Textbook of engineering materials. Melvin Nord. New York, Wiley, c1952. 518 pp., illus., $7.80.

Written for first year students, the book is divided into two sections. It introduces fundamental concepts in physics, chemistry, geology, and other basic subjects, and in this framework gathers scattered information about engineering materials. After this general treatment the specific materials of engineering are treated in the light of the generalizations made. Practical problems of occurrence, of production and of properties are solved and the uses of various engineering materials are described. Thus the student is shown how to apply simple concepts in science to engineering, and how economic factors affect engineering practice. The book is illustrated and well indexed and bibliographical references are found at the end of each chapter.

Theoretical nuclear physics. J. M. Blatt and V. F. Weisskopf. New York, Wiley, c1952. 864 pp., illus., $15.00.

This book is concerned with the theoretical concepts, methods, and considerations of nuclear physics which have been devised in order to interpret the experimental material and to advance our ability to predict and control nuclear phenomena. Many aspects of the subject were omitted and the author restricted himself to phenomena involving energies below about 50 Mev. Subjects such as nuclear engineering, on which adequate textbooks are available, and such new theories as nuclear fission have been generally excluded. The text was last revised in the spring of 1951 and this fact alone restricts the material which is included. A list of symbols at the end of every chapter defines each one and references are found at the back of the book.

Water supply and purification. 3rd edition. Scranton, Laurel, 1952. 516 pp., illus., $6.50 (U.S.).

Now in its third edition, this publication has been in heavy use since 1938, when it was first published.

The major changes in this edition include a new chapter on fluoridation, and planning for emergencies and civil defense, including information on bacteriological and radiological warfare.

Chapters on ground water and filtration and the laying and maintaining of pipe lines have been completely rewritten, and information on pipe conduits and disinfection has been brought up to date.

The use of actual problems to illustrate the question under consideration adds greatly to the practical value of this book.

Appendices include: Distribution system symbols; drinking water standards of the United States public health service; planning for emergencies and civil defense; and problems based on the various chapters.

The book is well indexed.

World airline record, 1952. Chicago, Roy R. Roadcap & Assoc., 1952. 400 pp., illus., $12.50 (U.S.).

This new edition discusses 240 regularly scheduled airlines, representing for the first time 100% coverage of the world, including Russia. Traffic and financial data for most carriers are complete through 1951 with later data summarized under the heading "Interim Report". All airlines are carefully indexed and grouped according to nationality, with individual companies described under standardized

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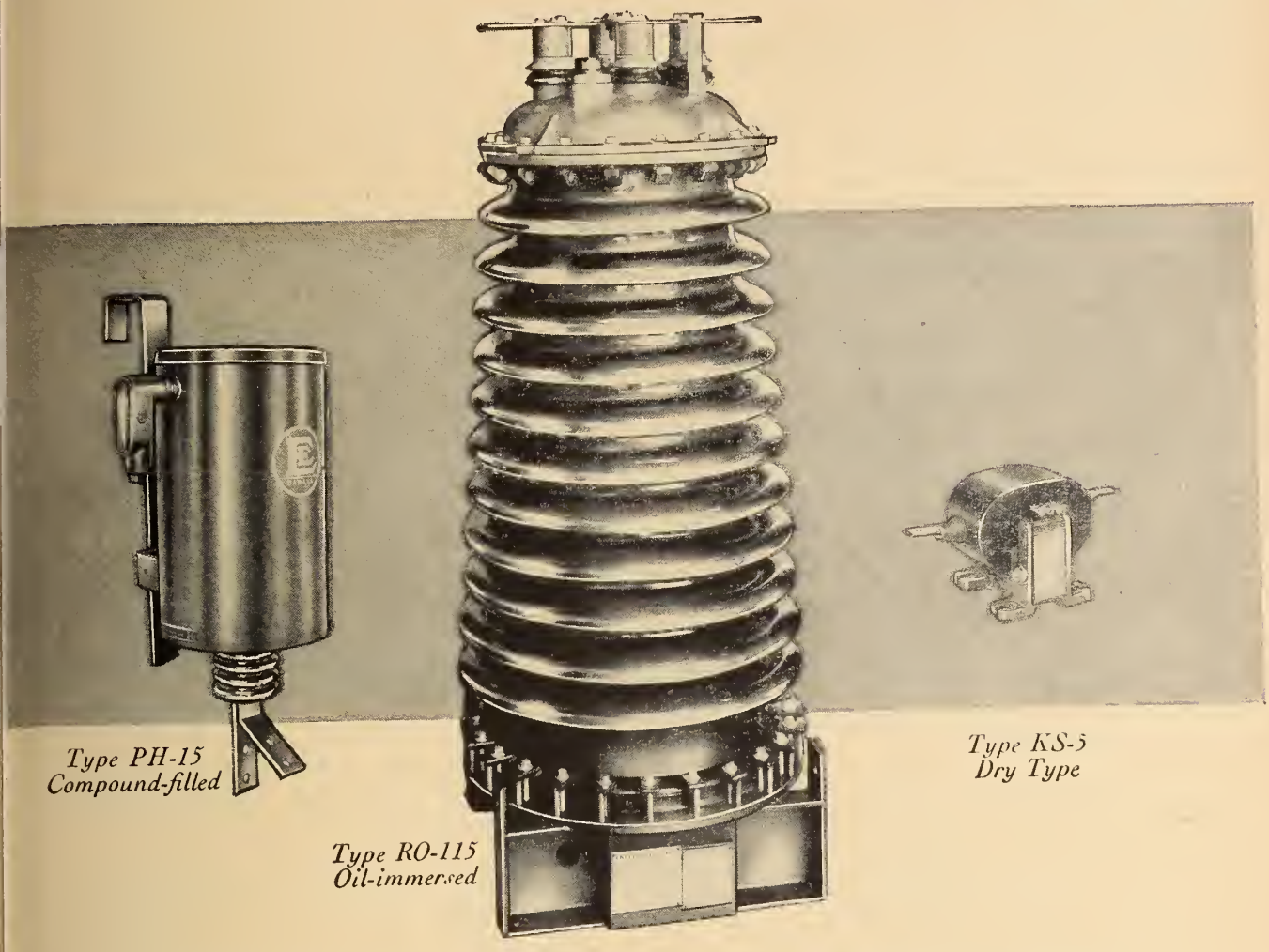

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The world almanac and book of facts for 1953. Harry Hansen, ed. New York World Telegram and The Sun, c1953. 896 pp., $1.10 (U.S.).

The United States 1952 national elec- ion is completely covered in this edition, s well as such other important subjects s the war in Korea, defense of the West nd the labour situation. The ratification f treaties is recorded, world economic nd diplomatic activities are summarized, nd population statistics are analyzed. Other sections cover sports, religion, nedicine, science and the weather.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Dairy engineering. A. W. Farrall, New York, second edition, 1953. 477 pp., illus., $6.00 (U.S.).

This comprehensive work covers electric power and equipment, hydraulics and pumping, refrigeration, evaporating and drying equipment, and materials handling as they relate to the dairy industry. Homogenizing, pasteurizing, sterilizing, filling and capping, and other specialized types of equipment are also given full consideration. Equipment maintenance, dairy plant design and layout, and waste disposal receive attention; and materials, operation, and servicing are discussed in relation to established sanitary standards and health-service requirements. Useful data tables are appended.

Electrical measuring instruments. Part I: General principles and electrical indicating instruments, 2nd ed. C. V. Drysdale and A. C. Jolley. Revised by C. F. Tagg. Toronto, British book service, 1952. 598 pp., illus., $15.00.

Beginning with general electrical principles and typical basic systems, this standard work continues with the mechanical design and construction of instrument mechanisms and the elements of electrical theory and design. The following types are dealt with in detail: permanent magnet moving coil instruments; soft iron instruments; dynamometer ammeters; voltmeters and watt meters; hot wire instruments; electrostatic instruments. Separate chapters are devoted to the conditions of rapid indication and the properties of electrical materials. Although electronic techniques are intentionally given only brief mention, other advances, since the earlier edition, in design, construction, and performance have been given full consideration.

Foundation engineering. R. B. Peck, W. E. Hanson and T. H. Thornburn. New York, Wiley, 1953. 410 pp., illus., $6.75 (U.S.).

A unified logical treatment of all aspects of the subject, with emphasis on the ordinary types of foundations most likely to be met in practice. Part A is a self-contained text on basic soil mechanics. Part B similarly deals with foundation types and construction methods. Part C discusses in detail the problems of selection of foundation type and provides a basis for the structural design of foundation elements dealt with in Part D. A feature of the book is the presentation of specific procedures for exploiting geological information.

Metadyne statics. J. M. Pestarini. New York, Wiley, 1952. 415 pp., illus., $10.80.

A metadyne is an electric machine provided with an armature having a commutator upon which bear at least three brushes per cycle of the machine, commutation being independent of the main windings of the stator or any eventual magnetic member acting upon the armature. The author, who is the original proponent of this new group of electric machines, presents logically and thoroughly the theory, design, and applications of metadynes, emphasizing that specific characteristics particularly suited to each application can be provided, rather than having to adapt existing equipment to performance requirements. Steady-state characteristics are covered in the present volume. A subsequent volume on "metadyne dynamics" is to cover transient characteristics when the machines are subjected to rapidly varying currents.

BOOKS RECEIVED

The agricultural tractor. P. H. Southwell. London, Temple press, 1953. 169 pp., illus., 15/-.

Automation; the advent of the automatic factory. John Diebold. Toronto, Van Nostrand, c1952. 181 pp., $4.00.

Basic electronic test instruments. R. P. Turner. New York, Rinehart, c1953. 254 pp., illus., $4.00 (U.S.).

Britain's railway liveries; colours, crests and linings, 1825-1948. E. F. Carter. London, Burke, 1952. 360 pp., illus., 36/-.

British commonwealth scientific conference, Australia, February-March, 1952: report of proceedings. Ottawa, United Kingdom information office, 1952. 74 pp., 75c.

Electronic engineering principles, 2nd ed. J. D. Ryder. New York, Prentice-Hall, c1952. 505 pp., illus., $9.00 (U.S.).

Elements of food engineering, vol. 1. M. E. Parker, E. H. Harvey, and E. S. Stateler. New York, Reinhold, c1952. 386 pp., illus., $8.75 (U.S.).

Elements of the theory of functions. Konrad Knopp. New York, Dover publications, c1952. 140 pp., $1.25 (U.S.)

Flatland, 6th ed., rev. E. A. Abbott. New York, Dover publications, c1952. 103 pp., illus., $1.00 (U.S.).

The high-speed internal-combustion engine, 4th ed. H. R. Ricardo. London, Blackie & Son, 1953. 420 pp., diagrs., 40/-.

History of civil engineering. Hans Straub. London, Leonard Hill, 1952. 258 pp., illus., 25/-.

Industrial leadership and joint consultation. W. H. Scott. Liverpool, University press, 1952. 207 pp., 12/6.

Introduction to hydraulics and fluid mechanics. J. O. Jones. New York, Harper, c1953. 403 pp., illus., $6.00 (U.S.).

Ireland. National university. Calendar for 1952. Dublin, The university, 1952. 232 pp.

Lectures on Cauchy's problem in linear partial differential equations. Jacques Hadamard. New York, Dover publications, c1952. 316 pp., $1.70 (U.S.).

La mécanique ondulatoire. T. Kahan et B. Kwal. Paris, Armand Colin, c1953. 220 pp., 260 fr.

National conference on industrial hydraulics, 8th meeting, September 4-5, 1952. Proceedings. Chicago, Illinois institute of technology, c1952. 242 pp., illus., $4.50 (U.S.).

National fire codes, vol. 2: The prevention of dust explosions, 1952 ed. Boston, National fire protection association, c1952. 288 pp., illus., $3.00 (U.S.).

National research council review, 1952. Ottawa, Committee of the privy council on scientific and industrial research, 1953. 271 pp., illus.

La pratique des traitements thermiques des métaux industriels, 4. ed. Gerard de Smet. Paris, Dunod, 1953. 405 pp., illus., 2900 fr.

Problems in hydraulics. R. S. Paradise. Glasgow, Blackie and son, 1953. 342 pp., illus., 17/6.

Quebec. Department of trade and commerce. Bureau of statistics. Year book, 1951-52. Quebec, Queen's printer, 1952. 610 pp.

Radio amateur's handbook, 30th ed. American radio relay league. West Hartford, Conn., The league, c1953. 180 pp., illus., $3.50.

Radio and radar technique. A. T. Starr. Toronto, Pitman, 1953. 812 pp., figs., $15.00.

Radioisotopes; industrial applications. G. H. Guest. Toronto, Pitman, 1950. 185 pp., illus., $4.50.

Recurrent electrical transients. L. W. Von Tersch and A. W. Swago. New York, Prentice-Hall, 1953. 399 pp., figs., $10.35 (U.S.).

Tables and formulas for fixed end moments of members of constant moment of inertia. Paul Rogers. New York, Frederick Ungar, c1953. 95 pp., figs., $3.75 (U.S.).

Technical data on fuel, 5th ed. H. M. Spiers, ed. London, British national committee, World power conference, 1952. 517 pp., diagrs., 25/-.

TV manufacturers' receiver trouble cures, vol. 1. M. S. Snitzer, ed. New York, John F. Rider, c1953. 115 pp., diagrs., $1.80 (U.S.).

Theory of electrons, and its applications to the phenomena of light and radiant heat, 2nd ed. H. A. Lorentz. New York, Dover, c1952. 343 pp., $1.70 (U.S.).

Vacuum-tube oscillators. W. A. Edson. New York, Wiley, c1953. 476 pp., figs., $9.00.

Weight-strength analysis of aircraft structures. F. R. Shanley. Toronto, McGraw-Hill, c1952. 394 pp., illus., $10.65.

What is science? Norman Campbell. New York, Dover, c1952. 186 pp., $1.25 (U.S.).

Wood's register of Canadian manufacturers, 1952 ed. Montreal, W. R. Woods Ltd. Loose leaf. volume 2, $75.00. For review, see the April, 1953, *Journal.*

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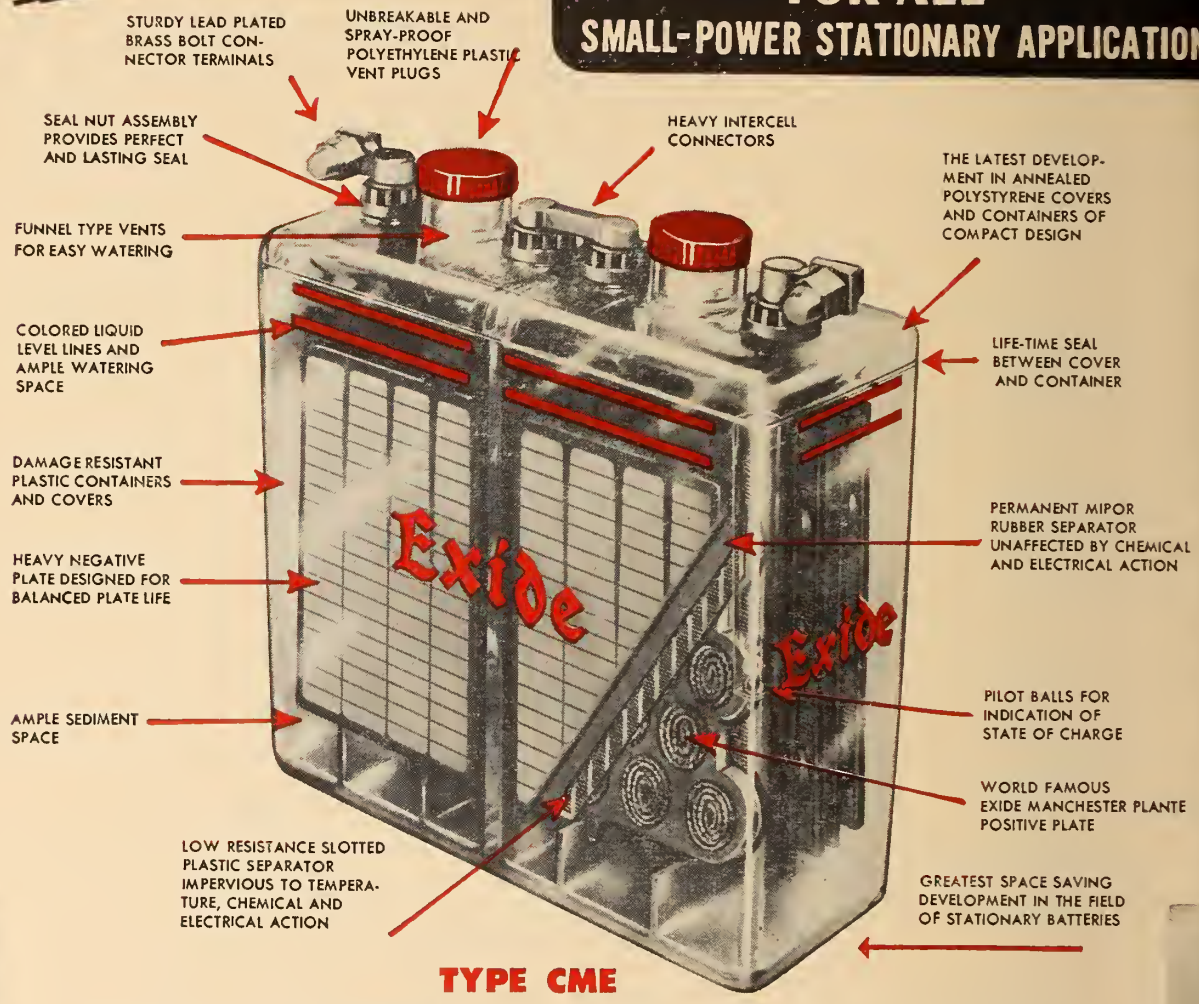

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STANDARDS REVIEWED

British standards, British standards institution, 24/28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 249: 1953 — Free machining brass rods and sections. 3/-.

This standard specifies requirements for free machining brass rods and sections having a diameter or width across flats of not less than 1/16 inch. Specifications are given for chemical composition and tolerances, amended to bring them up to date with present-day practice.

B.S. 1942: 1953 — Aluminium filler alloys for brazing. 2/-.

Four types of aluminum alloy, suitable for brazing a number of alloys, are covered here. This is in line with the series of British Standards for aluminum and aluminum alloys. Chemical composition and limits of impurities are specified, together with the form of material and the approximate melting ranges.

B.S. 1946: 1953—Flat dies for thread rolling. 4/-.

This standard presents dimensional and accuracy requirements for flat dies, intended for the production of Unified, Whitworth and BA threads. The limits of tolerance on the thread forms refer to the production method of finishing the form by grinding, not by milling. Dimensional and other relevant details for duplex dies are also included, and information is given in the Appendix on the process of thread rolling.

B.S. 1947: 1953—Circular dies for thread rolling. 4/-.

This companion standard gives requirements for dies of circular form used for the production of screw threads by rolling on bolts, studs, screws and similar components. The thread form tolerances relate to the three types of threads mentioned above and are intended for the production of threads to the close fit limits of the various systems. An allowance for die wear is also included. Information and production hints are found in the Appendix.

B.S. 1948: 1953—Copper-silicon alloy rods, sections and forgings (for general engineering purposes). 3/-.

Requirements are here specified for copper-silicon alloy rods and sections having a diameter or width across flats of not less than 1/16 inch, and for forgings of this alloy, with regard to chemical composition and mechanical properties. The standard also includes tables of tolerances on round, square and hexagon rods.

B.S. 1949: 1953—60/40 brass rods, sections and forgings (for general engineering purposes). 3/-.

This standard for 60/40 brass rods has the same scope as the foregoing B.S. 1948. Test tables are given for mechanical and tensile qualities and brief sketches illustrate the dimensions of test pieces.

Canadian standards, Canadian standards association, National research building, Ottawa, Canada.

C.S.A. A14.1-1953—Specification for concrete poles (not prestressed). 3rd ed. 75c.

This specification applies to cast concrete poles and to the various combinations of short, medium-length and long poles with light, medium and heavy lateral strains. It is also intended for poles designedly stronger in one direction than in another, such as, for example, poles supporting trolley lines.

C.S.A. A14.2-1953—Specification for concrete poles (prestressed). 75c.

This specification provides an official set of standardized requirements for prestressed concrete poles. It applies to all poles prestressed to avoid tension set up by the stresses due to external loads, temperature change, shrinkage, and creep, and to take advantage of both high tensile steel and high strength concrete.

C.S.A. C22.2 No. 4-1952—Construction and test of enclosed switches. 2nd ed, $1.25.

This standard applies to enclosed air-break switches which have all current-carrying parts enclosed and which are manually operable by means of external handles. The maximum ratings are 600 amperes or less at 600 volts or less.

C.S.A. G38-1953—Specification for heavy steel shaft forgings. 2nd ed. 75c.

The primary purpose of this standard is to cover rough turned shaft forgings for hydraulic turbines and generators driven by such turbines, and for similar heavy industrial equipment. It does not extend to highly stressed forgings such as the rotors in steam turbines, nor to ring-shaped forgings. Supplementary requirements of an optional nature are provided.

TECHNICAL BULLETINS RECEIVED

American institute of electrical engineers. Standards:

No. 22 — Air switches, insulator units, and bus supports. No. 25 — Fuses above 600 volts. No. 50 — Automatic circuit-reclosers for a-c distribution systems. No. 53 — Proposed guide for operation and maintenance of dry type transformers with class B insulation. No. 54 — Proposed standard, test code, and recommended practice for induction and dielectric heating equipment. No. 55 — Guide for temperature correlation in the connection of insulated wire and cables to electric equipment. Nos. 601 and 602 — Large 3600-r.p.m., 3-phase, 60-cycle condensing steam turbine-generators (larger than 10,000-kw. rated capacity) and generators for large 3600-r.p.m., 3-phase, 60-cycle condensing steam turbine-generators (larger than 10,000-kw. rated capacity). No. 800 — Test code for d-c. aircraft rotating machines.

American water works association. Standard specifications:

ASA A21.10-1952 (AWWA C110-52) — Short-body cast-iron fittings, 3 inch to 12 inch, for 250-p.s.i. water pressure plus water hammer.

Bell telephone system. Monographs:

No. 2026 — Communications and electronics, by M. J. Kelly. No. 2027 — Electrical noise in semiconductors, by H. C. Montgomery. No. 2029 — Impedance bridges for the megacycle range, by H. T. Wilhelm.

British electrical and allied industries research association. Technical reports:

No. C/T108 — Selection and characteristics of wind-power sites, by E. W. Golding and A. H. Stodhart. No. G/T253 — Effect of series resistance on the energy dissipated in capacitive spark discharges across small gaps, by H. G. Riddlestone. No. G/T256 — Performance of a.c. fuses with small over-currents at 11 kv., by H. W. Baxter and M. T. Cree. No. G/T265 — Flameproof enclosure of electrical apparatus. Gaseous explosions in communicating compartments; the influence of turbulence and pressure piling, by J. A. B. Horsley. No. G/T267 — Flameproof electrical apparatus: flanged joints, one inch and one half-inch in radial breadth, in atmospheres of heptane-vapour and air, by H. Robinson and H. L. Williams. No. L/T252 — Measurement of permittivity at high frequencies, by E. Rushton. No. O/T8 — Examination of corroded insulator spindles, by G. Mole. No. S/T60 — Statistical survey of overvoltages observed during switching tests on a 66 kv. system with arc-suppression coil and with resistor earthing, No. S/T66 — Arcing phenomena in unearthed high-voltage systems, by S. Silbermann. No. S/T70 — Design, construction and performance of a new high-speed cathode-ray oscillograph for recording high-voltage surges, by E. L. White.

Canada. National research council. Canadian government specifications board. Specifications:

15-GP-1A — Calcium chloride; flake. 15-GP-5A — Soda ash. 15-GP-7A — Caustic soda (lye). 15-GP-8A — Sulfuric acid, battery electrolyte grade. 32-GP-111A — Tea; black.

Colorado school of mines. Department of publications. Publications:

Vol. 47, no. 1 — Metallurgical research in uranium, manganese and nodular cast irons.

Dominion fire prevention association. Proceedings of meetings:

Thirty-fourth annual meetings, 1952.

Lehigh university, Bethlehem, Pa. Fritz engineering laboratory. Progress reports:

No. 6 — Column strength under combined bending and thrust. Metropolitan water district of southern California. Annual reports:

Fourteenth annual report, 1951-52.

. . . Royal commission on the South Saskatchewan river project. Reports:

No. 1 — 1952.

United States. Department of commerce. National bureau of standards. Handbooks:

No. 46 — Code for protection against lightning.

. . . Applied mathematics series:

No. 9 — Tables of chebyshev polynomials $S_n(x)$ and $C_n(x)$. No. 18 — Construction and applications of conformal maps.

United States. National research council. Highway research board. Bulletins:

No. 58 — Compaction of embankments, subgrades, and bases.

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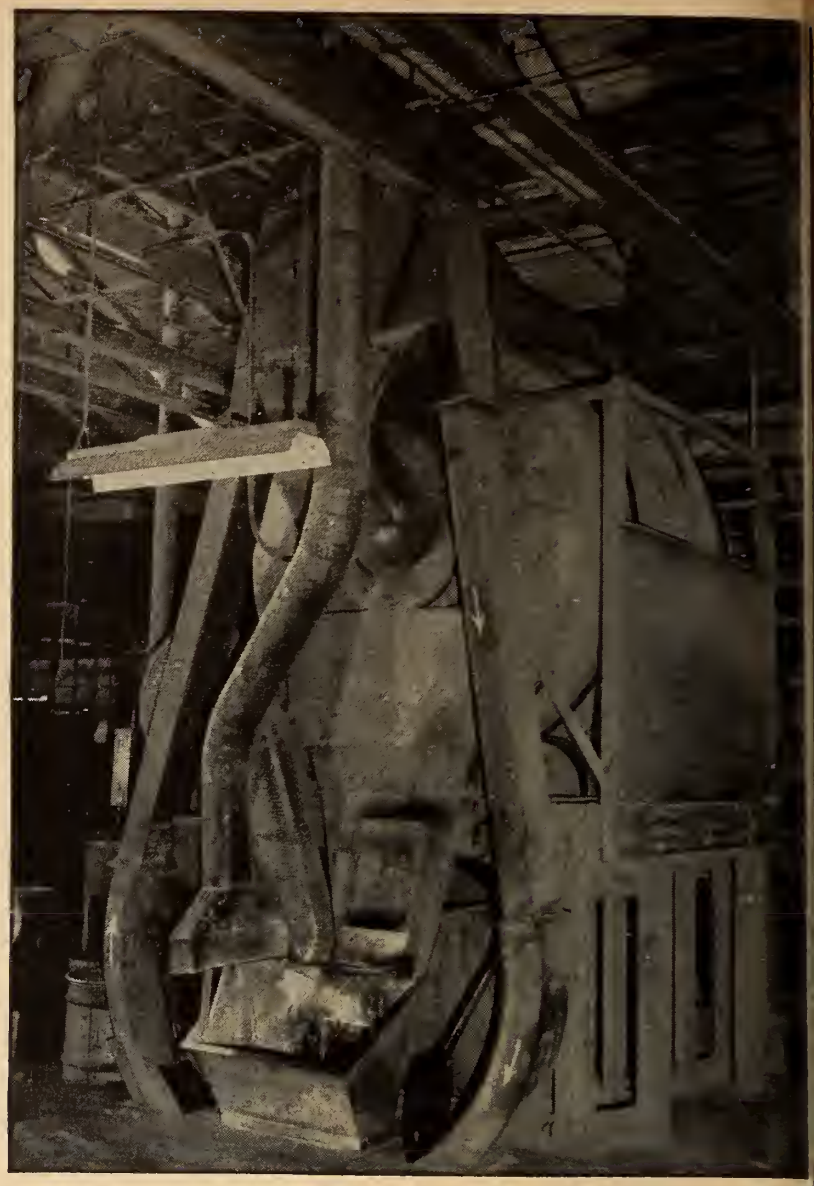

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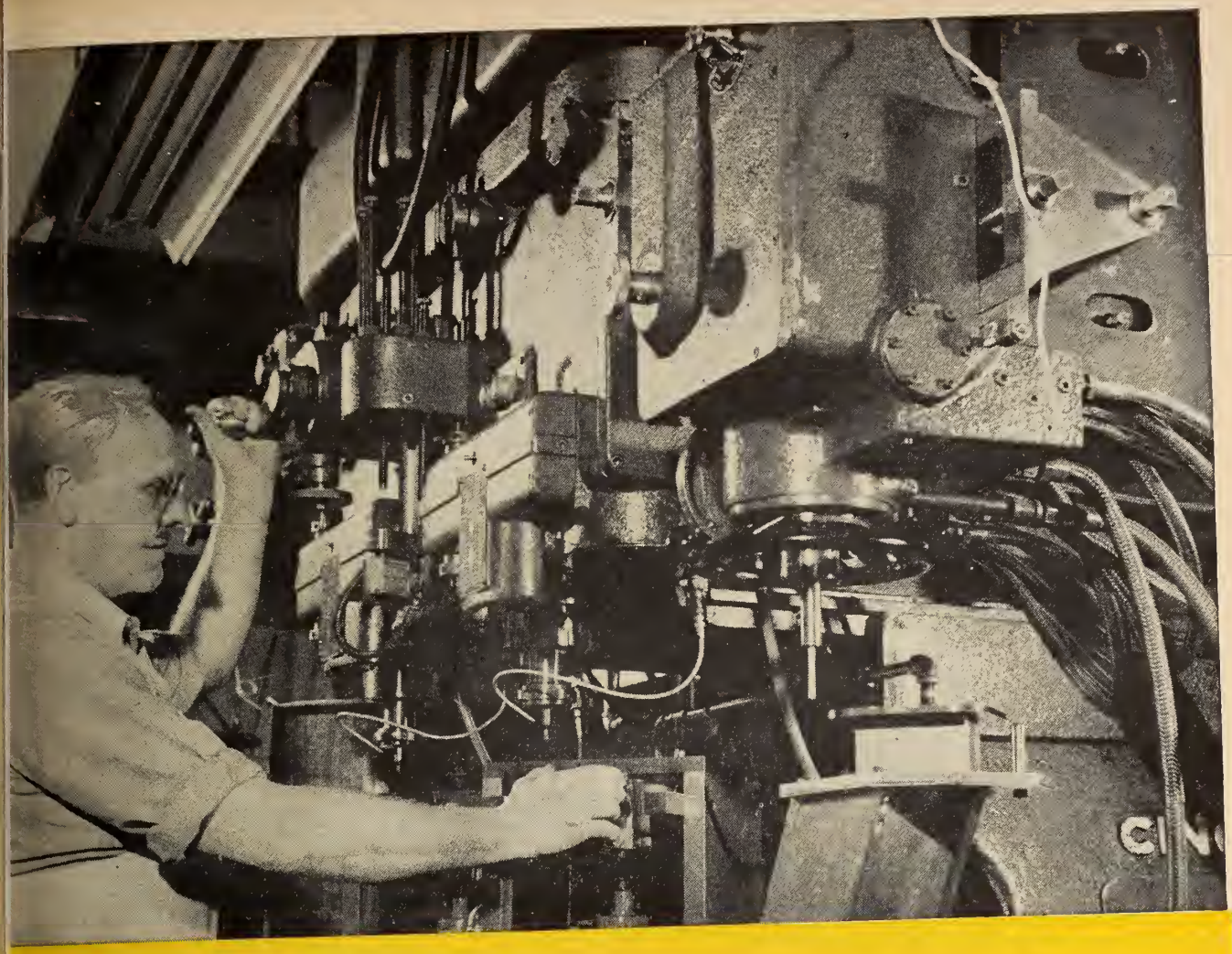

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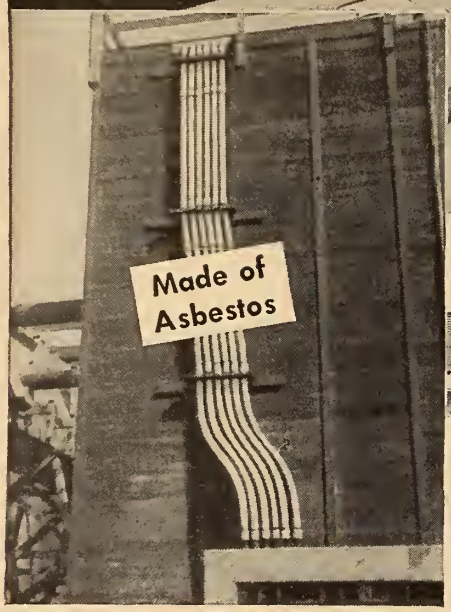
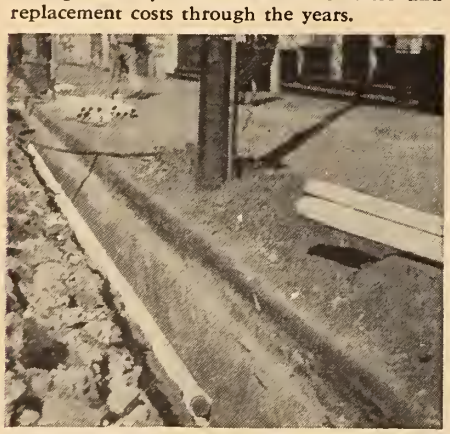
Corrosion resistant

Installed over 18 years on this bridge, Transite Conduit is still on the job despite the attack of corrosive fumes, weather and vibration.



Resists the Elements: Transite Ducts are standing up far longer than other materials on this cooling-tower wall despite corrosive conditions. Transite's exceptional corrosion-resistance practically eliminates maintenance and replacement costs through the years.



Outlasts other Materials: When other ducts failed to stand up under the streets of a city in the Far West, Transite Ducts were installed. Their life expectancy is far greater than that of the ducts they have replaced.

That's why TRANSITE® DUCTS stay on the job despite corrosive fumes, soils and weather

If you're looking for a conduit that will stand up for years in tough service . . . use Transite Ducts that not only resist corrosion but are immune to electrolysis, too.

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You will find that Transite Ducts save you money on your cableway system not only by staying on the job longer . . . but by holding down the initial cost, too. For further information write Johns-Manville, 199 Bay Street, Toronto, Ontario.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Incombustible. Transite will not burn or contribute to formation of smoke, gases, or fumes. It confines burnouts and protects adjacent cables.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Easy To Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. And, long 10-foot lengths reduce the number of joints in the line.

4. Higher Thermal Conductivity. Cables run cooler in Transite Ducts, reducing I^2R losses, increasing current capacity, and prolonging insulation life.

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Johns-Manville TRANSITE DUCTS

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...a strong, tough, ductile cast iron... readily machinable

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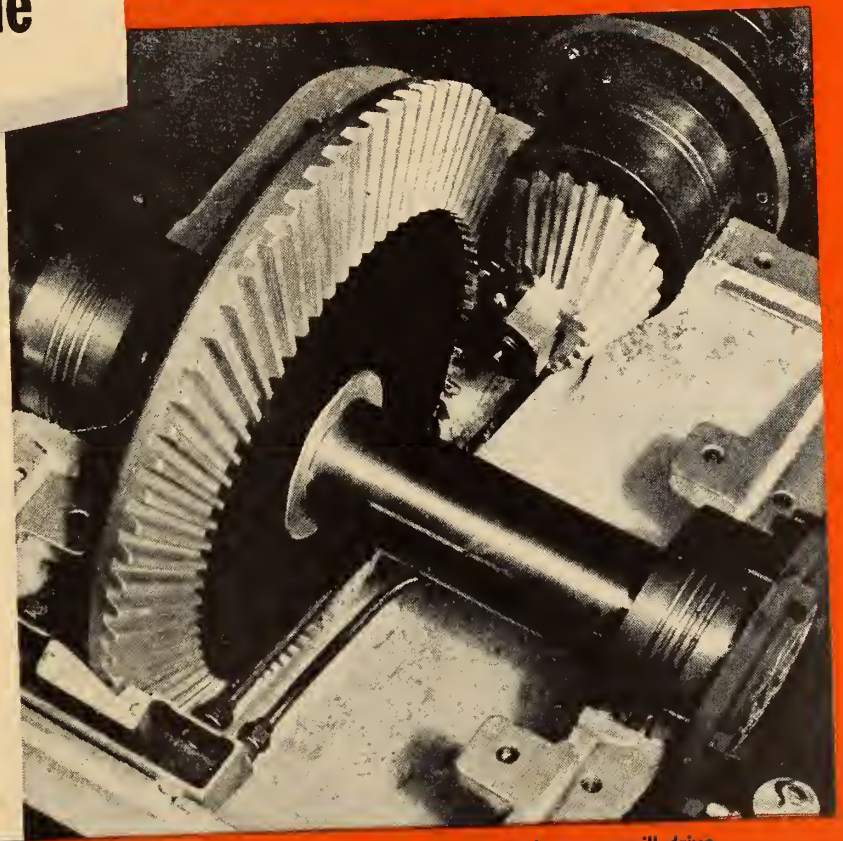

Flame-hardened Ductile Iron ring gear in paper mill drive

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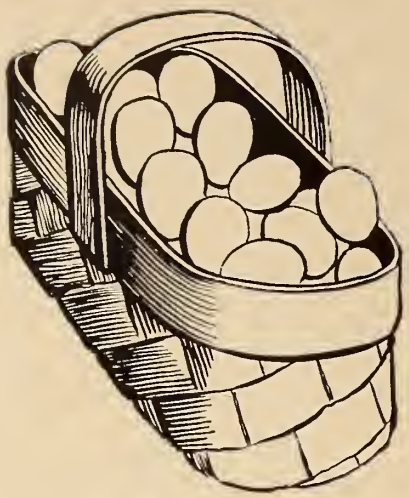

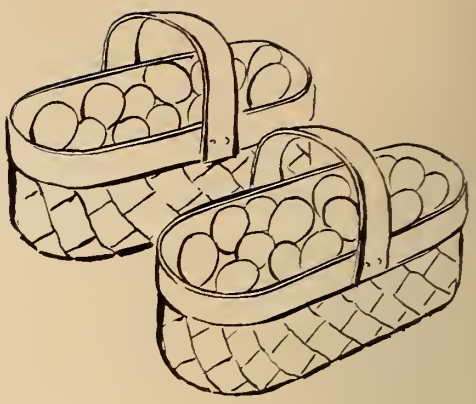

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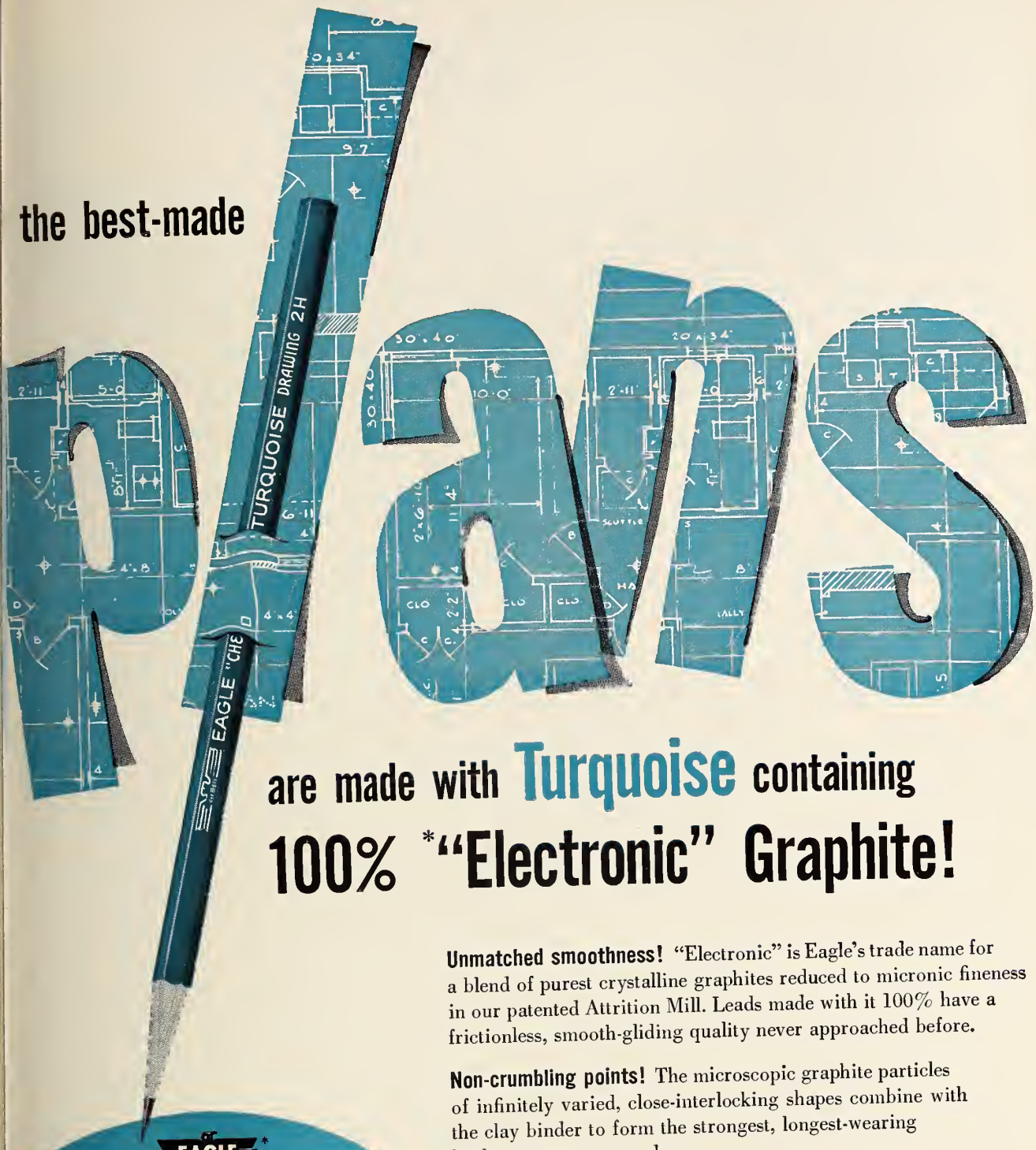

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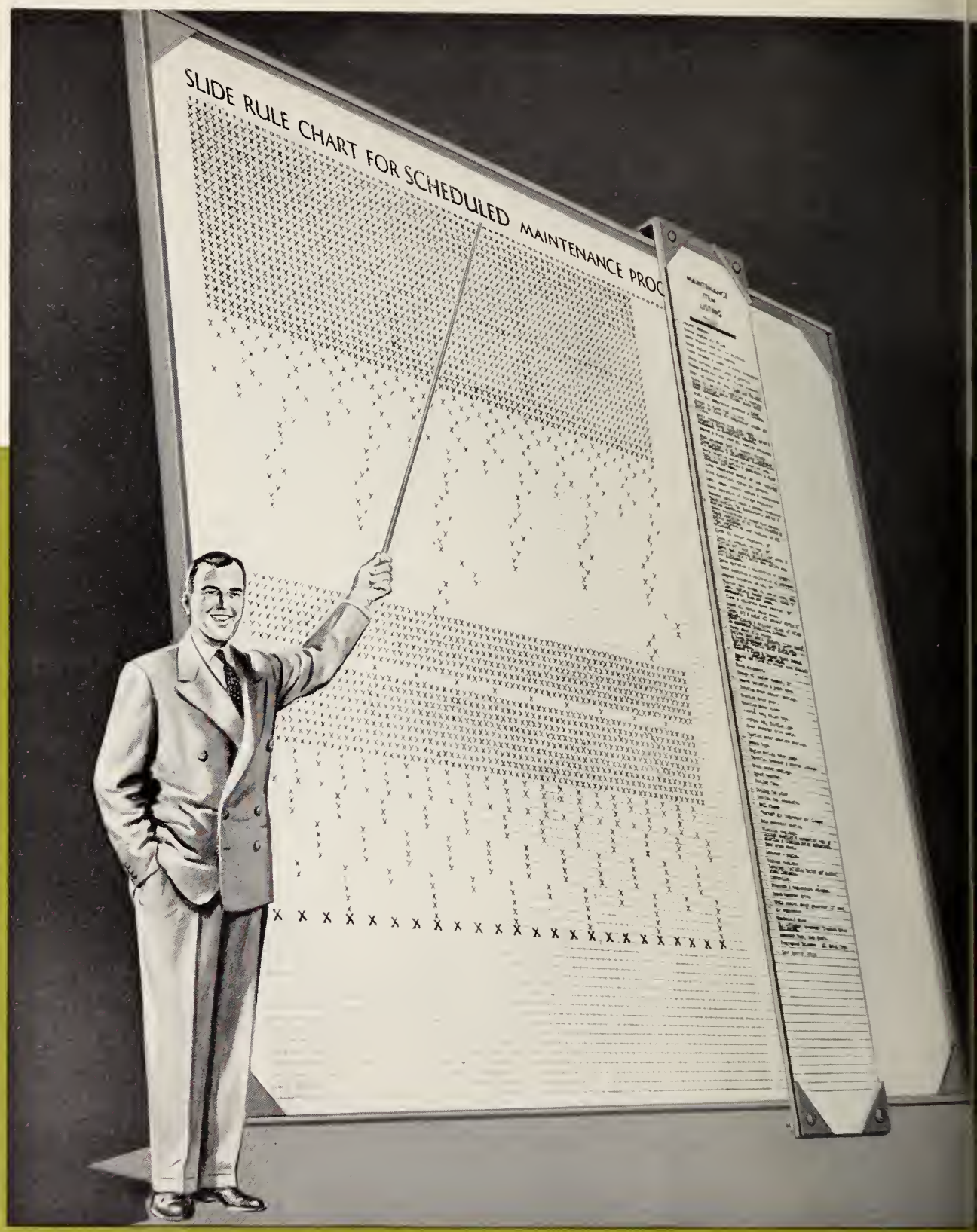

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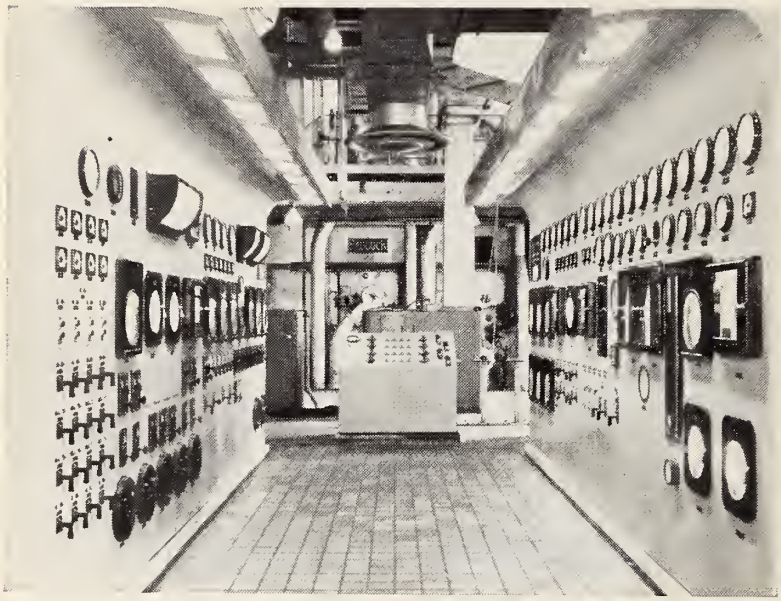

THE RICHARD L. HEARN GENERATING STATION
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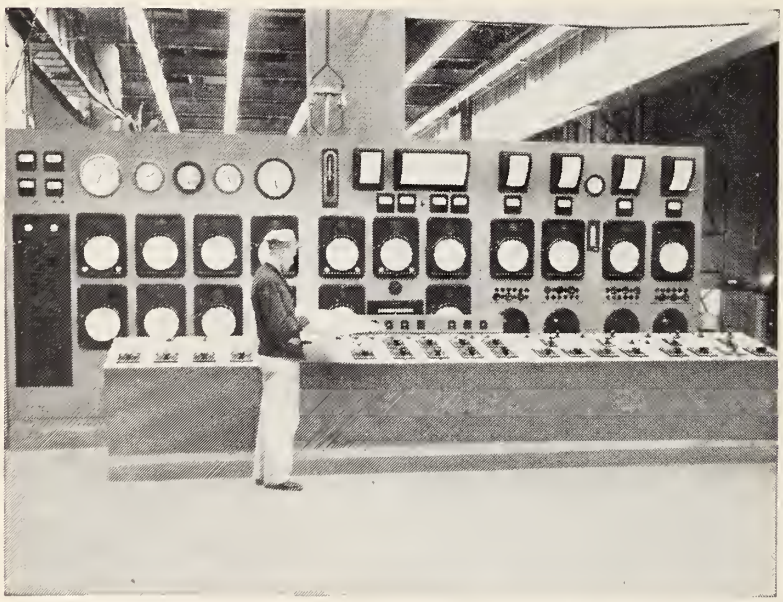
Bailey is represented in the boiler control and turbine control panels illustrated left and right. Consulting Engineers: Stone & Webster Engineering Corporation.



THE J. CLARK KEITH GENERATING STATION
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The boiler control panel for this station was supplied by Bailey Meter Company Limited. Consulting Engineers: H. G. Acres & Company.

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ENGINEERS AT YOUR SERVICE FROM COAST TO COAST

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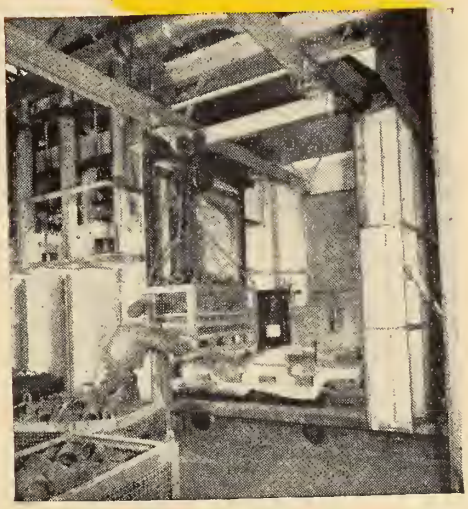

Peacock automatically controlled oil-heated indirectly fired car-bottom furnace for stress relieving and heat treating at temperatures up to 2,000°F. at the valves, fittings and piping plant of Crane Limited in Montreal.

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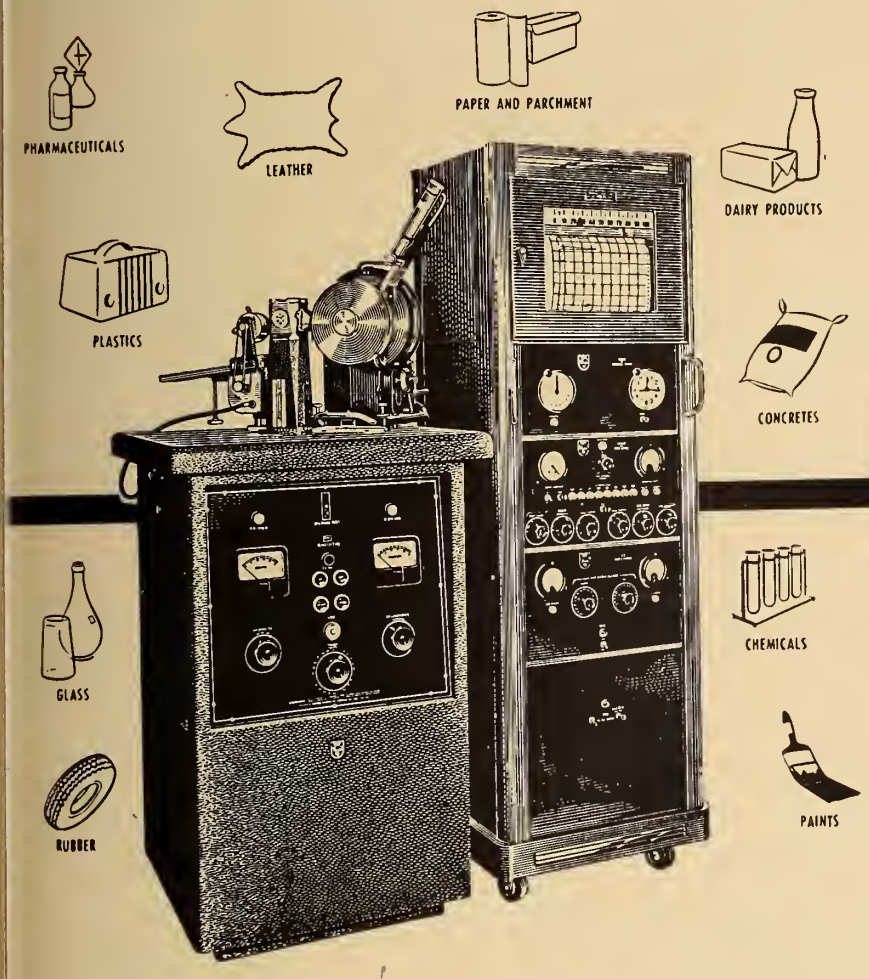

At ROGERS "Science in Industry" Automotive Building

Rogers "Science in Industry" exhibit at the C.I.T.F. will preview the world's most up-to-date industrial research and processing control equipment. Among dozens of electronic devices on display will be Philips X-ray diffraction equipment, foremost in its field. It provides a rapid, non-destructive method of analysis for industrial purposes which cannot be duplicated by any other means. See Philips X-ray diffraction equipment and many other electronic instruments at Rogers "Science in Industry" exhibit at the Trade Fair.

X-RAY DIFFRACTIOMETER

Remarkably accurate and rapid method of analysis, for laboratory or production line. Angles and intensities available in minutes on strip-chart recorder. Permits immediate checks on presence or absence of significant lines. Rapid identification or comparison — with large or small quantities of material. Geiger Counter technique facilitates exact determination of line positions, intensities, widths.

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plastic to metal

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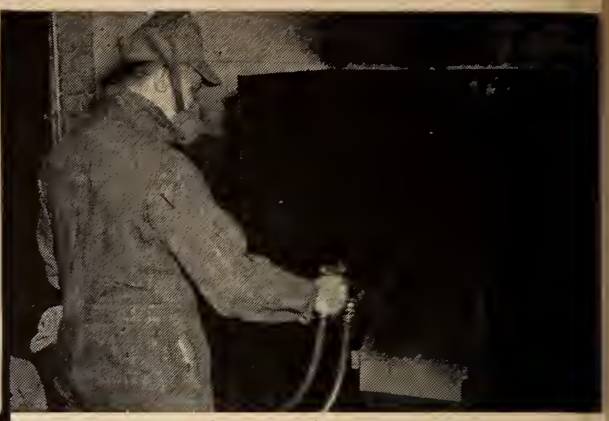
Whether you make mops or airplanes, adhesive problems will crop up now and then on the production line. Some difficulties you might overcome with a little experimenting yourself. But then you'll never know for sure if you are getting the best possible results. To be really certain, turn the question over to our specialists. They'll either recommend one of our hundreds of standard adhesives or develop a brand new one especially for you. Then you'll be sure of fast, positive adhesion with consequent saving of time and expense.



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Switchboard efficiency to meet your needs!

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PRIVATE BRANCH EXCHANGE

This is a modern switchboard with the new "plug-in" type units, permitting actual service requirements to be closely met.

Available in capacities of

60 and 120 Station Lines
14 Central Office Trunks
15 Cord Circuits

Two positions may be installed side-by-side to increase the maximum capacity to 240 lines.

The low design makes it convenient for attendant-receptionists to converse with employers' visitors or client over the top of the switchboard.

No. 507

PRIVATE BRANCH EXCHANGE

A small compact switchboard with a capacity of

12 Station Lines
5 Central Office Trunks
5 Connecting Circuits.

Requires about the same amount of space as the average typewriter.

Convenient and simple to operate by an attendant with other duties.

Northern Electric

COMPANY LIMITED

41 BRANCHES THROUGHOUT CANADA

2053-1

Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

G.M. Diesel Appointment. — William M. Warner has been appointed director of sales of the engine sales division of General Motors Diesel Limited, London, Ontario. He succeeds Norman H. Daniel who has retired after 32 years' service with the old McLaughlin Motor Car Company and General Motors. The change became effective on May 1st.

The engine sales division was transferred from General Motors of Canada, Oshawa, to London a year ago. It handles industrial and marine engines.

•

John H. English. — John H. English, commercial counsellor of the Canadian Embassy at Washington since 1948, will return shortly to Ottawa to fill the position of director of the Canadian Trade Commissioner Service. He will take over from George R. Heasman, recently appointed as Canada's first ambassador to Indonesia.

•

McArthur Chemicals.—A new board of directors of the 111-year-old McArthur Chemicals Co. Ltd. and its subsidiary, Chemicals Ltd., has been elected at a general meeting of shareholders. Control of the McArthur Company was purchased, recently, by St. Maurice Chemicals Limited, which, in turn, is owned jointly by Shawinigan Chemicals Limited, of Montreal, and Heyden Chemical Corporation of New York.

Members of the new board are V. G. Bartram, P. W. Blaylock and H. S. Sutherland of Shawinigan Chemicals; J. P. Remensnyder, Simon Askin and F. A. Degener, of Heyden; and Robert Berry and G. A. Lee, members of the former McArthur Board.

•

J. Irving Lawson.—J. Irving Lawson, has retired from the service of the division of building research of the National Research Council. He has been with the division since 1948.

•

Monsanto (Canada) Changes. — On April 17, Arnold H. Smith, President of Monsanto (Canada) Limited since 1948, resigned that position to become a special assistant in St. Louis to E. A. O'Neal, Jr., general manager of Monsanto Chemical Company's overseas division. Mr. Smith also resigned as a member of the board of directors of the Canadian organization.

Mr. O'Neal was elected a director of the Company and named president. He will be responsible for the general supervision of the Company's affairs.

Leo E. Ryan, executive vice-president of Monsanto (Canada) Limited was made responsible for all the operations of the Company as from April 17.

•

J. A. Wilson Sales Staff.—J. A. Wilson, Lighting and Display Limited have announced two new appointments to its sales staff. Viateur "Vic" Labbe has been appointed to the Montreal district and Ross Meyrick to the Toronto district.

•

T. A. Moore

T. A. Moore.—Thomson A. Moore has been named executive vice-president of R.C.A. Victor Company Limited.

•

Howard A. King.—Howard A. King of Elmira, Ont., has been promoted to factory manager of General Motors Diesel Limited. He succeeds George D. Baker who has returned to G.M.'s electro-motive division at La Grange, Illinois. This change is in keeping with the Company's policy of replacing United States personnel with Canadian.

•

Fairbanks-Morse Executives. — The Canadian Fairbanks-Morse Co. Ltd. have made the following executive changes. Robert H. Morse, Jr., is now president and general manager and chairman of the executive committee.

George R. Wyer is executive vice-president and member of the executive committee. J. E. McQuilkin is assistant to the president and member of the executive committee. C. W. Coughlin is vice-president, industrial products and H. C. Rindfleisch is vice-president consumer products.

F. T. Ball now manager of the Edmonton Branch has been appointed to the position of manager of the Montreal Branch.

•

Research Council Changes. — Three new members have been appointed to the National Research Council and three of the present members, whose terms of appointment expired March 31 this year, have been re-appointed, for the three-year period to March 31, 1956.

The new members are: Dr. R. F. Farquharson, M.B.E.; Dr. E. G. D. Murray, O.B.E.; Dr. David L. Thomson.

The three scientists who have served one term as Council members and have now been re-appointed for another three years are: Dr. C. W. Argue, C.B.E.; Dr. A. G. McCalla and Dr. G. M. Shrum, O.B.E.

In addition to the men listed above, other members of the Council for 1953-54 are: de Gaspe Beaubien, C.B.E., M.E.I.C.; Dr. Albert Bertrand, Dr. A. N. Campbell, Dr. Gordon G. Cushing, Dr. G. E. Hall, Dr. J. H. L. Johnstone, O.B.E.; Dr. C. J. Mackenzie, Dr. Cyrias Ouellet, Dr. T. Thorvaldson, Brig. F. C. Wallace, D.S.O., Dr. W. H. Watson.

•

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In Canada's rapidly expanding economy, steel warehouses serve an essential function by supplying steel shapes of all kinds for a multitude of industries. We, in Dominion Bridge, are proud of the fact that we maintain the only *national* warehouse service, serving thousands of customers from steel stocks at nine strategic centres from coast to coast. Under present day conditions, this "on the spot" service means a great deal in meeting urgent requirements.

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WAREHOUSE DIVISION
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Dominion Bridge Company warehouses at:
MONTREAL, OTTAWA, TORONTO, WINNIPEG, EDMONTON, CALGARY, VANCOUVER.
Associate Company Warehouses at: AMHERST, SAULT STE. MARIE.
Other Divisions: Structural, Platework, Boiler, Mechanical.

W. S. Cowell

J. C. Anderson

Atlas Asbestos Appointments. — C. H. Jackson, president of the Atlas Asbestos Co. Ltd. announces the appointment of W. S. Cowell, formerly general sales manager to vice-president of sales, and J. C. Anderson, formerly production manager to vice-president of production.

●

Norcanda Engineering Appointment.— Robert (Bob) Fry, formerly superintendent of the Doncaster Mine of Beattie-Duquesne Mines Ltd. has joined the staff of Norcanda Engineering Company Ltd., Toronto. He will be general superintendent in charge of quarrying, shaft sinking and underground development.

●

W. D. Hagen.— W. D. Hagen has been appointed to the post of manager of The Robb Engineering Works Ltd., Amherst, N.S.

He joined Dominion Bridge Company in 1946 as junior engineer and draughtsman and has since served the Company as designer, estimator, and sales engineer. In 1952 he was transferred to Robb Engineering Works Ltd. at Amherst as assistant to the late J. F. F. Mackenzie, whom he succeeds in the managerial position.

●

Minneapolis-Honeywell Move. — Minneapolis-Honeywell Regulator Co. Ltd., Montreal office has been moved from 637 Craig Street West, to 6277 Upper Lachine Road. The telephone number is DExter 3501.

●

Export Credits Appointments. — Leon J. Koerner of Vancouver and K. F Wadsworth of Toronto, have been appointed to the Advisory Council of The Export Credits Insurance Corpn. The Corporation is a crown organization set up to insure exporters against nonpayment by foreign buyers due to credit and political risks involved in foreign trade.

●

(*Continued on page 664*)

COGHLIN SPRINGS

for Quality and Satisfaction

We manufacture all kinds of Springs, large and small, for every purpose.

Our eighty-four years' experience is your guarantee of superior quality and workmanship.

B.J. COGHLIN CO. Limited

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LEVELEZE FLOOR DRAINS have all these features

Series No. 3610

Josom Leveleze Floor Droins solve the problems caused by voriations in floor levels. The adjustable top is completely detachoble from drain body and is held in position by o set screw until the floor construction sets. Where the drain has been set too high or too low in concrete floors, formerly it wos necessary to teor out floor construction, disconnect drain, remove nipple, install new nipple, reconnect droin at proper level and patch floor. NOW all that is required is to chip out finish, loosen odjustable top, odjust top to proper elevotion and potch finish. Droin body ond orch ore not disturbed. Time ond lobor ore saved; costs reduced and low spots resulting in unsanitory woter pools ore eliminoted.

THE JOSAM LINE INCLUDES: Floor, Shower and Urinol Droins, Roof Droins, Backwater Valves, Interceptors for Greose, Oil, Sediment ond Hair, Swimming Pool Fittings, Modorotor Mixing Volves, Shock Absorbers.

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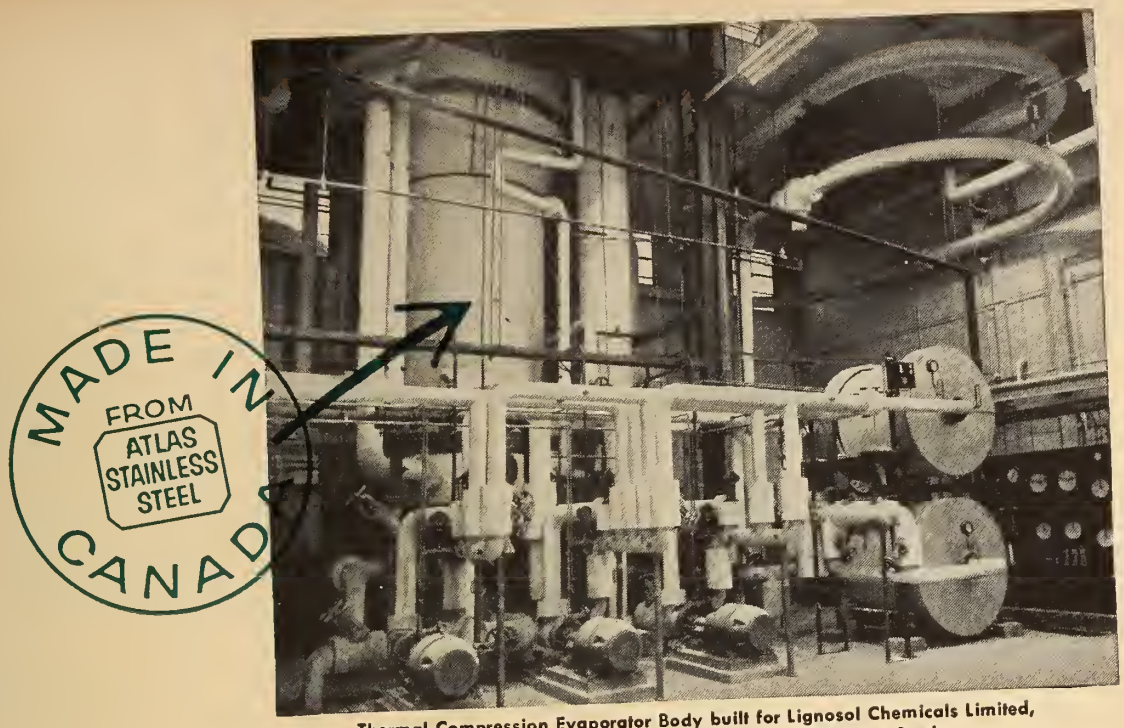

Thermal Compression Evaporator Body built for Lignosol Chemicals Limited, by Canadian Vickers Limited, from Atlas Stainless Steels.

Excellent Facilities For Large-Scale Stainless Steel Fabrication Are Available In Canada

Lignosol, a chemical product of many uses is obtained by concentrating spent sulphite liquor, a once useless by-product of pulp and paper manufacturing. When growing demand overtaxed pilot plant capacity, Lignosol Chemicals Limited, Quebec City, faced the problem of building a larger concentrating plant.

Earlier production experience indicated the advantages of a Thermal Compression Evaporator of very durable construction. Choice of Atlas Type 316L (extra low Carbon) Stainless steel over other grades and materials was obvious after exhaustive testing under operating conditions. Type 316L successfully resisted the severely corrosive acid solutions and vapours encountered in the process.

Canadian Vickers Limited, Montreal, fabricated approximately 17 tons of the Stainless 316L plate in large sizes, bar, sheet, forgings and wire supplied by Atlas for the installation. Expert welding, experienced fabrication with reliable Canadian Stainless steel combined for complete customer satisfaction.

This is a good example of how teamwork between leading fabricators, their customers, contracting engineers and Atlas makes it increasingly practical and possible to "buy Canadian".

SS2-53

ATLAS STEELS LIMITED, WELLAND, ONTARIO

Canada's Pioneer Producers of Fine Alloy Steels for Special Industrial Uses

Warehouses and Offices at:
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ATLAS STAINLESS STEELS

SAVE 15 to 20%

on building costs with

COSELEY STANDARD

Steel Framed INDUSTRIAL BUILDINGS

There is a straight 15 to 20% saving for you if you will plan your building to "Coseley" Standard measurements.

Your saving is effected simply by accomodating yourself to the standard measurements which have been proved best by Architects, Engineers and Contractors for various Industries, Warehouses, schools, garages, barns, fairground buildings, airplane hangars — even grain storage units.

In all "Coseley" buildings there IS UNOBSTRUCTED HEIGHT between floor and apex.

BECAUSE all connections are bolted ON THE SITE and there is no cutting or welding ANY "COSELEY" building is readily transferable TO A NEW LOCATION.

Among more than fifty models there is a "COSELEY" Standard Steel Frame Building to meet YOUR particular requirements.

THERE IS A "COSELEY" STANDARD STEEL FRAME BUILDING OF COLD ROLLED STEEL SECTION FOR EVERY PURPOSE

Widths: 30, 40, 50, 60 ft. CLEAR SPAN, with 15 and 20 ft. extensions on either or both sides.

Lengths: Indeterminate, in increments of 12'-6"

Practical Interiors — Graceful and Harmonious Exteriors

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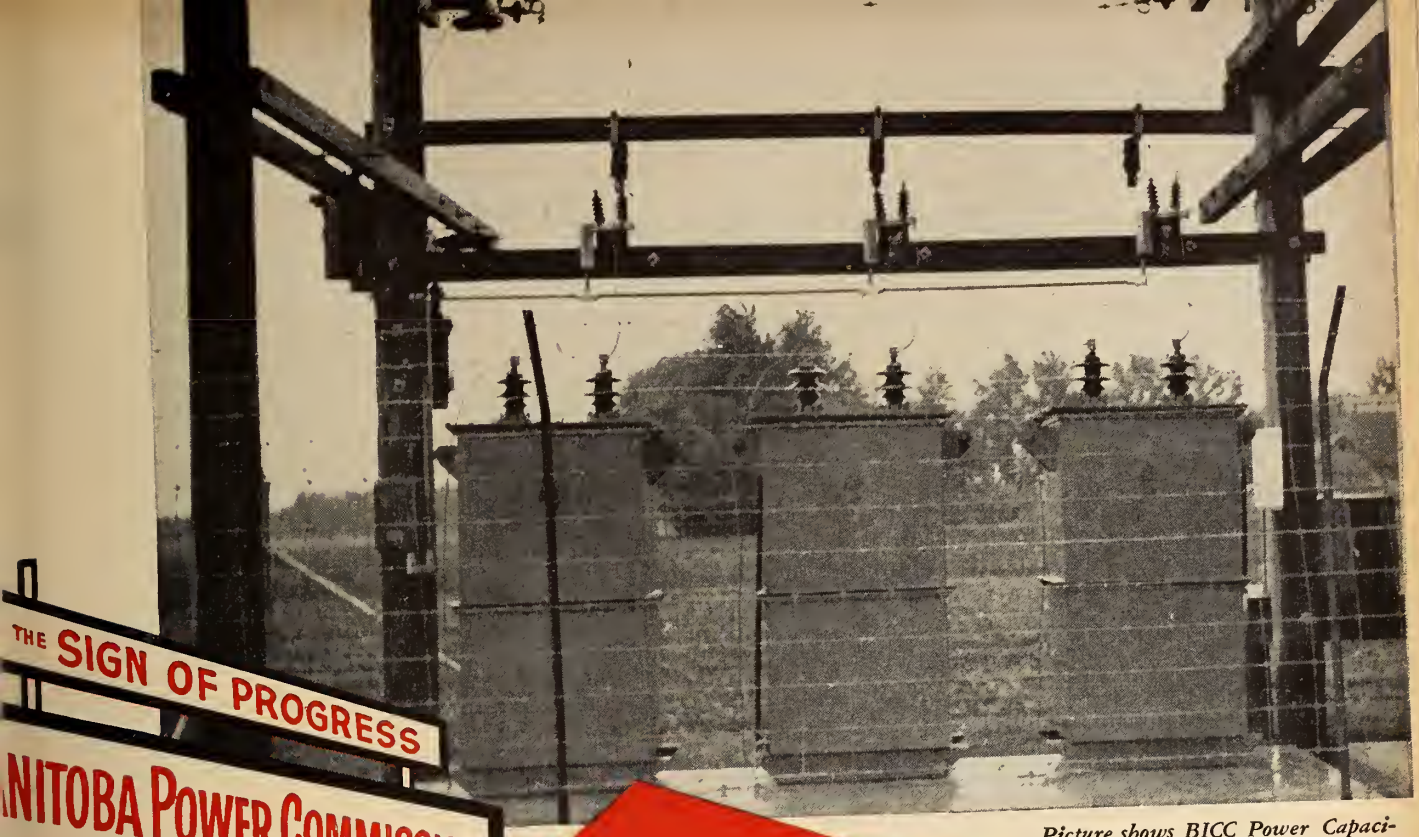
Coseley Engineering (Canada) Ltd.,
1532 Crescent Street
MONTREAL, QUE.
Authorized Representatives from Coast to Coast



Picture shows BICC Power Capacitor bank recently completed for the Manitoba Power Commission at Glenboro, Manitoba.

Steer clear of power supply trouble with POWER CAPACITORS

B.I. Callender's

Idle currents in circuits can be troublemakers. In flowing from generator to load such currents magnify transmission losses, displace useful current and lower the performance of an entire system.

With today's power demands often difficult to meet, why allow this waste of useful power when a solution is ready to hand. BICC Power Capacitors improve the Power Factor, reduce distribution losses, increase your system's load carrying capacity and improve voltage regulation.

These modern Capacitor Banks can be made up from single-phase or three-phase units. Installed in *small banks* at secondary sub-stations or *large banks* at main sub-stations they are 99.87% efficient, require no maintenance, and give years of trouble-free service.

WRITE FOR COMPLETE INFORMATION

B-5201

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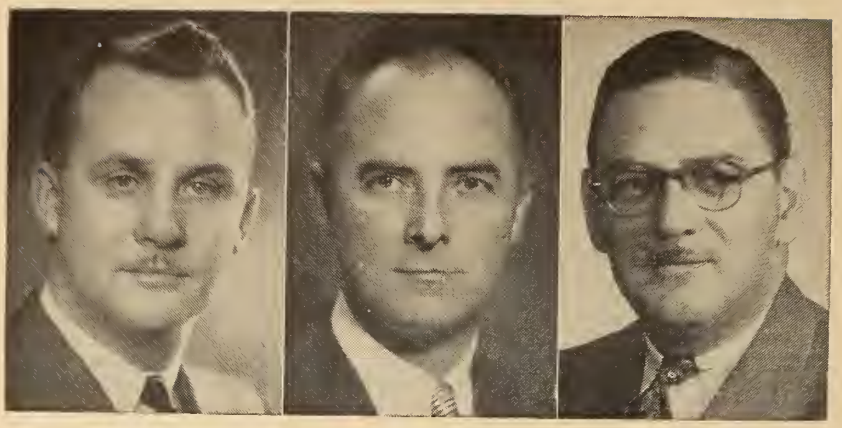
(*Continued from page 660*)



C. R. Hughes E. R. O'Kelly S. C. Bird

R. M. Johnson

Automatic Electric Changes. — Automatic Electric Sales (Canada) Ltd. has announced that Carman R. Hughes has been named vice-president and a director of the Company. Mr. Hughes joined the organization in 1941 and was formerly with The Northern Electric Company.

E. R. O'Kelly has been elected secretary-treasurer and a director of the Company and of its affiliate, Automatic Electric (Canada) 1953 Ltd. He joined the organization in 1937.

S. C. Bird is manager of the Industrial Division of the sales organization. Previous to this appointment he was sales manager of industrial specialty products.

A new telephone manufacturing plant will shortly be erected and operated by Automatic Electric (Canada) 1953 Ltd.

●

R. M. Johnson. — R. M. Johnson has been appointed sales manager of the Ottawa and District Sales Office of Canada Cement Company Ltd. He will make his headquarters at the newly opened Ottawa branch at 700 Metcalfe Building.

●

New Equipment and Developments

Representation Required. — An internationally known British company, which has been established in Canada for over 40 years, is planning to expand its representation here. Current plans call for the appointment of representatives in all provinces except Quebec, where the head Canadian office is located.

The products to be represented are: Diesel and dual-fuel engines, in four and two stroke cycle, in capacities ranging from 300 hp. to 5,800 hp. in single units. Also to be offered is a complete range of moulding machines and foundry equipment.

Journal readers who are interested in expanding their representation are invited to communicate to the publications manager of the Journal, who will be pleased to put them in touch with the Company concerned.

●

Award For John Inglis. — The John Inglis Company Limited of Toronto, one of the Canadian members of The English Electric Group, has been presented with a special award for the design of their deluxe home washer at an exhibition of the winning entries in a design competition at Ottawa.

Humphrey B. Style, president of the Company, received the certificate and was congratulated by Trade Minister C. D. Howe, HON.M.E.I.C., and by the Prime Minister.

The award states "In recognition of excellence of design in a manufactured product, this certificate is awarded by the National Industrial Design Committee on the recommendation of a jury, representative of Design, Manufacture and Marketing".

●

C.G.E. Speed Drives. — A simplified addition to its line of Thy-mo-trol packaged electronic adjustable-speed drives has been announced by Canadian General Electric Company's apparatus division.

Designed for use on many types of equipment, including testing machines, printing presses, conveyors, variable volume or proportioning pumps and machine tools, the new unit is available for ¾ to 3-hp. drives.

It offers stepless speed-control, preset speed control and close speed regulation, and includes the smallest G.E. Thy-mo-trol drive panel, measuring 15 x 18 x 12½ inches.

The new electronic drive is offered in standard speed ranges of 5:1 and 20:1 and comes in both reversing and non-reversing forms. It operates on 220/440 volts, single-phase 50/60 cycles. For complete details communicate with any C.G.E. office.

●

Mechanical Seals. — Simplicity of design is an important feature in Garlock new "O" Ring Mechanical Seals for rotating pump shafts. The small number of parts affords easy manufacturing adaptability of this improved seal to withstand any liquid, whether mild, harmfully corrosive or extremely hazardous on rotating pump shafts.

These "O" Ring Seals are designed to provide leakless operation of rotary shafts on centrifugal pumps handling chemicals, petroleum products, edible liquids, pulp liquors and many other liquids. They are furnished in Type C an unbalanced seal for pressures up to 200 p.s.i., and in Type OB, a balanced seal for pressures up to and over 1,000 p.s.i. Both types can be supplied with single spring or multiple spring, and in either pin-drive or sleeve-drive construction.

For additional details, write to the Garlock Packing Company of Canada Ltd., Toronto, Ontario.

●

Gates Rubber in Canada.—The Gates Rubber Company of Denver, Colo., will soon build a manufacturing plant in Brantford, Ontario. This announcement was made on April 7, by Howard Winter, mayor of Brantford.

The new modern plant will be built of reinforced concrete and brick. It will be a one-storey building, so constructed that it may easily be expanded to meet future needs. Ground has already been broken and manufacturing operations will commence this fall.

The Gates Rubber Company has been selling its products in Canada for over thirty years. It has a subsidiary corporation, Gates Rubber of Canada Ltd., a sales organization which has been operating here for the past few years. Commenting on the Company's development of the Canadian market, Charles C. Gates, president, said "our expansion into Canada comes as the result of our confidence in the strength and stability of the Canadian economy. We regard Canada as a vigorous, progressive country with a great future ahead of it. We are looking forward to the opportunities ahead for closer business relationships with our good Canadian neighbors".

●

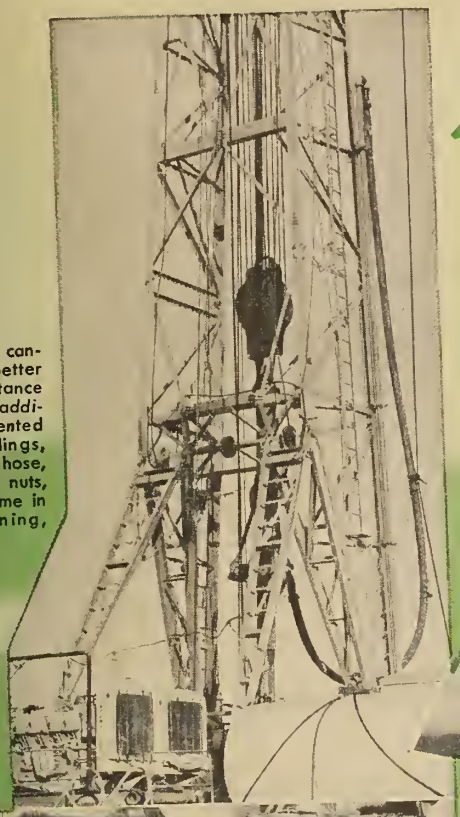
(*Continued on page 668*)

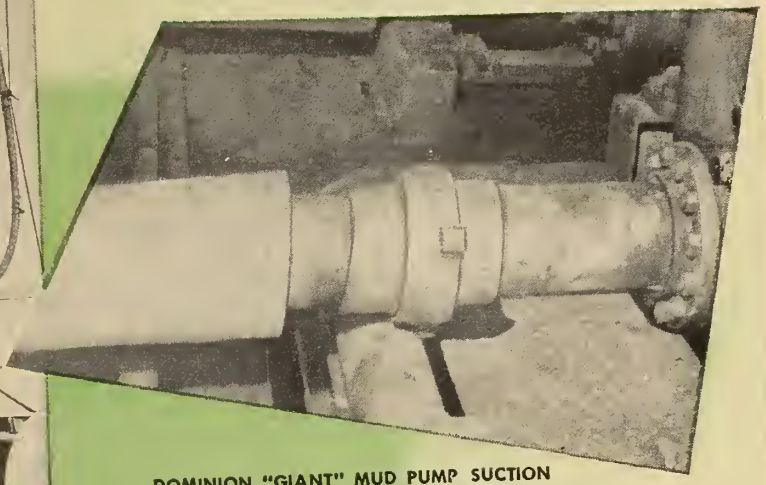
ominion Rubber Products CUT YOUR COSTS— GIVE YOU

Lowest Cost-per-Foot DRILLING

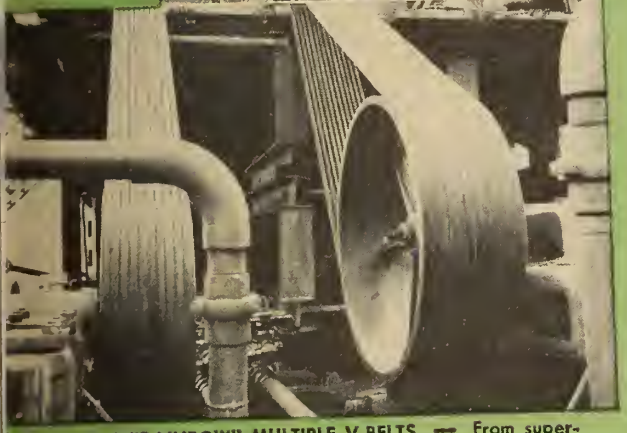
OMINION
OTARY
RILL HOSE

nique wire-ply con-ruction gives far better exibility and resistance pressure *without* addi-onal *weight!* Patented ak-proof couplings, uilt right into the hose, iminate flanges, nuts, olts, and save time in ecking, tightening, aintenance.





DOMINION "GIANT" MUD PUMP SUCTION HOSE — Flexible, can be quickly adjusted to correct position without changing connections. Designed with heavy duty built in nipples and non-collapsible, abrasion resisting tube for maximum life under the toughest operating conditions.



DOMINION "RAINBOW" MULTIPLE V-BELTS — From super-tough protective cover to special rayon cord carcass, Dominion "Rainbow" are the hardest working, longest wearing V-Belts you can get. Multiple jacketed, for extra protection and grip, they stand up to toughest all-weather service in the oil fields.

NEW PIPE WIPER — Reversible, molded in one piece with double wiping lips. Does work of 2 old-style wipers yet costs no more than single type! Easily cut to pipe size. Far outlasts ordinary wipers.

DOMINION RUBBER offers Canada's most complete line of proven rubber products for the oil fields. Other equipment includes:

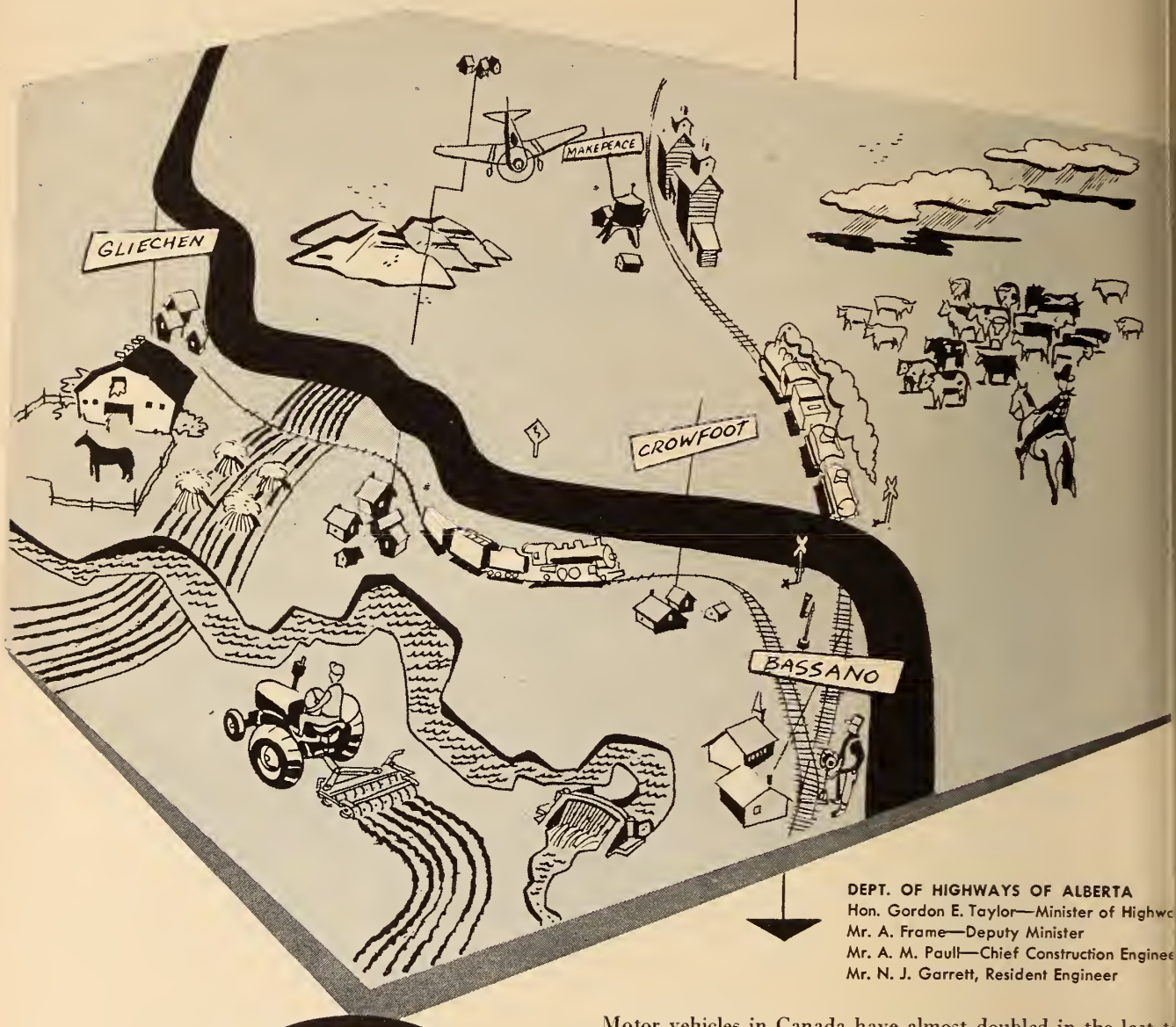
- **Rubber Covered Fire Hose**
- **Vibrator (Floor Hose)**
- **Water Hose (Wash Down)**
- **Shale Shaker Tubing**
- **Friction Tape**
- **Steam Hose**
- **Drill Stem Protectors**
- **Packings**
- **Hose Couplings of all Types**

DOMINION RUBBER — ENGINEERED RUBBER PRODUCTS FOR EVERY INDUSTRY

Specialized Service to the Oil Industry through our Branches in Regina, Calgary, Edmonton, Winnipeg and from our Branch offices in other Principal Cities.

paving the way for happy motoring with

IMPERIAL ASPHALT



DEPT. OF HIGHWAYS OF ALBERTA
Hon. Gordon E. Taylor—Minister of Highwc
Mr. A. Frame—Deputy Minister
Mr. A. M. Paull—Chief Construction Enginee
Mr. N. J. Garrett, Resident Engineer

IMPERIAL ESSO PRODUCTS

Motor vehicles in Canada have almost doubled in the last t years. To bring this vastly increased and remunerative mot transport into many local areas, an urgent requirement is goo roads, such as the one shown here.

Illustrated above are 41 miles on the Trans-Canada Highwa from Bassano, Alberta, to a point 10 miles north of Gleichen- hard surfaced in 1952 by Standard Gravel and Surfacing Canada Limited, Calgary. Imperial Oil's 200/300 Pen. Aspha was supplied for an important section of this smooth, durab highway.

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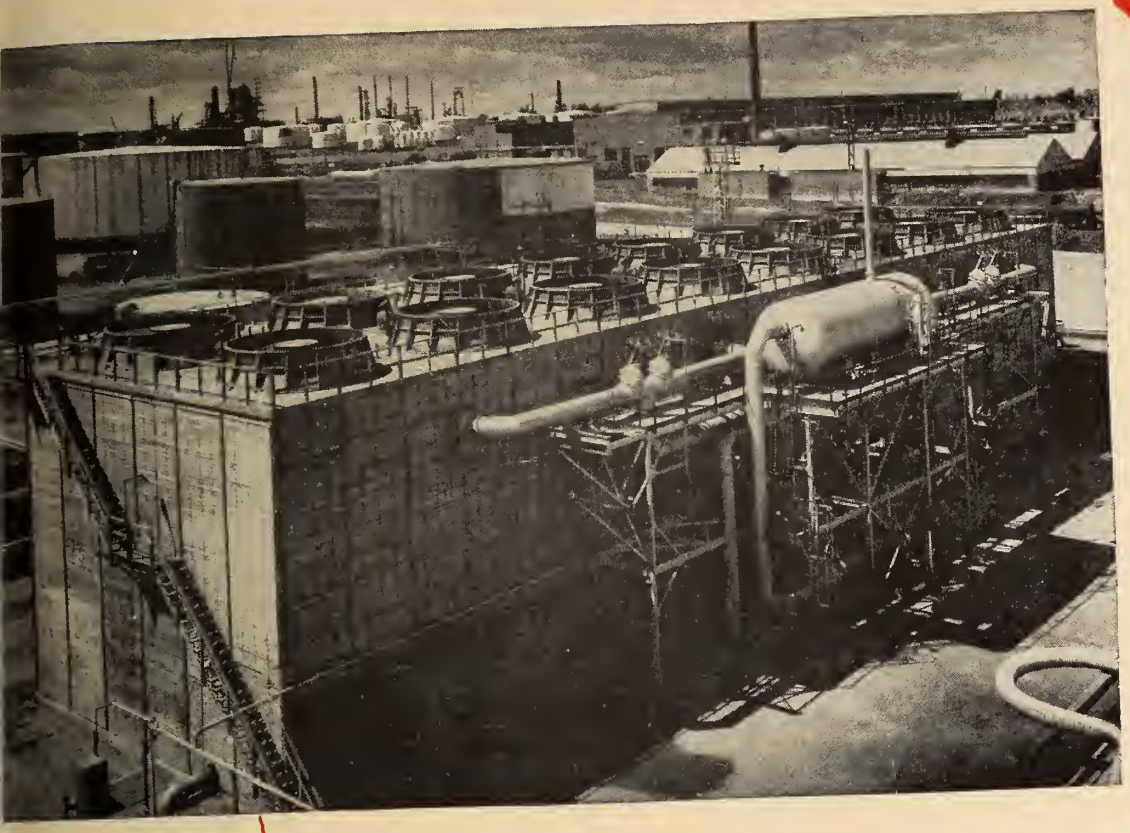
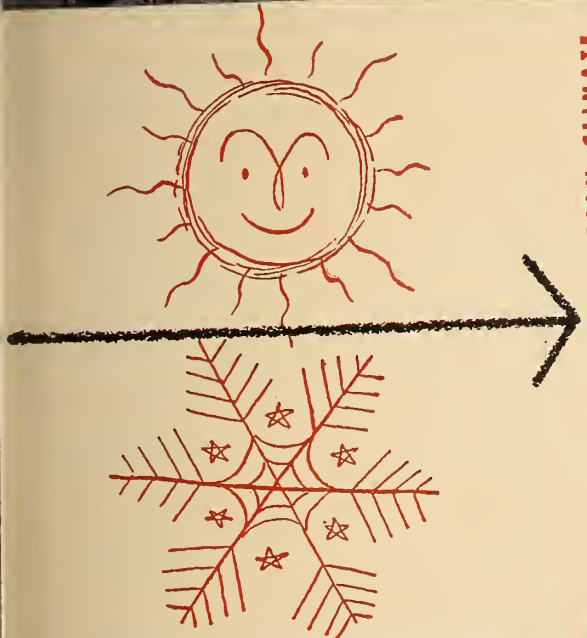
IMPERIAL OIL LIMITED

Asphalt Sales Department, Head Office: 56 Church St., Toronto, Ont.

ROAD ENGINEERING SERVICES ACROSS CANADA

COOLING TOWERS BY...





If you use more than 300 gallons of water per minute for cooling purposes you can probably economize with a cooling tower designed, engineered, fabricated and installed by Foster Wheeler.

DESIGNED FOR THE CANADIAN CLIMATE

It has been determined, through years of practical experience, that the induced draft cooling tower is the most suitable type for trouble-free cold-weather operation. To meet the rigorous climatic conditions encountered in most parts of Canada, a cooling tower must be designed and fabricated to provide controlled cooling even in below zero temperatures.

In an FW cooling tower of the induced draft type, ice will not form on the fan, either during operation or when idle, due to the upward flow of warm air. Foster Wheeler have been able to decrease the possibility of ice-formation to a minimum through the use of specially FW designed air inlet louvers which permit the throttling of the incoming cold air, and through the use of two-speed motors for the reduction of air quantities during freezing weather.

FOSTER WHEELER

FOSTER WHEELER LIMITED

designers and manufacturers in Canada of equipment for

COOLING TOWERS

head office and plant: ST. CATHARINES, Ont.

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FW-53-31

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 664*)

Polyethylene Production. — The Dow Chemical Company, Midland, Michigan, is entering the production of polyethylene according to a statement made by G. W. Beatty, manager of the plastics sales division of Dow Chemical of Canada, Ltd. Mr. Beatty announced that negotiations for patent licenses and technical knowledge had been made with Imperial Chemical Industries Limited, of Britain. Dow's Texas Division at Freeport, Texas, will construct plant facilities and they expect to start production of this plastic in 18 to 24 months.

●

Pressure Regulation—Filter.—A combination pressure regulator and filter has been added to its line of standard products by the industrial division of Minneapolis-Honewell Regulator Company. The new device provides a single, compact unit that contains the functions of a dependable reducing-relief valve and a filtering arrangement for line service.

Line pressure up to 150 pounds a square inch can be reduced and maintained at any regulated output pressure from 0 to 35 p.s.i. without appreciable drift or air consumption. For complete details communicate with the Company at Leaside, Ontario.

●

Plywood Forms.—Two years ago, the heavy runoff of the Pend-d'Oreille River rushed unhindered through the last few hundred yards of its dash to join the Columbia at Waneta about 13 miles south of Trail, B.C.

About a year from now a solid block of concrete weighing over half a million tons will bar the channel and a new power house with a capacity of 400,000 hp. will have harnessed the turbulent current to the uses of industry.

The construction of the forms for the four huge draft tubes was completed through the use of hot-press-bonded B.C. Douglas Fir Plywood. To form the moulds, four large tubes of timber and plywood were built up on skids. They were lifted into place in the foundation walls with cranes. Skeleton of the form consisted of 2 x 2 inch ribs set at 2 ft. intervals on timber keels and sheathed with 1 x 8 in. boards and 1 x 2 in. splines at points of extreme curvature.

To insure a smooth finish, the entire surface of each form was covered with a thin skin of B.C. Douglas plywood in 3-ply panels nailed to the sheathing with resin-coated box nails.

Approximately 365,000 cu. yds. of concrete are being poured on this job.

●

First Narrow Gauge Diesel.—The first narrow gauge, Diesel-electric locomotives of special design, built in Canada for the export market were shipped in the middle of this month from the Canadian General Motors Diesel Limited, London, Ontario to Vale de Rio Doce Company in Brazil. They will be used on the Vitoria a Minas Railway.

The Rio Doce will use the locomotives on a meter gauge line from Vitoria on the coast to serve the iron mines at Itibera, 300 miles inland in the State of Minas. The meter gauge is 39.37 inches compared with standard gauge in Canada of 56½ inches.

●

Ontario Hydro Plants. — Robert H. Saunders, chairman of the Ontario Hydro Electric Power Commission stated on April 13 that seven of the eight units of the fire-damaged Chat Falls Generating Station on the Ottawa River are now back in service. This represents 192,500 hp. of the station's 220,000 hp. capacity.

Mr. Saunders said "that No. 2 unit, the one most severely damaged by the March 2 fire, will not be back in service for some time."

●

Modern Sewage Plant. — One of the most modern sewage treatment plants on the continent, with a 3,000,000 gallons per day design capacity and costing $1,250,000 is in first phase construction for Don Mills, a suburb of Toronto.

A project of Don Mills Developments Limited, and involving an investment of $200,000,000 for industry, commerce, housing and services, the community has a scheduled program to provide public utilities, services and social amenities. Development will progress in orderly stages with construction of first phase housing to start this month and a $7,200,000 shopping centre is to be started in 1954. Installation of first phases of trunks and laterals, roads, sidewalks, etc., costing between $7 and $8 million will be started at an early date.

●

Canadian Roads. — C. W. Gilchrist, managing director of the Canadian Good Roads Association stated recently that Canadian governments plan to spend $415 million on roads and streets in the current year.

The greatest portion of this amount, $382 million, has been budgeted by the provincial governments. The remainder is the Federal government's share of the Trans-Canada Highway and estimated expenditures by municipal governments. The total does not include funds budgeted by Ottawa for park roads and military roads or money to be spent by private corporations for the construction and maintenance of forest and mining roads.

Mr. Gilchrist forecast that this year will be the most active in road building history in Canada and that provincial governments should be able to repair many of the existing deficiencies in their highway systems.

Mr. Gilchrist warned that if the nation is to meet the present critical inadequacies of highways and streets the present record level of construction would have to be maintained indefinitely.

●

New Cyanamid Laboratory. — A new laboratory, designed to improve processes and develop new products, has been opened at the Niagara plant of North American Cyanamid Limited.

Containing 4,500 sq. ft. of floor space, the laboratory will be staffed by more than 20 people.

●

Atlas Steel Sales. — Sales for Atlas Steels Limited, Welland, Ontario, in 1952 were at a high of $33,754,889 as compared to $31,441,264 in 1951.

June 1 will mark a quarter of a century's operations under the same management.

●

Explosion-Proof Motors. — Reliance Electric & Engineering (Canada) Ltd., Welland, Ontario, announce a new line of Reliance explosion-proof motors.

This is a completely new line of products and the motors have been designed for use in atmospheres containing explosive vapours designated by the Canadian Standards Association and Underwriters' Laboratories as Class I, Group D and Class II, Group F and G, hazardous locations.

The new motors have been approved by the Canadian Standards Association. They are supplied in totally-enclosed, non-ventilated and totally-enclosed, fan-cooled enclosures. They are available with all standard speeds in horsepower ratings from ¾ hp. to 100 hp. and in NEMA frames 203 through 505.

Standard face type and flange mounting brackets, NEMA types "C" and "D", respectively, are available for horizontal or vertical direct mounting.

The following are special features of the motors. Maximum corrosion resistance is provided for. Featured through the line are monel grease pipes, monel shaft "slingers", and heavy non-sparking bronze fans. An additional feature is the use of double-shielded ball bearings which afford maximum protection to the windings and interior of motor by the prevention of grease leaking into the motor and maximum protection to bearings against excess lubricant, insufficient lubricant, dirt and moisture.

Further details may be obtained by writing to the Company at Welland.

●

Huge Girder Shipped.—A steel girder of unusual size, one of the largest ever built in Canada, has just been shipped from Walkerville to Sault Ste. Marie. With a length of 115', depth of 12' 5" and weight of 112 tons, it required two flat cars for shipment and was preceded and followed by "idler" cars on account of overhang at the ends. The girder was built by the Canadian Bridge Company Limited and will be used in an extension to the open hearth facilities of Algoma Steel Corporation Limited at Sault Ste. Marie.

●

Rubber-Bonded Wire Rotary Brush.—A power-driven wire rotary brush, known as the Gem Vulcan, has its wire bristles set in a cushion of vulcanised rubber. It is claimed for the brush, which is well balanced, that it retains its shape for the whole of its life. An Air Ministry test showed its serviceable life to be 364 hours, whereas that of an ordinary brush averages 90 hours. The makers are A. Luson and Sons Ltd., of Gem Works, Minerva Road, Park Royal, London, N.W.10.

●

Floor Tile Cutting And Blocking Machine. — A machine for cutting rubber and plastics quickly and accurately into squares, blocks or strips has been developed by Francis Shaw and Company Ltd., Manchester 11, England. It is made in two sizes; the larger will handle material 80 inches wide, the smaller material 54 inches wide. Either will cut tiles ranging from 4 by 4 inches to 24

(*Continued on page 674*)

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Over the years a tremendous amount of experience has been accumulated and recorded—more, in fact, than by any other Canadian wire manufacturer. No matter what your problem in Spring Wire may be, Stelco Engineers and Metallurgists can tell you the *right* wire for the job, what it will stand, how it will behave in given circumstances, and how to process it for best results.

To make the service complete, Stelco's three wire mills have the greatest capacity in the country for producing the exact kind of wire you need.

The same is true of other kinds of steel wire. Stelco is regularly producing Fine Wire, Low Carbon Wire, Flat Wire, and Zinc Tight Electro Galvanized or Hot Galvanized Wire. Stelco has pioneered Zig Zag Spring Wire, Concrete Prestressing Wire, Oil Tempered Wire, Shaped Wire, Metal Stitching Wire, and Armature Binding Wire.

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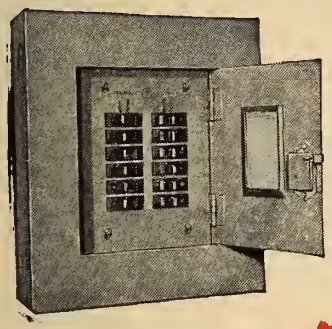
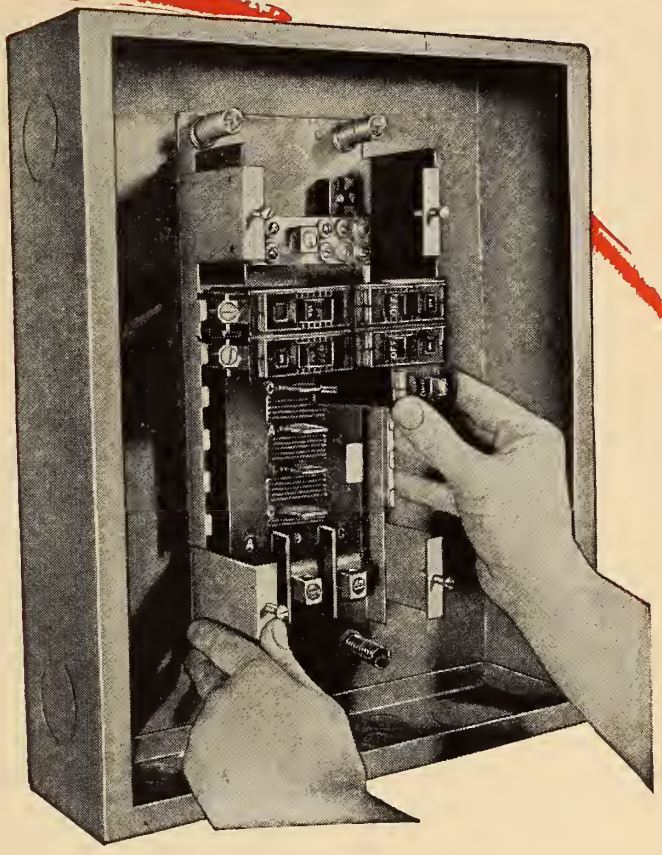
NEW TQL "PLUG-IN" CIRCUIT BREAKER

. . . for commercial -industrial panelboards





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Now, the new Trumbullite Lighting Panelboard that offers TQL "Plug-in" Circuit Breakers over a large rating range, plus a revolutionary new insulating material, *Plastisol*, that will add to the life and efficiency of your installation.

Initial wiring costs are slashed by easy-to-plug, easy-to-wire TQL Breakers. These new Breakers are physically interchangeable in 15, 20, 30, 40, and 50 amp. single and two pole ratings for 120/240 Volts AC. Interrupting capacity 5000 amps. They are quick-make, quick-break with both thermal and magnetic tripping action for double protection, and will trip on faulty conditions even when the handle is held at "on" position.

These new Panelboards, available up to 42 circuits, feature bus bars molded in a *Plastisol base.* This new base has high thermal conductivity—bus bars in *Plastisol* run 10% cooler than in open air—and it is resistant to acid or alkali, does not "age", shrink or become brittle, resists tracking and carbonizing, and will withstand 212°F temperatures.

You can get these new Panelboards from your supplier in three basic components ready for assembly —get "shelf" service for any circuit combinations to suit your exact requirements. For further information see your nearest distributor or write to: *Construction Materials Department, Canadian General Electric Co. Ltd., 212 King St. W., Toronto, Canada.*

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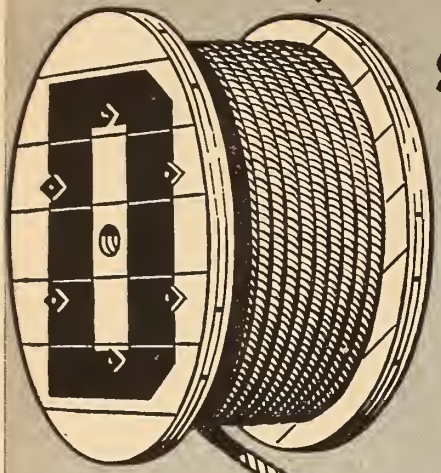

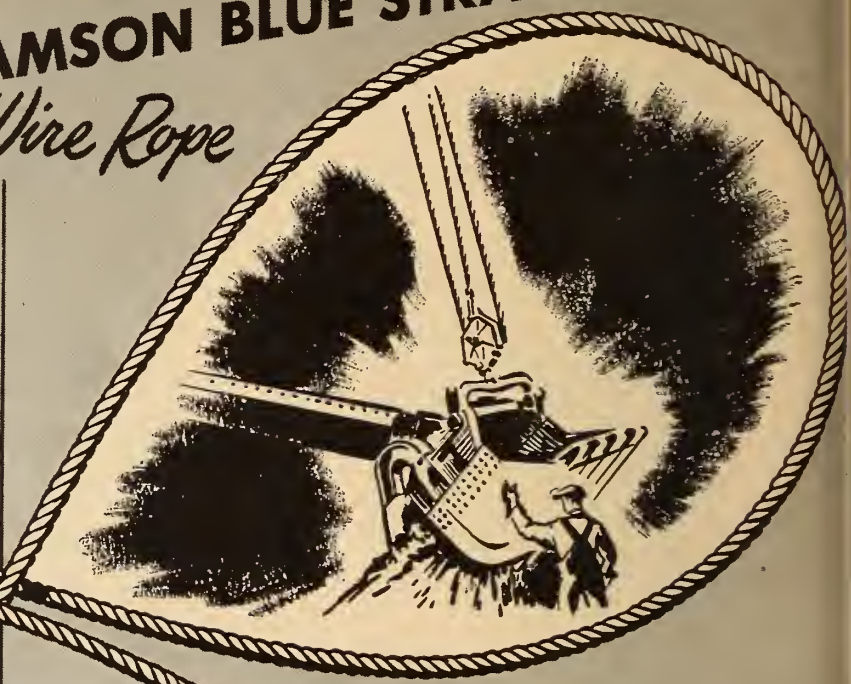

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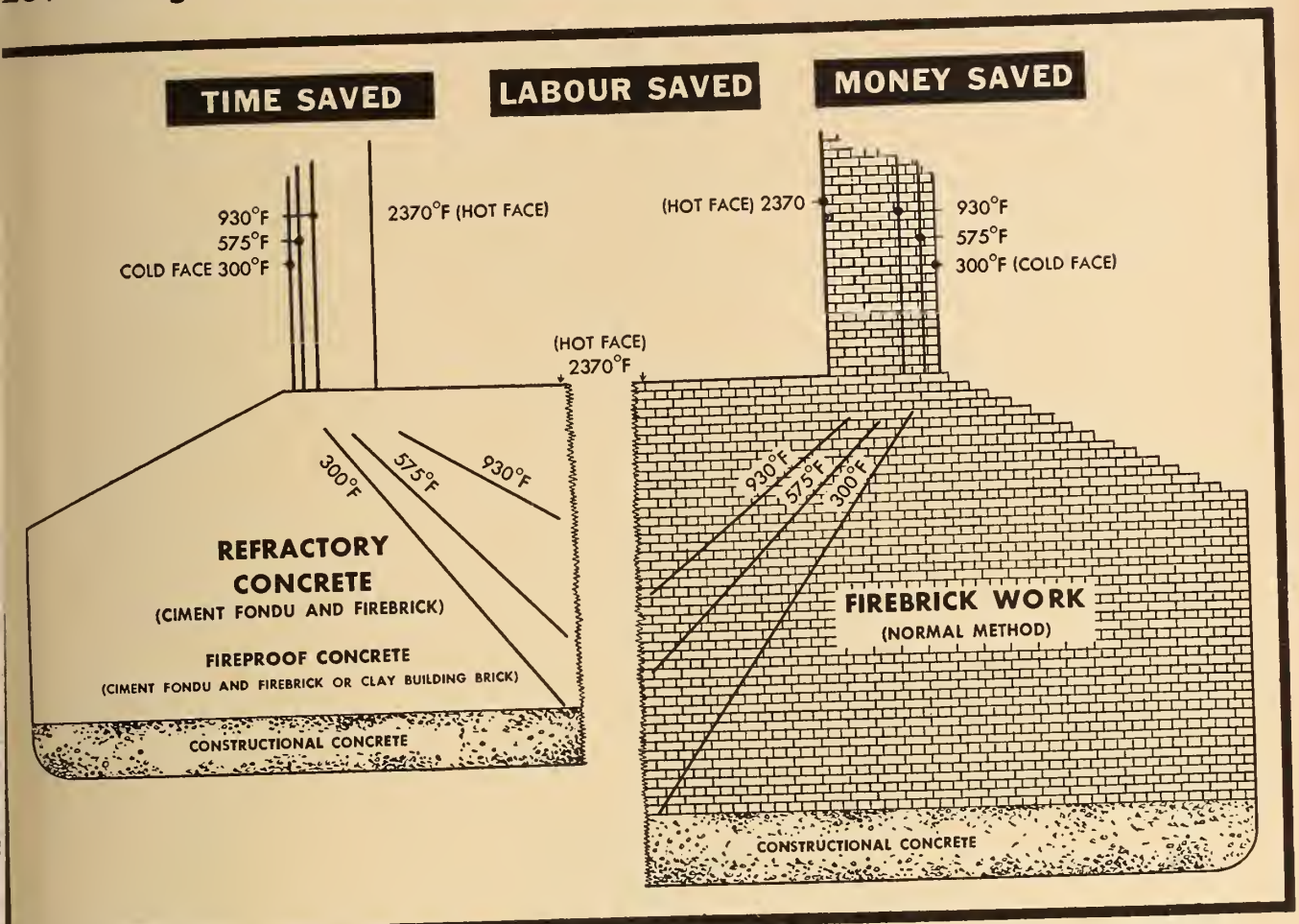

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 668*)

by 24 inches. Angle rolls for conveying the material are fitted to the cutting table, which may be heated when the material being used needs a high temperature to ensure a straight smooth cut. The cutting head can travel the whole length of the cutter bar, and is fitted with both ball and roller bearings. When the head reaches the end of its travel along the bar, during which it is pulling the knife through the material, a cam-operated switch stops the motor, and operates an air-valve which exhausts the cylinder clamping the material to the table, while heavy springs carry the adjustable knife clear and return the bar. A foot pedal controls the whole operation: there are guards over the drives.

●

Die-handling Truck.—The setting-up of such machines as power presses and moulding and die-casting machines is speeded with the aid of a new electrically-operated, pedestrian-controlled die-handling truck. The traction motor is rated at 2½ horsepower, and is fed from a 48v. 99 Ah lead-acid battery carried on the vehicle, while a separate motor gives the power required by the hydraulically-operated 2,240 lb. capacity lifting platform. The truck is 60 inches long, 30 inches wide and 70 inches high overall, and weighs 1,792 lb. Its wheel base is 41½ inches, and its turning radius 50½ inches, while the platform, which measures 27 by 30 inches, can be raised at a speed of 7½ ft. per min. to any height between 6 and 52 inches above the floor. For shift work, the built-in charger is inadequate, separate charging of the batteries being effected by a wall-mounted charger which is available. Makers are Lansing Bagnall, Ltd., Kingsclere Road, Basingstoke, in the English county of Hampshire.

●

Automatic Sliding Doors For Factories. — Press buttons which operate doors, mounted on ball-bearing rollers, have been developed by the Express Lift Company, Ltd., of Greycoat Street, London, S.W.1. Designed for use in factories and workshops, the doors have in their controlling mechanism a time delay by which they may be held open for a predetermined period. Consisting of two sliding panels, and opening from the centre, the doors reverse automatically should either encounter any obstruction. The transmission of excessive torque when being opened or closed is prevented by a clutch, through which their electric mechanism operates.

●

Hand Lift Truck. — Simple and safe control by the operator is obtained with the "Stallion" hand lift truck, manufactured by S.D. and O.M. Ltd., of 19, Buckingham Street, London, W.C.2. The load is lifted and automatically locked in position to be pulled by a movement of the T-shaped handle, while another single movement unlocks and lowers the load. The greater the weight, the slower is the return.. The operator is able to keep both feet on the ground, as other handles or pedals are entirely absent. The standard model will carry 2,240 lb., on a carrying frame measuring 36 by 18 inches. A choice of either cast iron or rubber wheels is available.

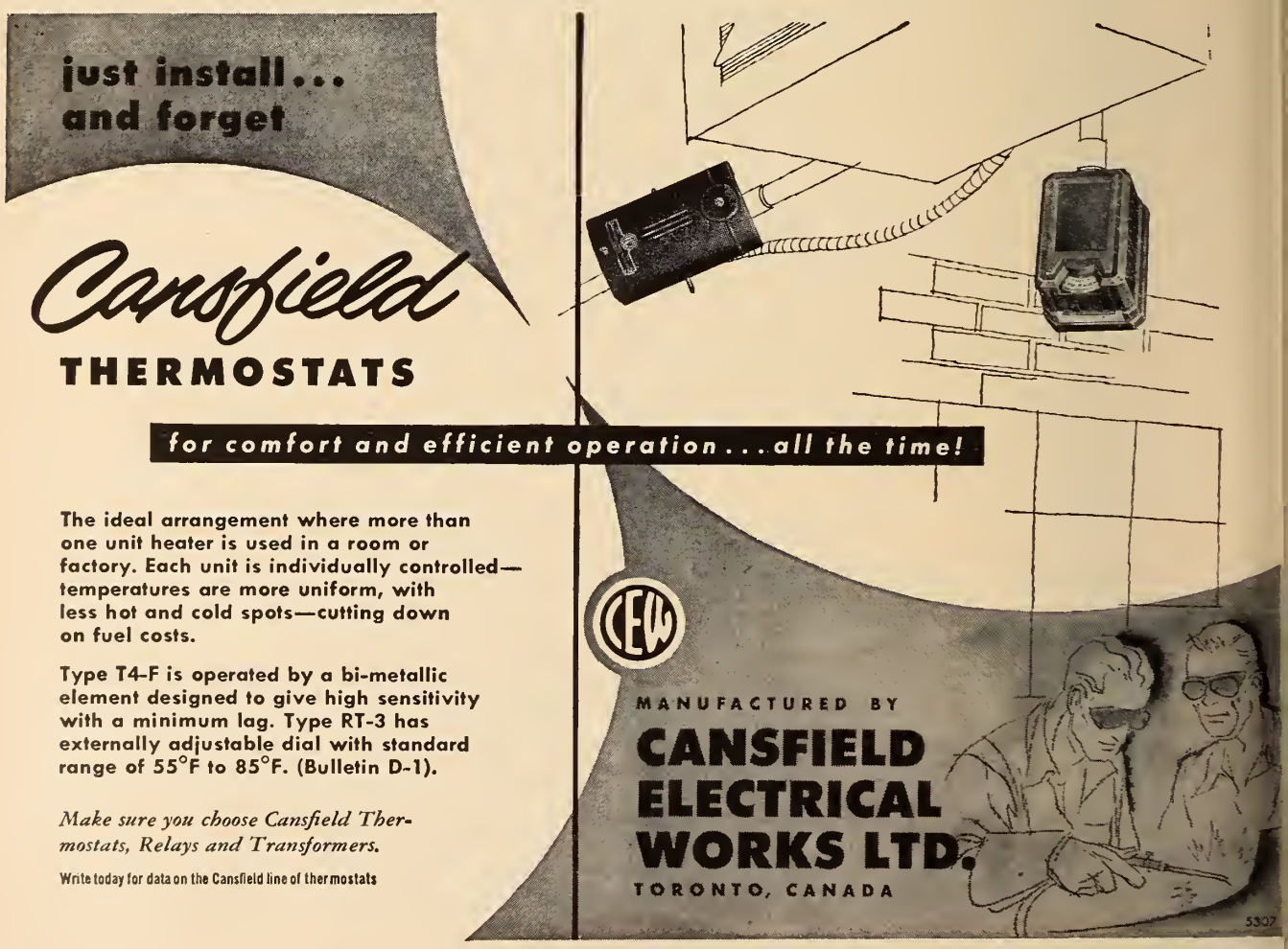
●

Jointing Compound. — A new jointing compound made by Richard Klinger, Ltd., of Klingerit Works, Sidcup, in the English county of Kent, can withstand a temperature of 572 degrees Fahrenheit and pressures of up to 100 atmospheres (1,422 lb. per square inch). It may be used either to improve the efficiency of metal-faced gaskets, or else by itself instead of paper, oiled paper, and so on.

●

Ring-Cutting Machine.—A new product of Richard Klinger, Ltd. is a manually-operated ring-cutting machine capable of cutting rings up to 48 inches outside diameter and from 2 inches inside diameter. Intended primarily for cutting Klinger jointing materials, it can also deal with such materials as rubber, cardboard, cork and felt. By means of a feed screw, the height of the cutting wheel above the work may be adjusted. To cut a ring, a centre pin, arranged to slide along the base framework, is adjusted and locked to the required cutting diameter, and then a ⅛ inch circular base disc is located thereon. Immediately below the cutting wheel is a roller on which this disc rests, the roller being fixed to the framework and rotated by a large handle. Before the work

(*Continued on page 678*)



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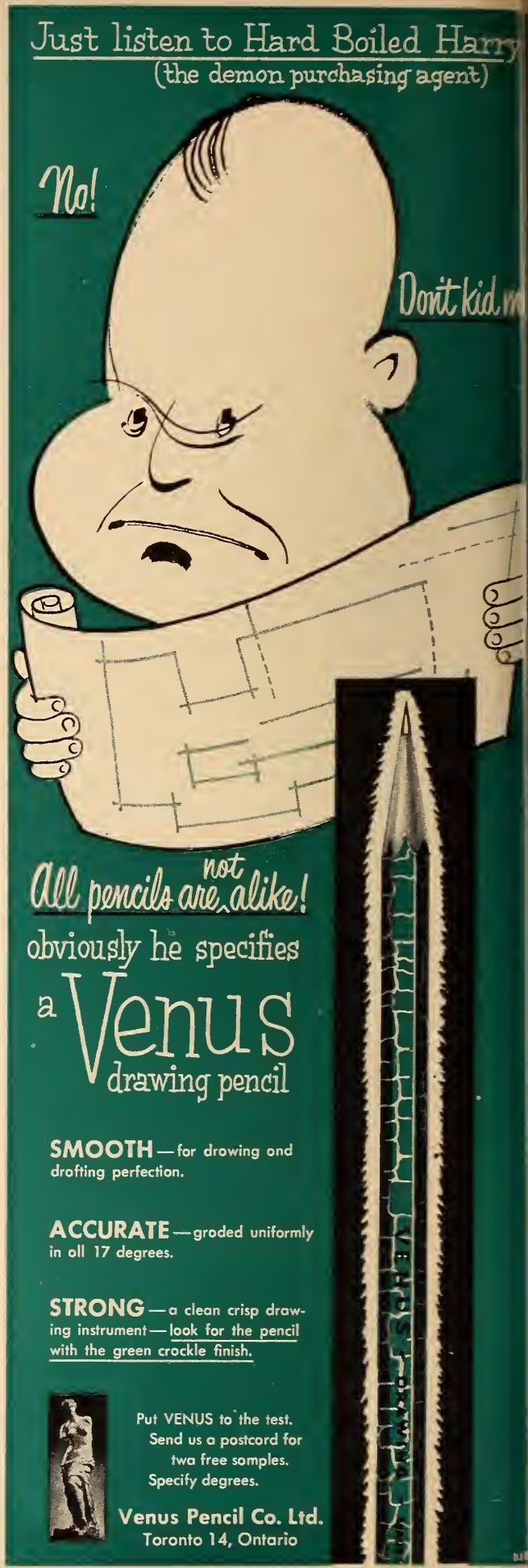
The June issue of the "Journal" will contain six important technical papers

- REFRIGERATION AND STORAGE OF FISH IN TRAWLERS by W. A. MacCallum, M.E.I.C.
- NATURAL RESOURCES OF THE NORTHWEST TERRITORIES AND THE YUKON by Major-General H. A. Young, C.B., C.B.E., D.S.O., M.E.I.C.
- THE DEVELOPMENT OF POWER FROM ATOMIC ENERGY IN CANADA by I. N. MacKay, M.E.I.C.
- FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF EXTERIOR WALLS FOR BUILDINGS by N. B. Hutcheon, M.E.I.C.
- A HIGH TEMPERATURE HOT WATER BOILER PLANT by J. G. Frost, M.E.I.C.
- UNDERPINNING—TORONTO SUBWAY by R. Harding Scrivener, M.E.I.C.



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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 674*)

can be placed in position, a ⅝ inch diameter hole must first be punched approximately in the centre of the material. With the cutting wheel lowered into position, rotation of the handle makes the cut. Supplied with the machine are a steel measuring tape (for fixing the centre pin), a 15-inch diameter base disc (larger sizes are available), and a ⅝ inch punch. With this machine, it takes less than 20 seconds to cut a 24-inch diameter ring 1/16 inch thick.

●

Hard Metal Burs. — Cemented tungsten carbide burs, which can generally be run at much higher speeds than steel burs and should normally last up to 100 times as long in working condition, are now available in a great variety of shapes and sizes. They are ideal for obtaining fine finishes and fine rates of stock removal, even with specially hard or tough materials. The makers are Protolite, Ltd., of Central House, Upper Woburn Place, London, W.C.1.

●

Valve Collar Improvement.—An ingenious refinement has been added by Earlsdon Components, of Moor Street, Coventry, in the English county of Warwickshire, to their Holdsworth valve collar, as fitted to the Standard Vanguard and other cars. This collar has two intersecting holes, a tapered one in the centre which mates with the taper on the valve stem, and the other off-set and of sufficient diameter to allow the valve stem to pass through: this arrangement eliminates split cotters and makes removal of the collar a simple matter.

One difficulty experienced with very oily engines, however, is that too much lubricant may reach the valve stems by way of the off-set hole. The new component to obviate this consists of a soft metal plug, shaped to seat firmly in the hole, yet automatically released when the collar is depressed for fitting or removal.

●

Wheelbarrow With Rubber Body. — Rubber bodies for wheelbarrows are now being made by the Dunlop Rubber Company, Ltd., of Fort Dunlop, Birmingham, England. Fastened to a steel frame mounted on the normal chassis, they are of various thicknesses according to their prospective use. Lighter in weight than equivalent standard wheelbarrows, they are, practically speaking, unaffected by acids or alkalis, while contents that tend to stick can be emptied without trouble. Tests have also shown that fragile contents are far safer, thanks to the flexibility of the body, than in a conventional barrow.

●

Electronic Temperature Controller. — Recently introduced by Mullard, Ltd., of Century House, Shaftesbury Avenue, London, an electronic device ensures very fine control of the temperature of water baths in the laboratory. A temperature-sensitive resistor, designed for immersion in the fluid in the tank, forms one arm of an a-c bridge network. The output from this is amplified and used for controlling a phase-sensitive circuit, which operates a relay able to switch up to 1 a. at 230 v. The instrument is calibrated to +1 deg. C, but near the working point, control is possible to within +0.02 deg. C. The temperature range, in three steps, is from 15 to 75 deg. C, while the instrument will operate on 50 c/s mains, from either 100/120 v. or 200/250 v. supply. The instrument consumes 25 W.

●

Airfield Ground Power Units. — By means of the "Petboost" automatic control circuit, the output of electrical power units for use at airports and airfields may be momentarily increased to meet the demands of large gas turbine plants (for example, that of the Comet, which is said to require 1,000 a. at 28 v. for a few seconds, yet a normal continuous load of only 400 a.), and so prove economical in power unit size and cost. Made by Petbow Ltd., of Richborough Works, Sandwich, in the English county of Kent, these units give a range of outputs from 28 v. 200 a. to 112 v. 500 a.—the firm is at present developing dual-voltage units.

●

Emergency Generating Sets.—The same firm is also producing generating sets intended as power supply in the event of mains failure—again, primarily for use on airfields. These are automatic in operation, and range from an 800-watt model, driven by a small petrol engine, to one of 140 kw., powered by a six-cylinder 220 hp. Diesel engine. There is a delay of some seven seconds between mains failure and full-speed running of this emergency plant, but a remote switch may be provided in, say, the airport control tower, which could make any necessary change-over instantaneous.

●

Laboratory Switch Kit.—Designed for the manufacture of prototype "H" type electrical switches, a kit brought out by A. B. Metal Products, Ltd., of 16, Berkeley Street, London, W.1. contains all the tools and piece parts necessary. It is housed in an attractive wooden cabinet.

●

Compression Units For Small Workshops. — Developed recently by the Hymatic Engineering Company, Ltd., of Redditch, in the English county of Worcestershire, for such jobs as tire inflation, spray-painting with an industrial spray gun, or high-pressure greasing in a garage or small engineering workshop are two self-contained electrically-driven compressor sets. The smaller, the G.3, consists of a compressor of 3 cubic feet: min. capacity, at a maximum working pressure of 150 lb. per square inch, driven at 700 r.p.m. by a 1-hp. motor; it carries a small nozzle attachment for use with the spray gun. The larger G.2, the compressor of which can deliver 7 cubic feet: min. at 100 lb. per square inch, has a 2-hp. motor, driving it at 1,000 r.p.m. The single-stage air-cooled compressor is mounted on a pedestal, which in turn stands on a 28-gallon cylindrical air receiver.

The motor and compressor unit is largely of aluminium alloys, while forged steel is used both for the crankshaft (which is provided with an oil seal at its driving end, and which runs in heavy-duty ball bearings) and for the connecting rod, which has shell-type white-metal big-end bearings. An oil dipper on the big end gives splash lubrication, the oil sump being of large capacity. The close-grained cast-iron compressor cylinder has a bore of 6 mm. and a stroke of 55 mm. A fan pulley, driven by twin V-belts from the electric motor, cools the cylinder wall. Light-weight large-diameter plate valves are used, while aluminium is employed for the cylinder head. When a predetermined pressure has been built up in the air receiver, the compressor motor is switched off by an automatic pressure control and unloader.

●

Wire Cutter For Awkward Corners.—Able to cut wires or cut out faulty components in positions inaccessible to the normal tools is the "Spearette" trigger snip, manufactured by the Spear Engineering Company, Ltd., Warlingham, in the English county of Surrey. Simple in design, it consists of a handle with large trigger, to which is attached a long thin rod bearing a cutting device at the end, the cutter being actuated by the trigger. The tool will also hold small components in awkward position for soldering, acting meanwhile as a heat shunt to safeguard delicate equipment. All component parts are replaceable.

●

Space-Heating Directly By Gas. — A new form of space-heating by gas-heated air was demonstrated recently in London, using the Chandos Gasanair cabinet heater. Under the system the gas is first purified, so that on burning, it may be used directly to heat circulating air which remains free from fumes, without the need for a heat exchanger. The smallest cabinet heater of this type has a gas capacity of 100 cubic feet per hour, develops 50,000 B.t.u., and will heat a space of 10,000 cubic feet, while other models are available with up to four times this capacity (with corresponding heating figures). Other heaters using the same principle develop up to 1,000,000 B.t.u. No flues are needed, as the warm air and gases escape from four outlet grilles at the top of the heater, or by ducts for circulation through a building.

Purification is effected by means of a welded mild-steel chamber containing Carbocell purifying material (manufactured by the National Smelting Company, Ltd., of Avonmouth, in the English county of Gloucestershire), which removes about 70 per cent of the residual sulphur from the gas when heated to approximately 500 degrees C. The combustion products mix with several times their volume of air, fresh or re-circulating, which is drawn through louvres in the cabinet walls by an electrically-driven fan, mounted at the top of the unit in the duct head. The heater lights up automatically when the gas cock and fan switch are turned on, needing no further attention, apart from periodic renewal of the Carbocell (necessary only once during the season, as a rule). The makers are the Chandos Engineering Company, Ltd., of 17, High Street, Egham, in the English county of Surrey.

●

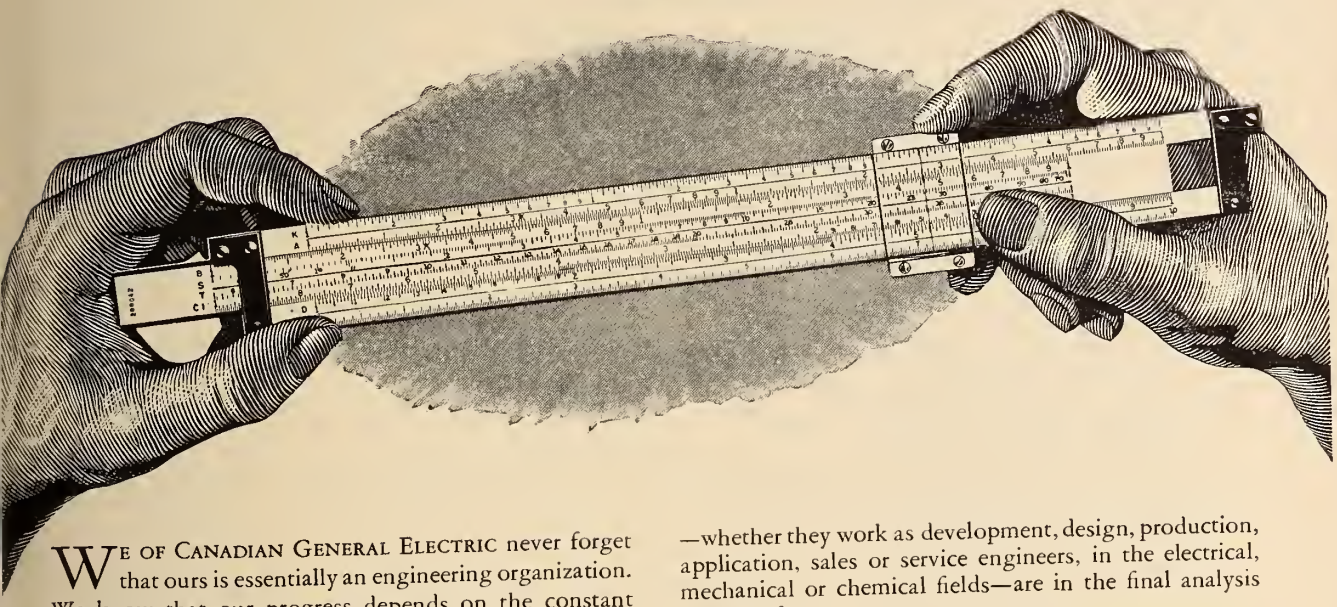
Heavy Duty A-C Relay.—Combinations of normally open, normally closed and change over contacts (providing for substantial loads as well as informative and switching needed in control circuits) are available in the Hilton type F.51 Heavy Duty a-c Relay. With normal

(*Continued on page 682*)

Wherever big things are going on there you'll find the engineer

Wherever you go in Canada today, you see the work of the professional engineer. A river's course is changed and its rushing power harnessed for man's needs . . . an oil pipeline scales a mighty mountain range . . . a highway is punched through the rocky wilderness . . . and behind each mighty accomplishment stands the engineer.

Behind our many new industries and the unprecedented development of our natural resources—stands the engineer. His is the vision that is contributing so much to Canada's phenomenal growth.



WE OF CANADIAN GENERAL ELECTRIC never forget that ours is essentially an engineering organization. We know that our progress depends on the constant recruitment of young engineers and are proud of the contribution we are making to their training.

Engineering graduates join this Company each year

Each year, since its earliest days, engineering graduates have joined this Company to continue their training in special courses—nearly twelve hundred have already gained invaluable experience on the Company's well-known "Test" Course.

The purpose of the course is primarily to ensure a constant supply of trained talent for this Company yet over the years it has also contributed a constant stream of highly-trained graduates to fill the ranks of Canadian industry.

Everybody benefits from the engineers' work

Canadian General Electric currently employs some eight hundred engineers—that's one out of every eighteen employees—and is continually adding to their number. These men—whether they work as development, design, production, application, sales or service engineers, in the electrical, mechanical or chemical fields—are in the final analysis working for *you*.

They develop, design and manufacture the complex electrical equipment that generates power, transmits it across great distances, controls it and then puts it to work for the common good. They improve and simplify existing products to increase their efficiency and lower their cost. They develop brand-new products to meet brand-new needs. In cooperation with our customers' engineers they design and install equipment to meet specialized needs.

The engineers' part in Canada's rising prosperity

It is an important part of their work to find better ways of producing both equipment and products that do more, last longer and cost less to operate. It is by employing outstanding engineers—*the key men in Canada's progress*—that we are able to play a worthy part in our country's industrial growth, and in the developments that are raising the living standards of all of us.

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

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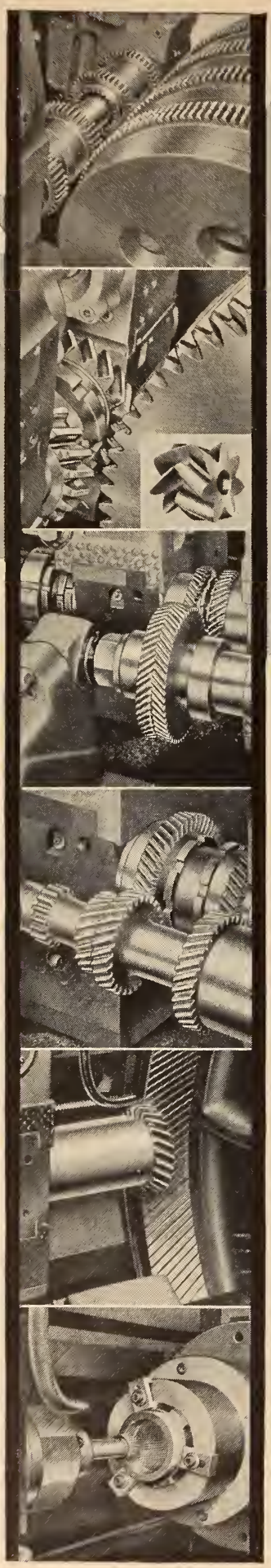
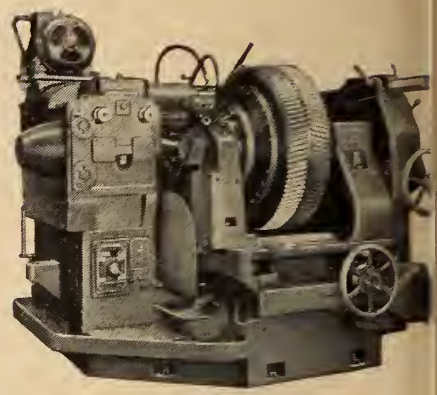
Canada's Oldest and Largest Electrical Manufacturer



FLEXIBILITY IN GEAR PRODUCTION



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As specialists in the design and manufacture o precision Gear Generating Machines, Hobs, and Gear Shaper Cutters, the Sykes Organisation extends you a cordial welcome to meet us at the Trade Fair Toronto, Booths 3776-3780, 3675-3679, 3819-3820. Our technicians will be in attendance to discuss your gear production problems, and a range of Vertical and Horizontal Gear Generators and Universal Hobbers will be in operation on actual production work for your inspection.

Generating Machines for Gears up to 66 in. dia.
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For the Production Engineer's Notebook—

Ideas for Welded Design

Product engineers, even the geniuses among them, find that the formula, "1% inspiration, 99% perspiration,"* pretty regularly applies.

Perspiration in design is brought about by the inevitable conflict between operating function—how well the part will do its job—and such other important factors as sales appeal, serviceability, and manufacturing methods.

What we are all striving for is to apply welding most economically. We in Dominion Oxygen stand ready to help the product engineer in the applications of welding methods wherever we can. Sometimes economies in production come from a substitution of welding for more expensive methods, but often just a small change in design or practice reduces the cost of present welding operations.

Pointers on welded design leading to production economies.

Use the process that gives the greatest total economy.

Design for down-hand welding where possible. But locate welds so as to minimize handling.

Mechanize welding. Weld as many joints simultaneously as possible.

Make minimum dimension changes when making different sized models.

Reduce the number of parts. But sometimes it is better to increase the number of parts and cut rejects in intricate castings or forms by welding together simple forms.

Use standard shapes and easily formed sections.

Pointers on welding processes leading to production economies.

UNIONMELT welding: high speed process for deep-penetrated welds—minimum cleaning and finishing—no spatter, sparks, or smoke—usually mechanized—will make butt, tee, and lap fillets, plug, and molded welds. Used for most ferrous and many non-ferrous metals. Ask for booklet F-6077.

HELIARC welding: used for most metals, especially aluminum, magnesium, stainless steel, and copper alloys. Particularly useful for sheet steel. Manual or mechanized—high speed—greatest feature is minimized cleaning and finishing because of flux and spatter elimination. Ask for booklet F-6291.

Take advantage of other economies that are inherent in such oxy-acetylene processes as flame-cutting, welding, surfacing, hardening. For more information on any of these processes call or write to Dominion Oxygen Company, Limited, offices listed below.

* "Genius is 1% inspiration and 99% perspiration," credited in GOLDEN BOOK, April, 1931, to a newspaper interview with Thomas A. Edison.

DOMINION OXYGEN COMPANY, LIMITED

DOC

40 St. Clair Avenue East, Toronto 5, Ont.
Montreal Winnipeg Vancouver
"Heliarc" and "Unionmelt" are trade marks.

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 678*)

British supply frequencies, it can be supplied for use on any voltage up to 550 v., and with as many as 15 pairs of 10 A contacts. The accurately finished pole faces of laminated Silicon iron are shaded to give silent "hold-on", while the operating coils are paper interleaved and protected sufficiently to withstand severe climates. These relays are made by the Hilton Electric Company, of 67, Merridale Street, Wolverhampton, in the English county of Staffordshire.

●

Key Operated Rotary Switches—Where rotary switches may only be operated by authorized persons, a range of switches introduced by Tok Electrical and Industrial Mechanisms, Ltd., of 2, Wadsworth Road, Perivale, in the English county of Middlesex, will be found to fill the need. Over 50 different switching sequences are supplied in each of the following sizes: 5 A, 10 A, or 20 A for voltages up to 600 v., either d-c or a-c.

●

Load Cells.—By converting changes in force and weight into changes in electrical resistance, load cells produced by Elliott Brothers (London) Ltd., of Century Works, Lewisham, London, S.E.13, are able to measure forces in tension or compression within the range of 1,120 lb. to 448,000 lb. maximum working rating (although the entire range is not covered by a single cell). The calibration accuracy at all points from 0-100 per cent. of capacity at 70 degrees Fahrenheit is within ± ¼ per cent, while the maximum temperature recommended is 150 degrees Fahrenheit.

Being hermetically sealed, the cells may be used under all atmospheric conditions, while the system does away with all moving parts. A high-tensile steel member is put into tension or compression by the force to be measured, the member carrying strain gauges which convey current. The resistances of these gauges change proportionately with the applied stresses, as also does the output signal provided by the bridge circuit in which they are arranged. It is the signal which operates an instrument calibrated directly in force, weight or percentage strain.

●

Coal Sampler.—To give accurate sampling of coal in generating stations was the intention of International Combustion, Ltd., of 19, Woburn Place, London, W.C.2, when introducing their patented "Pollock" sampler. Its uses, however, are by no means confined to this material. It is readily applicable to new and existing belt conveyor installations, is of very reasonable dimensions, and is easily maintained. A thruster, operating through a link mechanism, moves a hinged scraper arm across the width of the conveyor belt to which it is fitted, thus removing a cross-section of the material, which it pushes into a side chute. During its return movement, the scraper rides back over the material without moving it, due to the hinging and spring loading of the lower section of the arm.

●

Machine To Test Jet Aircraft Tires.—What is claimed to be the world's fastest machine for testing jet aircraft tires has recently been installed at the Dunlop Works in Birmingham, England. It has been designed to simulate landing, taxi and take-off conditions for aircraft tires of jet aircraft up to 3,000 revolutions per minute — equivalent to well over 200 m.p.h. with some sizes of tire. Hitherto tire performance data under the extreme service conditions of high speed aircraft could be got only from actual service, a method which is far from accurate. With the new machine tests can be undertaken under perfectly safe and reliable conditions and various aspects of tire behaviour can be studied under running conditions which it would be difficult to observe in actual practice. Examples of these are centrifugal growth, tire distortion, wave phenomena and variation of tire deflection due to centrifugal stresses.

Tire loading conditions are provided by a pneumatic cylinder operating at a maximum pressure of 300 lb. per square inch. Two tires are tested in contact with each other, the one wheel/tire assembly being attached to an overhung power spindle, the other assembly being carried on a dead spindle. Power is provided by a Rolls-Royce Merlin aero engine developing 1,725 brake horsepower. All engine and test machine controls are contained on a panel housed in the control room. Landing tests are automatically controlled to simulate impact loading, load relief on "float" of the aircraft, and resumption of the load equivalent to the static weight of the aircraft for a period corresponding to that of the aircraft rolling to a standstill.

Prototypes of all Dunlop aero tires are to be tested on this machine. The Dunlop company makes considerably more than half the tires used on Britain's commercial and military type machines.

●

Grinding Equipment. — Cost reduction by over three quarters, it is claimed, has been achieved by a United Kingdom firm of electric tool manufacturers in their new method of bright grinding stub axle forgings. Their special purpose shaft grinding equipment can also be used for grindings and burrs and adhered mouldings and from the inside of tractor gearboxes. It has already been used—with a consequent speeding up of production—by one of Britain's leading motor manufacturers on their coaches and trucks.

Special bogies fitted to the machinery enable it to be used for the internal grinding of stainless steel tubing, and it can be supplied for floor use—mounted on base and casters—or with an overhead mounting. It provides six speeds from 900 r.p.m. to 8,700 r.p.m., and will make its debut in the engineering section of the 1953 British Industries Fair (Earls Court and Olympia, London, and Castle Bromwich, Birmingham, April 27 to May 8). Manufacturers: E. C. Hopkins, Ltd., of Grosvenor Street West, Birmingham, 16, England.

●

Pre-Stressed Concrete—A United Kingdom method of pre-stressing concrete is to be used in the United States of America for the first time in the construction of a three-mile length of trestle bridge at Tampa Bay, Florida. The pre-stressed length of the structure (which will have a total length of 15 miles) will include 363 spans for which 2,178 beams are being made.

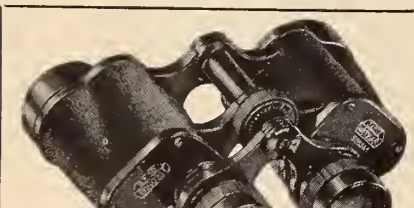
The method, known as the Lee-McCall system, uses bars of a new type of high-tensile alloy steel instead of wire cables. The pre-stressed part of the structure will be the longest ever built. The Lee-McCall system has been evolved by McCalls Macalloy, Ltd., of Sheffield, in the English county of Yorkshire.

●

Soil Boring Machine. — A soil boring machine which can be mounted on a lorry or trailer has been developed at the Road Research Laboratory of Britain's Department of Scientific and Industrial Research. The machine, a complete unit powered by its own engine, will drill clean boreholes up to 20 inches in diameter and 16 feet deep in most soils. It will bore vertical or inclined holes in a wide range of soils at a rate of about one foot a minute.

The machine's air-cooled, twin-cylinder diesel engine develops 7 B.H.P. at 1,200 r.p.m. The chief feature of the machine is a hollow lattice mast 9 inches square which can be raised from its sloping travelling position to a vertical position by means of a pair of feed screws controlled by a friction clutch. The main pivot is formed by trunnions mounted on the outside of a gear box attached at the lower end of the mast.

The boring bar is rotated by passing it through a central square hole in a gear wheel controlled by a second clutch. The bar is able to slide through this gear wheel and is steadied at its upper end by a bearing mounted in a



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When hunters, naturalists and all those who enjoy scenic beauty look for Prism Binoculars, they choose Leitz—*famous for precision for over a hundred years.*

Illustrated is the 8 x 30 "BINUXIT" Standard Glass with centre-wheel focussing. Also available: "BINUX" with separate eyepiece focussing.

Ask your dealer for Leitz Binoculars or write for illustrated literature.

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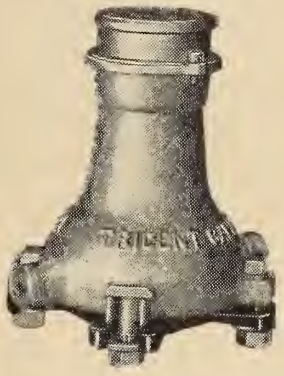
35 YEARS AGO...

when this advertisement appeared in The Engineering Journal there were 1,000,000 Trident Meters in service



Facts

There are more than a million and a half Tridents in service—many more than any other meter. They are constructed by the largest manufacturers of water meters in the world.

You'll find them everywhere. And wherever you go, you'll find the reputation of the **Trident** well established as the most excellent of water meters.

Their design has become standard in meter manufacture. Materials are of the highest quality and are scientifically tested. Parts are machined accurate to the **thousandth of an inch.** As a result, Tridents are the most accurate, the most durable, the most economically maintained meters made.

Our Service Flag has Forty-Six Stars thus far.

Don't stint quality,—you **need** the best for your services!

Trident Water Meters

A type for EVERY service condition!

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raising which is free to slide inside the mast. The normal speed of rotation of the boring tool is between 50-100 r.p.m. and the average lifting velocity is approximately 3 feet per second.

●

Echo Device For Whale Hunters.—Two United Kingdom whaling expeditions are to be fitted with the echo device developed by Kelvin and Hughes (Marine) Ltd., of 100, Fenchurch Street, London, E.C.3. The new whale-finder will keep the harpoon gunner continuously informed of the position of the whale below the surface from the moment it is sighted.

●

A Register For Canadians.—A register of United Kingdom manufacturers and exporters whose products and services are available in the Canadian market is being sponsored by the Canadian Association of British Manufacturers and Agencies. The Association has arranged publication of the new register jointly with Iliffe and Sons, Ltd., of Dorset House, Stamford Street, London, S.E.1., publishers of technical journals, and Kelly's Directories Ltd., who will bring out the first "CABMA Register", as the new directory is to be called, in June.

The Register, to be published annually, will give the names, addresses, proprietary names and trade marks, products and services of British manufacturers and exporters actively engaged in trade with Canada, including Newfoundland. There will be a glossary in French and English. Six thousand copies of the first issue will be published.

●

Driving And Drilling Tools.—Two unusual tools, one for driving posts and stakes and the other for breaking or drilling concrete, are now being manufactured. The "Drivall" is a hand-operated tool of patented design in which the driving tube rides over the post on the piston principle, allowing maximum power to be concentrated on the head of the post. Tests are being carried out by the United States in the Arctic—they are using the tool to drive 2 inch angles for the purpose of anchoring guy wires in frozen ground.

The second tool was designed for concrete-breaking. An Archimedes drill has been designed for use with it and this has been tested on a five-inch thick reinforced concrete roof. The average time for drilling through this was three to four minutes. The manufacturers DRIVALL, Ltd., of Hadley Highstone, Barnet, in the English county of Hertfordshire, claim that where the extent of the work is limited and does not justify the use of a compressor, the "Roadall" saves considerable time and work as against the use of a sledge-hammer and points.

●

Air Compressors.—A firm which started production only two years ago, Arpic Engineering Limited, of Queenslie Estate, Glasgow, Scotland, has made rapid strides in the production of portable and stationary air compressors of 75 to 500 c.f.m. An important feature of their production process is the method employed for assembly and finish: a form of flow-line production has been installed for which are claimed speed, economy and ease of inspection. The bulk of Arpic compressors are exported and their machines have been sold in 49 countries, the two most important by volume of sales being Canada and Australia.

Arpic recently shipped from the Clyde five petrol-driven compressors fitted with Austin "New Age" engines of 105 c.f.m., to Hepburn, Ltd., of Toronto. Already Arpic has sent the company 10 similar compressors 14 of 160 c.f.m. and three of 211 c.f.m.

●

Repetition Cutter.—For repetition cutting to a given length of any reeled or strop material, such as a leather, rubber, woven or plastic fabric, a machine has been introduced which may be used in the production of belts, straps, wire, tape, electrical conductors, gummed paper strip and so on. Material is fed through feed rollers which rotate intermittently and in one direction. The amount of material fed through the rollers can be determined by varying the amount of rotation of the rollers. The machine is made in three types: series "A" cutting from up to 24 inches; series "B" up to 12 inches; series "C" up to one and a half inches, and for special purposes up to 48 inches.

Maximum width of material on all types is four inches. On the series "C" 20,000 cuts per hour can be obtained. By feeding a number of strips at the same time, production can be increased. The unit is supplied motorised for d.c. Makers: E. W. Cowell, of 7a, Sydney Road, Watford, in the English county of Hertfordshire.

●

Electronic Megaphone.—For communication between dock, ship, tug and pilot, and to convey orders from the bridge a lightweight electronic megaphone, completely self-contained, has just made its appearance on the market. The "Jericho", as it is named, gives distortion-free amplification of the voice, making instructions or information clearly audible, without shouting, up to distances of 500 yards or more from the speaker. Amplification is achieved without the use of valves, and the device is powered by four small dry batteries contained in the megaphone, so that valve replacements, acid batteries and trailing wires are obviated.

Total weight, including batteries, is 7 lb. 4 oz., and a pistol-grip, into which is built a thumb-operated on/off switch, is fitted at the point of balance. The "Jericho" can, therefore, be used for comparatively long periods without fatigue. The makers are Marconi International Marine Communication Company of Chelmsford in the English country of Essex.

●

Bookbinding Machine. — The development of a United Kingdom bookbinding machine owes a lot to the plastic, polyvinyl. The machine, called the "Flexiback Thermoplastic Binder", prepares the back of a book in a new way and uses polyvinyl cold emulsion glue, applied in between every leaf as well as on the fibrillated back. The whole book, in fact, is literally welded together.

The machine is made in two models. The first produces in one operation completely lined unsewn bound books from folded and collated sections. It is suitable for rounded and backed cased-in books, flat back paper-wrapper books, telephone directories and diaries, and serves a dual purpose inasmuch as it also lines all classes of sewn work, using polyvinyl cold emulsion synthetic glue. The second model makes a large ran of commercial books in one operatio complete with covers or boards, elimi ating the separate processes of wi Stitching and back stripping. At the sam time a saving of up to 15 per cent paper is effected on sales duplicat books between perforation and spi edge.

The books are first processed by a unsewn binder cutting head of new d sign, and then passed swiftly along a endless conveyor belt to a deflect mechanism which causes the leaves the book to be stepped out and allow the glue to be applied between th leaves. A regulated flow of glue is ap plied, and the book is then allowed t return to its normal shape. A secon spray then applies glue to the fibrillate spine edges, and a third glues the linin strip which is mechanically applied t the glued book back.

Formers give knife-sharp edges to th back of the book, which then pass through a thermostatically controlle heater former mechanism. This sets th glue and welds the lining to the whol of the back. The binder requires on operator and an assistant. The firs model has an average speed of 40 com plete books per minute, the secon model of 1,500 foolscap or 2,400 nine inch books per hour. Books produce by this process open completely fla The makers are The Book Machiner Company, Ltd., of 72 and 74, Victori Street, London, S.W.1.

●

Tire Chains For Tractors. — A whee chain for tractor tires, which can b put on the vehicle at the beginning o the wet period and left on until th end of the season has been develope by John Griffiths and Son (Grif Chains), Ltd., of Dudley Wood, Cradley Heath, in the English county of Staf fordshire. It can be used on roads a well as in the fields and is an aid t maintaining production when condition would otherwise bring machines to a standstill. This "griff" type of chain i well-known on the farms of Britain.

The chains can be supplied to fit any type of tractor tire. They give the necessary additional traction to keep the tractor going in the wettest weather and are specially useful for such tasks as ploughing, lifting root crops, manure moving and spreading. They can be rapidly fitted and as they give smooth running on land and road there is no necessity to remove them until the season has ended. They give longer life to tires and are invaluable on "bald" tires. The track of the vehicle is increased by only a fraction of an inch on either side, thus making the chains excellent for work between rows of growing crops or ploughing. They will not damage tires and through being specially hardened will last for years. Fastening is made by a patent level hook which ensures that once fastened the chains maintain an even tension.

●

Mark Buoy For Submarines.—The Admiralty in London has approved a new type of mark buoy for release by submarines unable to surface after diving. The first unit has been fitted to H.M. Submarine Seraph and other submarines will be similarly equipped as they come in for refit.

The buoy carries a flashing light with a range of 3,500 yards in good visibility so that aircraft and searching vessels

Turnall Trio

Three highly efficient materials for industrial construction. They can be used individually or in combination. Year after year the Turnall Trio pays dividends in lasting satisfaction for maintenance cost is practically nil. Literature available on request.

CAVITY DECKING

An asbestos-cement roof deck that combines a series of features—ight in weight—strong—dry—non-corrosive—fire resistant—damp proof—thermal insulation—attractive ceiling which never needs paint—entirely inorganic

TRAFFORD TILE

Never needs paint for protective purposes and becomes even tougher with age. Large areas can be covered quickly. Weathers well under extreme and varied climatic conditions—fire resistant—rot vermin and moisture proof.

Sprayed "LIMPET" Asbestos

Asbestos fibre applied by a spray method. Provides a tight thermal nsulation—highly effective for anti-condensation—fire protection—dust exclusion—sound absorption—anti-corrosion—can be applied to any surface.

AA

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can locate it without difficulty. An added aid is a ring of reflecting studs. Investigations are in progress with the object of adding a radio transmitter. Buoyancy is obtained by packing watertight pressure-resisting metal capsules in the annular structure.

●

Buckrake, Disc Harrow and Sprayer. —Three additions to the range of farm machinery and implements made by Harry Ferguson, Ltd., of Fletchamstead Highway, Coventry, in the English county of Warwickshire, are a buckrake, a mounted tandem disc harrow, and a sprayer. The buckrake is built to take advantage of the principles centred in and around the Ferguson tractor. Outstanding features are lightness, hydraulic control of tine pressure over ground contours, simple tripping mechanism which is automatically re-engaged by operating the hydraulic control lever; telescopic carrying link which relieves the tractor hydraulic system of all load while transporting the crop; and ability to discharge load vertically downward into pit.

The mounted tandem disc harrow has all the advantages of hydraulically controlled direct mounting. It is attached to the tractor by the normal three-point linkage. Provided the draft of the harrow remains constant the working depth of the gangs is automatically controlled to a predetermined degree. Should the draft alter, a touch of the control lever restores the required depth.

The low volume spraying machine has been designed to provide an efficient and economical method of using a large number of insecticides for the control of common pests. The volume of spray it can deliver to the crop ranges between 5 and 20 gallons per acre. The sprayer consists primarily of a 45-gallon steel tank lined to resist corrosion, one centre and two side spray booms, the latter fully hinged and raised and lowered by levers attached to the tank side. A single cock of special design selects spray, shut off and anti-drip positions Attention has been paid to ease of attachment and compactness of design

●

Electrostatic Voltmeter. — Intended primarily for use in the television field, a new electrostatic voltmeter, the "Scalamp" is also suitable for many other purposes, thanks to its compactness, portability and ease of operation. A taut-suspension of the galvanometer type holds a vane near an insulated electrode. A magnetic device critically damps the movement in all circumstances. The inside face of the front panel carries the optical system, the removable external face having the 4 v lamp mounted on it (the lamphouse is integral with the front panel). The instrument may be worked from a 4 v battery, or by means of the transformer provided with the standard model, from 200-250 v mains supply. Present available ranges of instruments are: 1-5 kv d-c or a-c, 3-10 kv d-c or a-c, 5-18 kv d-c, and 5-12 kv r.m.s. a-c. The accuracy up to a frequency of 100 Mc/s is within 1 per cent of full scale on all d-c ranges and on a-c up to 12 kv r.m.s. (W. G. Pye and Company, Ltd., of Granta Works, Cambridge, England.)

●

Bifurcator Fan Units. — Used for the mechanical exhausting of dust, gases and fume-laden air, the new "Tornado" bifurcator fan units can deal with obnoxious, inflammable or corrosive gases at fairly high temperatures. The fan casing is bifurcated or split across a diameter and opened out to provide a separate chamber for housing the driving motor, thus isolating it from the fumes passing along the duct which surrounds it. As the motor housing is open to atmosphere, the motor may work in a reasonably low ambient temperature with quite high temperatures in the surrounding duct. The motor is also readily accessible. Among details which should accompany inquiries, it is stated, are the volume of air or gases to be exhausted; nature of fumes and concentration per cent of air passing, if possible; temperature of gas or mixture; frictional resistance of system exclusive of the fan; and electric supply available. (Blackman Export Company, 23, Queen Square, Southampton Row, London, W.C.1.)

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Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Belting Manual.—A new 32-page manual on the installation and maintenance of conveyor and elevator belting has just been published by the B. F. Goodrich Rubber Company of Canada, Limited, Kitchener, Ont. More than 60 photographs and drawings illustrate ways to improve belt services and to lengthen belt life.

For copies of the publication, write to the Company at the address given above.

●

"Dominion Engineer". — No. 1—Volume 20 of the "Dominion Engineer" is devoted to a description of the products and achievement of the hydraulic division of the Company. To obtain copies of this, and other issues of the publication, write to the Editor, The Dominion Engineer, P.O. Box 220, Montreal, Que.

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Laminated Plastic Chart. — National Fibre Company of Canada Limited have available a new sample chart descriptive of their "Phenolite", laminated plastic.

The chart lists 24 basic grades, applications, base materials, and resins used for a complete line of sheets, tubes and rods. It will be particularly valuable for design, engineering and purchasing personnel. Copies will be sent free, on request on company letterhead. Address requests to National Fibre Company of Canada, Cor. Atlantic and Hanna Avenues, Toronto 3, Ontario.

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English Electric Journal. — An outstanding company publication is the "English Electric Journal" which is published by The English Electric Company Limited. Number one of volume thirteen contains some excellent articles with the following titles: Direct Current Locomotives built for the Spanish National Railways; Thrust Bearings for Vertical Shaft Water Turbine Driven Generators; Some Recent British Cotton Mill Electrifications; The Use Of Quadrature Booster Transformers In Power Systems; A Transformer Installation Incorporating On-load Tap-changing Equipment for In-phase Voltage Regulation and Phase-angle Variation. Write to English-Electric Co. of Canada Ltd., St. Catharines, Ont., for copies.

●

Small Motors and Controls.—The industries department of Canadian General Electric Company has announced a new folder (No. 4600) which covers 25 and 60 cycle fractional horsepower motors and controls.

This handy, pocket-size, bulletin gives application data on motors, along with recommended G-E controls for 1/20 to 1/3 hp. type KH split phase motors, 1/6 to ¾ hp. type KC capacitor motors and ⅛ to ¾ hp. type K induction motors.

Write to any C.G.E. office for a copy.

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Westinghouse Technical Bulletin. — Canadian Westinghouse Company Limited offer an excellent 16 page publication "The Application of the Light-Duty Overhead Secondary Network System". The authors are H. G. Barnett, H. B. Thacker, R. A. Zimmerman. To obtain copies of this interesting publication, write to Canadian Westinghouse Company Limited, Apparatus Advertising and Sales Department, Hamilton, Ontario.

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Instrument Catalogue. — Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario, offers *Journal* readers a copy of their new catalogue No. 53. It covers thermostats, thermostat accessories, limit controls, oil burner controls, gas controls, stoker controls, hand-fired controls, damper controls, relays, lo-water cutoffs, circulation and flow valves, commercial controls, motors, motorized valves, dampers, refrigeration controls, mercury switches and snap-action switches. To obtain copies, write to the Company at the address given above. Applications should be made on official letterhead.

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"Josam Digest".—Josam Canada Limited, 267 Davenport Road, Toronto, publish a small, but interesting publication "Josam News Digest". It covers the manufacture and uses of plumbing specialties. For copies write to the Company at the address given above.

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Canada's Power Output. — Canadian General Electric Company has recently published a pamphlet, prepared from Dominion Government's statistics, showing in graph form Canada's power station output for the past thirty years.

The chart not only indicates total output but the "firm" power curve which is one of the most reliable indices in the economic life of our nation.

To obtain copies of the pamphlet write to any C.G.E. office and ask for pamphlet No. 4089U.

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FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF EXTERIOR WALLS FOR BUILDINGS

by

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A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, Halifax, May, 1953.

Observing that wall design is based on building practice rather than on building science, the author assesses the functions of exterior walls and lists their requirements; strength, ability to control the flow of heat, air, vapour and water; resistance to fire, durability, and minimum annual cost.

Insulation, adsorption, moisture migration, efflorescence and ventilation are discussed and these major considerations are shown to be highly interrelated. The application of techniques developed in soil science to wall design is recommended. Proper wall construction should satisfy the various requirements by the use of several components, avoiding the use of more than one for each objective.

The design of the exterior walls for buildings has been, and still is to a large extent, based on building practice as contrasted with what may be called building science. Changes have been slow, and in the main have come about through an evolutionary process of trial and error. Building practice has been fundamentally an inheritance from the past, modified by contemporary factors such as climate, economy, social habits, local aesthetic values, and local resources of materials and skills. The evolutionary process works slowly under the influence of new factors, and is equally slow in rejecting the obsolete.

The growth of scientific knowledge has led to great advances in the analysis and rational design of the purely structural functions of a building. There has been a great deal of development also in individual materials and components. There have been relatively small advances as yet in dealing adequately with all the combinations of elements, and with the complex inter-relations of phenomena involved in the performance of a complete building. The reasons are not too hard to find. It will be sufficient to note that, even now, contemporary building design draws upon the knowledge and experience of almost every branch of engineering science.

We have long since passed the point where we are content to rely on the "trial by use" method of assessing changes in design, materials and construction. Many new and interesting articles, materials, and proposed systems and methods of design and construction are offered each year. Those responsible for assessing and screening such new developments, realize only too well the relative inadequacy of our present knowledge of the suitability in any given case.

In addition, our standards of performance are continually being raised. As we reduce our major difficulties in turn, minor ones assume greater relative proportions, and we clamour for their reduction or elimination also, in the name of progress. The existing state of knowledge appears less and less adequate as the demands upon it increase.

Function of Exterior Walls

The function of exterior walls is to assist, together with floors and roofs, in the enclosure of space, in such a way that some or all of the physical environmental conditions, either inside or outside the enclosed space, can be regulated within acceptable limits. Physical environment must be regarded in the broadest sense, to include not only weather factors such as temperature, air movement, humidity, rain, snow and light, but also dust, odours, noise, and perhaps even now, nuclear radiation. Some thought will show that control of physical environment may include consideration of all forms of energy, and of all forms of matter which can occur in space.

Environment implies a subject, or subjects, which may be living plants and animals, including humans, or may be inanimate materials such as goods in process or in storage. The space either inside or

outside a building may be occupied by any or all of these. A building is normally used for the control of the physical environment in the enclosed space, but it may also be used to contain or control substances, organisms or radiation, which might otherwise become a nuisance or a hazard in the space outside the building.

Consideration of the broad function of exterior walls serves two purposes; it emphasizes the range of considerations which may be involved in establishing the specific functional requirements in any given case. It serves also as a background for a logical approach to more practical discussions of wall design. An exterior wall may be regarded as a large membrane separating indoor and outdoor environment.

In fulfilling this function it must possess adequate strength and rigidity, with these requirements varying with the extent to which the wall must contribute to the overall structural strength and rigidity of the building. It there are no significant differences between indoor and outdoor environment a wall may be unnecessary. It is important to note that a wall may be subjected to variations at times from one side to the other of almost all the factors which go to make up physical environment.

The differences in these factors represent the use which is being made of the wall. The differences which it is desired to maintain will determine the properties the wall must have. The variation in the magnitude of the conditions throughout a wall from time to time will determine the conditions under which the materials making up the wall must function.

Environmental factors can originate within and on the wall itself as a result of matter and energy transformations. The materials in a wall may, for example, provide a source of odour or of undesirable gases indoors which are not found outdoors. Radiant energy may be absorbed by a wall and transmitted as heat. Water in liquid form may enter the outside of a wall and be transformed by changes in temperature, and with the uptake of heat, into vapour.

Similarly, water vapour originating either indoors or outdoors may enter a wall and be condensed to liquid or to ice within the wall. Wind blowing on the outside of a structure may produce vibrations which give rise to noise within the structure. Mechanical disturbances

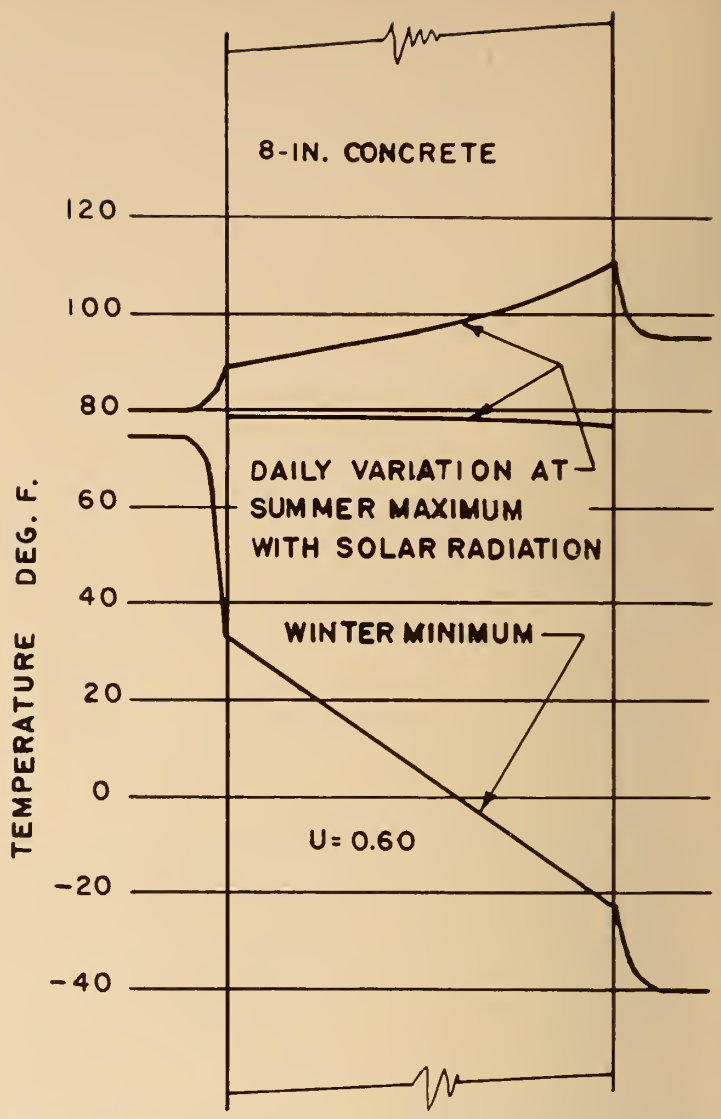

Fig. 1—Yearly temperature range throughout a plain concrete wall for air temperature range −40° to +95°.

at one point may cause vibrations and noise at some distant point. Such transformations create many problems, since the possibility of their occurrence is frequently difficult to predict.

Major Considerations

A list of all the possible specific requirements of walls might be of little value. Many items in such a list would apply only in special cases. The majority of the items would not be provided for intentionally in most designs, but would be satisfied incidentally.

The major considerations which should be recognized in the design of walls for Canadian conditions are as follows:

1. Strength and rigidity.
2. Control of heat flow.
3. Control of air flow.
4. Control of water vapour flow.
5. Control of liquid water movement.
6. Stability and durability of materials.
7. Fire.
8. Aesthetic considerations,
9. Cost.

Strength and rigidity of building components have been studied by engineers for more than a century. While there are still many gaps in our knowledge and in our ability to predict, the phenomena involved are well recognized. No elaboration of them is needed, nor is it necessary to emphasize the importance of strength and rigidity in wall design.

Flow Control

All flows of mass and of energy

have certain fundamental aspects in common. The movement of heat represents an energy flow, while air and moisture movement represent mass flow. Flow takes place due to potential differences, at a rate dependent on the potential difference and on the resistance offered to flow by the medium, in this case the wall.

An analogy with the well-known relationship between current, voltage and resistance in the flow of electricity may be drawn, although in some cases the equations may not be so simple. The potential is temperature in the case of heat flow, and air pressure and vapour pressure respectively in the flow of air and vapour. The potential in the case of liquid water movement may not always be readily identified.

All engineers will recognize the obvious possibilities of hydrostatic head, pressure and gravity forces. Liquid water can also be caused to migrate under electrical, thermal, and chemical forces, as well as by surface tension or capillary forces. The general situation in all cases may be described as a tendency for flow from a position or condition of higher potential to one of lower potential. The net result is a tendency to equalization of the potentials.

The flows of heat, moisture and air in walls have implications not only by themselves, but for all the other considerations listed. Air merits major consideration mainly because of its influence on heat and moisture flow. The overall transmission of heat, air and moisture through a wall can affect the ease with which the desired environmental conditions may be maintained, and so may have a marked influence on cost of operation of a building.

Temperature, and temperature change with the associated heat flow, together with moisture, are important factors in the deterioration of almost all materials. These deteriorating effects can and frequently do occur in walls. Such deterioration may interfere with the proper functioning of the wall if allowed to progress, or may result in high maintenance costs if materials have to be replaced or restored.

The temperature and moisture conditions imposed on the materials making up a wall can only be predicted through a knowledge of the overall conditions imposed on the wall, and of the nature of heat and moisture flow within a wall. This in turn requires a knowledge of heat and moisture flow in individual materials, and of how the overall flows in the wall will be affected by the type and arrangement of materials.

Stability

Stability of materials has been included with durability, as a major consideration, rather than with strength and rigidity. Some effects of dimensional change due to temperature, and to creep and shrinkage in materials, are taken into account in assessment of strength and rigidity of walls, yet there are many cases of dimensional change which are more properly associated with considerations of durability.

The action of a bi-metallic strip, for example, under a change in temperature is well-known. Con-

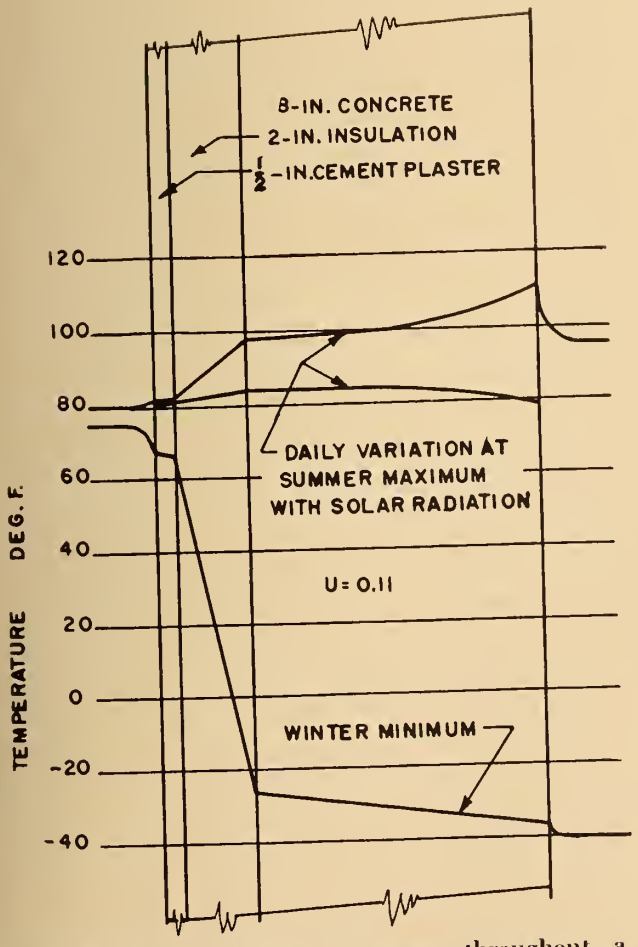

Fig. 2—Yearly temperature range throughout a concrete wall insulated on the inside, for air temperature range −40° to +95°.

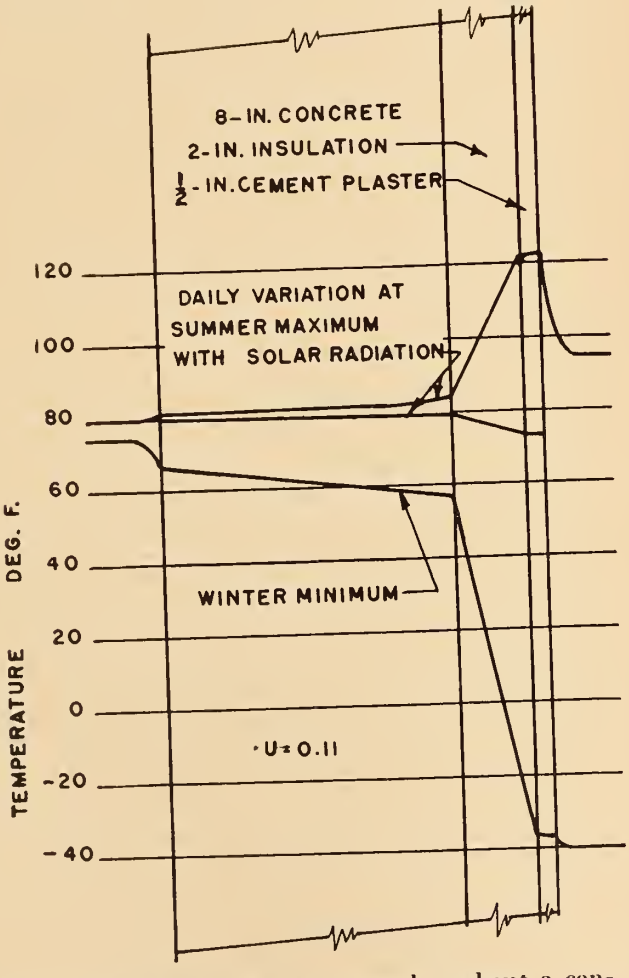

Fig. 3—Yearly temperature range throughout a concrete wall insulated on the outside, for air temperature range −40° to +95°.

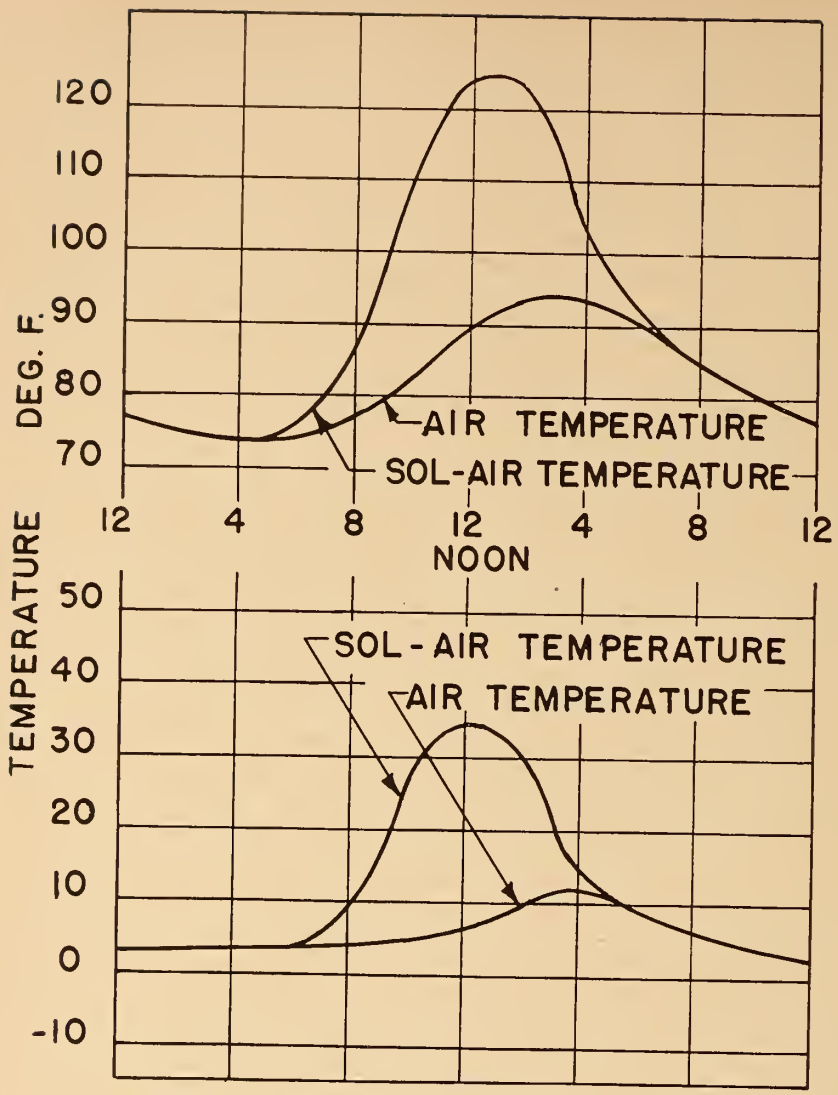

Fig. 4—Air temperatures and sol-air temperatures for a dark wall at 40°N. latitude on a summer day, and for a medium coloured wall at 52° N. latitude on a winter day.

sideration is not always given, however, to the possibility that two materials fastened together in a wall and subjected to a change in temperature will expand differently, and if free to do so will take on a warped or changed shape. A similar condition can be produced by a temperature gradient maintained across a uniform material.

Some materials used in walls change markedly in dimension with change in moisture content, and effects similar to those described for temperature change and temperature gradient may result. If the wall elements or combinations of them are free to expand, little or no stress may be induced. When such tendencies to change in dimension are resisted, temperature stresses, and "moisture" stresses are produced. Frequently stresses are relieved by localized failure, such as cracking or tearing.

All materials exhibit some expansion due to temperature, while almost all non-metallic materials exhibit moisture expansion on an increase in moisture content. Moisture expansion is not confined to cases where contact with liquid water occurs, since most natural organic materials are hygroscopic and may absorb substantial amounts of water from the air, roughly in proportion to relative humidity.

Durability

Ability to resist destruction by freezing and wetting combined may be an important durability consideration for a material. When thoroughly saturated, good grades of both stone and concrete can be fractured in a single freezing (1). Under less severe wetting conditions concrete, stone and brick can be rendered unserviceable by repeated freeze-thaw cycles (1) (2).

While the conditions under which a material can become highly saturated in practice, and the destructive mechanism of freezing are not well understood, it is generally conceded that the destructive force is associated with the expansion of water on changing to its solid form at or below 32°F. Some complication is introduced by the fact that water may be super-cooled under certain conditions. Water held in a material may freeze at a temperature lower than normal, or may not freeze at all (2) (3).

Materials which must possess durability to freeze-thaw action are of course those used under conditions where both wetting and freezing will occur. The conditions under which the material is used are extremely important in determining whether the moisture conditions at the time of freezing will be serious. Examples of spalling brickwork will be found in most areas in Canada which have both high precipitation and freezing conditions, and where certain types of paint have been applied to the exterior.

A particularly troublesome class of durability consideration is that involved in change of properties of a material, brought about by the association of certain materials in a wall. Aluminum for example, is susceptible to attack by alkalis. Cases are known where aluminum conduit used in concrete slabs, in which calcium chloride had been used were attacked chemically, producing a corrosion product of increased volume, so that the slabs were either cracked or caused to spall.

Fire Hazard

The inclusion of fire, or fire hazard, as a major design consideration will not be questioned. Several factors associated with the severe winter conditions combine to give it special importance, for example:

1. Extensive use of wood.
2. Substantial amount of heating required in winter.
3. Low indoor humidities which result in dry materials.
4. Increased difficulty of providing fire fighting services.

The extensive use of wood comes about not only because of the cost advantage, but also because of its low thermal conductivity in relation to strength, which gives it a unique advantage for certain uses in walls for cold weather conditions.

A fire hazard presented by one building is seldom confined to that building, and it is in the public interest to impose many restrictions

(1) Numbers in parentheses refer to items in the bibliography.

by way of building by-laws. These mandatory requirements will frequently affect the ease with which almost all the other major requirements can be met in a particular design, and may begin to affect the public interest in another direction. Responsibility is shifted to the legislating authorities and their advisors, to see to it that the regulations imposed are technically sound, and do in fact achieve their purpose at reasonable cost. This applies equally to other regulations than those dealing with fire, but particularly to those which may of necessity have to be based on limited empirical data.

There is no adequate overall basis as yet for assessment of fire hazard. Studies in this field are peculiarly difficult. All the complicated mechanisms of heat and of air movement by convection occurring at ordinary temperatures in buildings, occur in exaggerated form at the high temperatures in a fire. Heat affects all the materials involved. The situation is made still more difficult by the highly transient nature of a building fire, and by the influence of scale or size. Experimental studies are costly when carried out on an empirical basis in large scale.

Aesthetic considerations, although of major importance in many designs, need not be discussed here, except to note that both inside and outside appearance may require consideration.

Annual Cost

The rational cost basis for assessment of the design excellence is the yearly cost, made up of the yearly cost of the initial capital outlay, operating cost, and maintenance and depreciation. All of these are peculiarly involved in wall design. The total yearly cost will determine the refinement to be attempted in the final solution to the design problem.

Beyond this, capital outlay can be reduced at the expense of increased operating and maintenance costs. The omission of insulation, for example, will decrease the capital outlay at the expense of increased operating cost. Increased cost of materials possessing superior properties can be offset by reduced maintenance and depreciation cost. The designer is not normally in a position to evaluate cost factors accurately in wall design.

Available technical knowledge will seldom be adequate for accurate prediction of service conditions and of performance, even when technical data on specific materials are available. It may be difficult or impossible, also, to assess many features of the functional excellence in terms of a cost criterion, particularly with regard to such things as comfort, and appearance. In spite of this, cost remains the basic directing factor in design.

Temperature and Heat Flow in Walls

The equivalent of about 20 million tons of coal per year, or about 26 per cent of the total national energy consumption is used for space heating in Canada (4). The thermal properties of walls used for all buildings to be heated are therefore a matter of some importance. The primary interest in heat flow through walls arises from the economics of building heating during the winter months, with the problem of heat gain in summer assuming a less important role.

Calculation of heat transfer through walls follows well established procedures involving the assumption of a uni-directional, steady-state, heat flow condition. The overall coefficient of heat transfer, U, can be calculated using accepted coefficients for the individual wall elements, with sufficient accuracy for establishing the size of the heating system required.

The temperatures throughout the wall for a particular set of conditions can likewise be calculated on the basis of the same simple theory. For wood frame walls these methods

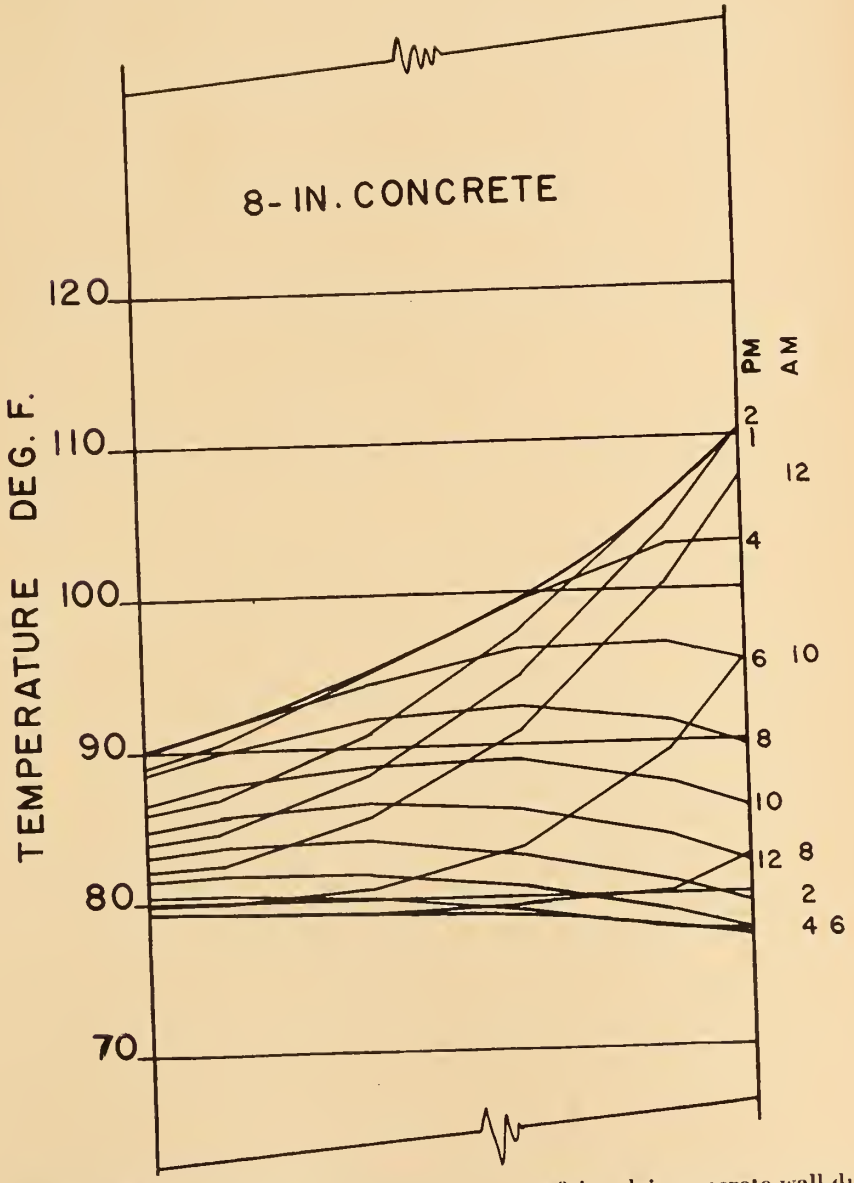

Fig. 5—Variation of temperature with time in an 8-in. plain concrete wall due to solar radiation in summer.

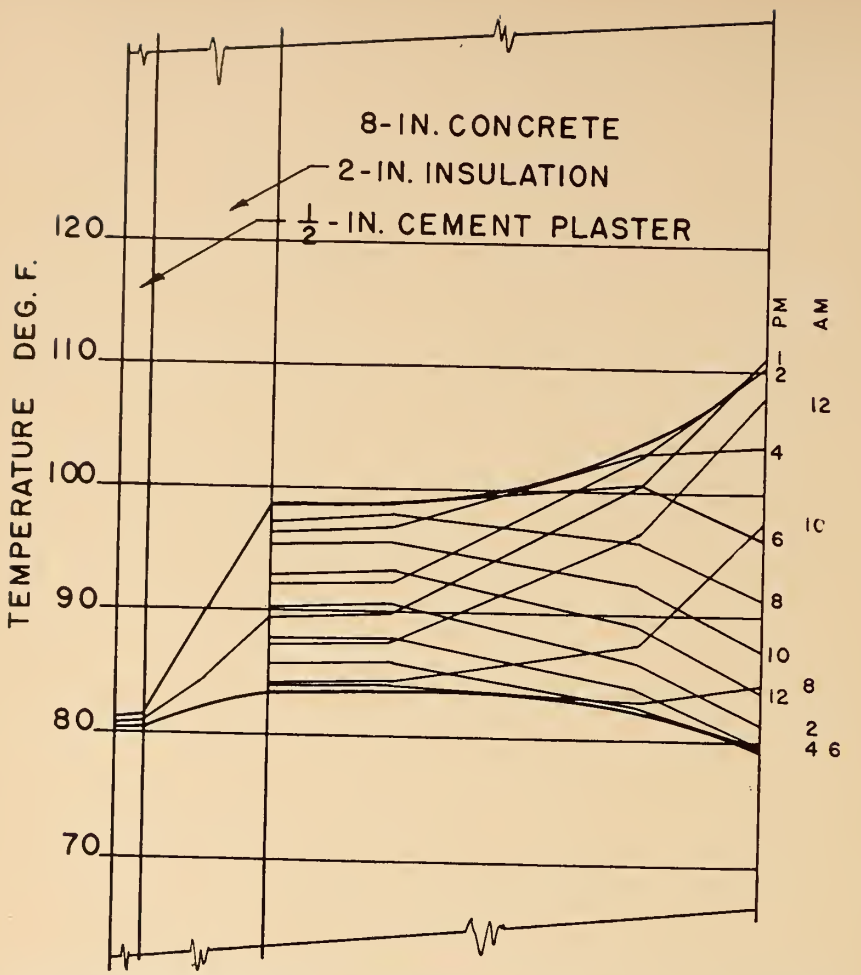

Fig. 6—Variation of temperature with time in an 8-in. concrete wall insulated on the inside, due to solar radiation in summer.

can be seriously in error for the prediction of wall surface temperatures, particularly when air spaces exist in the wall (5). The overall coefficient of heat transfer, U, for the average uninsulated wood frame wall with 2-in. by 4-in. studding, will be about 0.25 B.t.u. per sq. ft. per hour per degree temperature difference across the wall. Most simple masonry constructions without added insulation will have U values considerably higher than this.

Most walls used for houses are now constructed with added insulation, bringing the U value to 0.15 or less. The use of at least two inches of mineral wool insulation, or its equivalent, has been shown to provide the greatest reduction in yearly cost for wood frame walls (6). It is now common practice to provide similar amounts of insulation between 2-in. strapping on the inside of masonry walls used in house construction.

Temperature distributions and U values calculated by the usual methods for extreme winter and summer conditions are shown in Figs. 1, 2 and 3 for a plain concrete wall 8 in. thick, for the same wall with 2 in. of insulation added to the inside, and for 2 in. of insulation added to the outside. The effectiveness of the insulation in reducing the overall heat transfer, and in raising the inside surface temperature may be noted. Insulation therefore improves comfort conditions, and permits higher indoor humidities without the occurrence of surface condensation.

Insulation

The use of insulation in walls of commercial and industrial buildings has not been so widespread as in houses. This is due partly to the complications in introducing insulation into the usual "permanent" type wall construction. It is also due to the reduced surface-to-volume ratio in larger buildings, which reduces the heating cost per cubic foot of space, and makes a higher heat loss per square foot of wall somewhat less of a problem. In many industrial buildings high humidities must be carried for manufacturing and process work. Here the use of insulation becomes necessary to prevent surface condensation.

Insulation applied to a wall results in changed temperatures throughout the wall, with temperatures on the warm side of the insulation being raised, and those on the cold side being lowered. Unless the materials on the warm side are capable of restricting the flow of water vapour to the colder parts of the wall, condensation will occur, producing a troublesome and serious wetting condition within the wall. It becomes necessary to consider carefully the question of control of vapour flow, which can be achieved by the incorporation of a suitable vapour barrier on the warm side of the wall.

Under summer conditions the heat flow is reversed, for part of each day at least, and flow occurs towards the inside of the wall. The calculation of this condition becomes complicated, since solar radiation absorbed on the outside raises the surface temperature, and produces a cyclical variation in temperature requiring more involved methods of calculation.

Solar Heat

The maximum solar energy received at the earth's surface has a heat equivalent somewhat greater per square foot measured normal to the sun's rays than the heat given off by one square foot of steam radiator. The solar energy falling on a wall varies with the orientation of the wall, with the position on the earth's surface and with the time of day and time of year. Of the energy falling on a wall surface, from 40 to 90 per cent is absorbed, depending on the colour of the wall, and is converted to heat, the remainder of the solar energy being reflected.

The solar energy gain may conveniently be expressed as an equivalent air temperature, called the sol-air temperature, which without sunshine would produce the same heat gain at the wall surface. The sol-air temperatures for a dark coloured south wall at 40° latitude are shown in Fig. 4, as given in the 1952 Guide of the American Society of Heating and Ventilating Engineers. These have been based on the assumed air temperatures also shown, and will be similar to the values for a wall of medium colour at 50° N. latitude.

The periodic heat flow condition has been worked out by Schmidt's graphical method (7) to show the approximate temperature variations

hroughout the day. These are ›resented in Figs. 5, 6 and 7 for he same three walls previously ısed. Under periodic heat flow conlitions, the temperature wave reach-es the inside of the wall, consider-ably reduced in amplitude, some con-siderable time after it is imposed on the outside. This characteristic lag is brought about by the heat storage capacity of the wall, and is seen to be about five hours for the plain concrete wall.

The addition of 2-in. mineral wool insulation increases the lag by another two hours. The solar heat gain on the outside of the wall reaches a peak at 1 p.m. while the maximum rate of heat transfer from the inside of the wall to the space occurs from five to seven hours later. It will be noted that after 4 p.m. heat is flowing from the centre of the wall to the surface in both directions. The lag for an uninsulated wood frame wall is about two hours, and for a fully insulated frame wall about five hours.

Temperature Gradients

These temperature variations, important though they are in determining the heat losses and gains, and thus affecting building operating costs, are equally important in that they largely determine the conditions of service imposed on the material. The maximum range in temperature from winter to summer may be seen from Figs. 1, 2 and 3 to be 133° for the plain concrete wall, 148° for the exposed surface of the wall insulated on the inside, and 160° for the ½-in. stucco finish over the insulation placed outside the concrete.

These temperature changes in concrete represent strains of from 1.1 to 1.35 inches per 100 ft. If fully restrained they would produce stresses of 2,330 to 2,800 lb. per sq. in. in concrete having a modulus of elasticity of 2.5×10^6 lb. per sq. in. The largest gradient in temperature for the winter condition in the concrete is shown to be 7° per inch throughout the plain wall of Fig. 1. This, if fully restrained, represents a stress of 980 lb. per sq. in., and under conditions of no restraint would cause a camber in the wall of 2.2 in. in 50 feet of height or of length.

The maximum gradients in the concrete are considerably reduced, to about 1¼° per inch for the winter condition, for both insulated walls. The maximum summer gradients however are very severe, although confined to the outside of the concrete and restricted in duration, at 7° per inch for the uninsulated wall and 5° per in. for the wall insulated on the inside. When the insulation is placed on the outside, the gradients in the concrete are drastically reduced, being less than 1° per inch for the summer condition and, as previously noted, 1¼° per inch for the winter condition.

The implications of these results in relation to the service required of the material will be obvious. The farther out, thermally, the material is placed in a wall, the more severe is the temperature range which it will experience from winter to summer. Substantial thicknesses of high heat capacity materials experience sharp gradients when exposed to solar radiation.

For the three-component wall used as an example, a choice may be made as to whether the main structural element (in this case the concrete) or the insulation and outside covering are to be subjected to the most severe temperature variation. The concrete can be protected if placed inside the thermal barrier. Consideration must now be given to the effects of position on the service requirements in relation to other phenomena, principally moisture conditions.

Moisture in Materials

Control of water vapour and of liquid water were listed separately under major considerations, mainly to conform to the procedure which might be followed in design of dealing with them independently. For present purposes however, transformations of vapour to liquid to ice and back again occur so frequently within a wall, not only with position in the wall but with time, that they may be conveniently considered together as moisture.

Water in its various forms presents far more problems, not only in wall design but in building construction and operation, than any other factor or group of factors. It is involved first of all in most materials manufactured in situ, such as

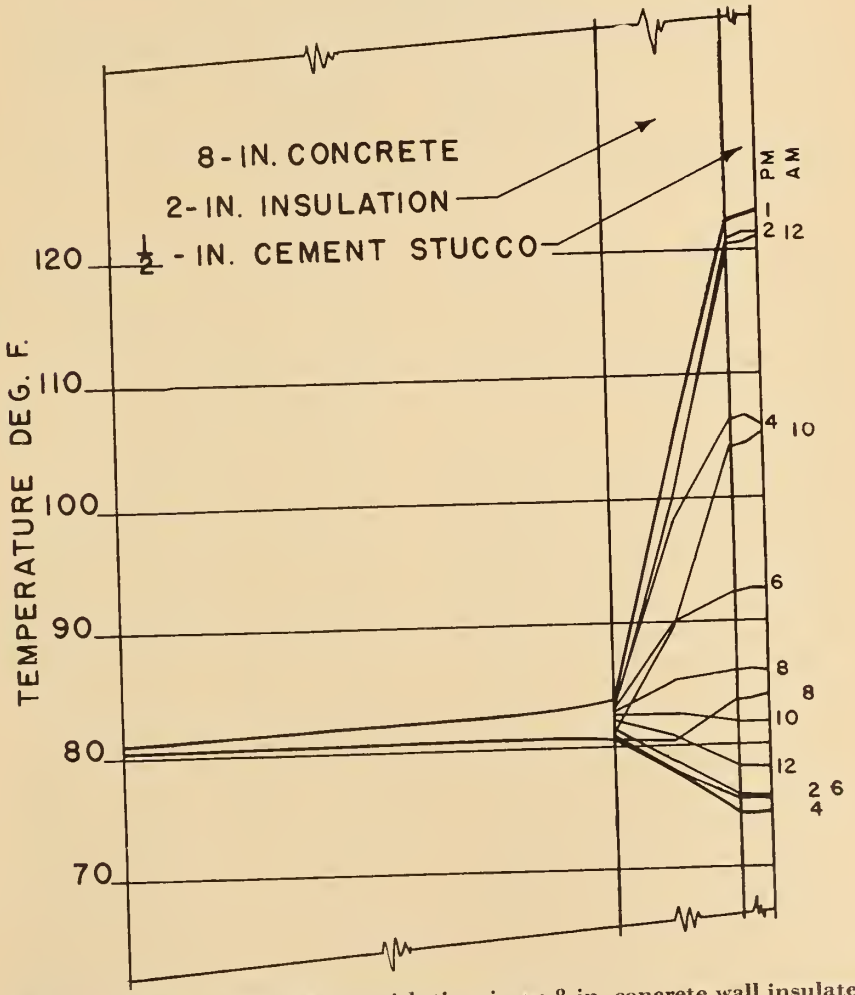

Fig. 7—Variation of temperature with time in an 8-in. concrete wall insulated on the outside, due to solar radiation in summer.

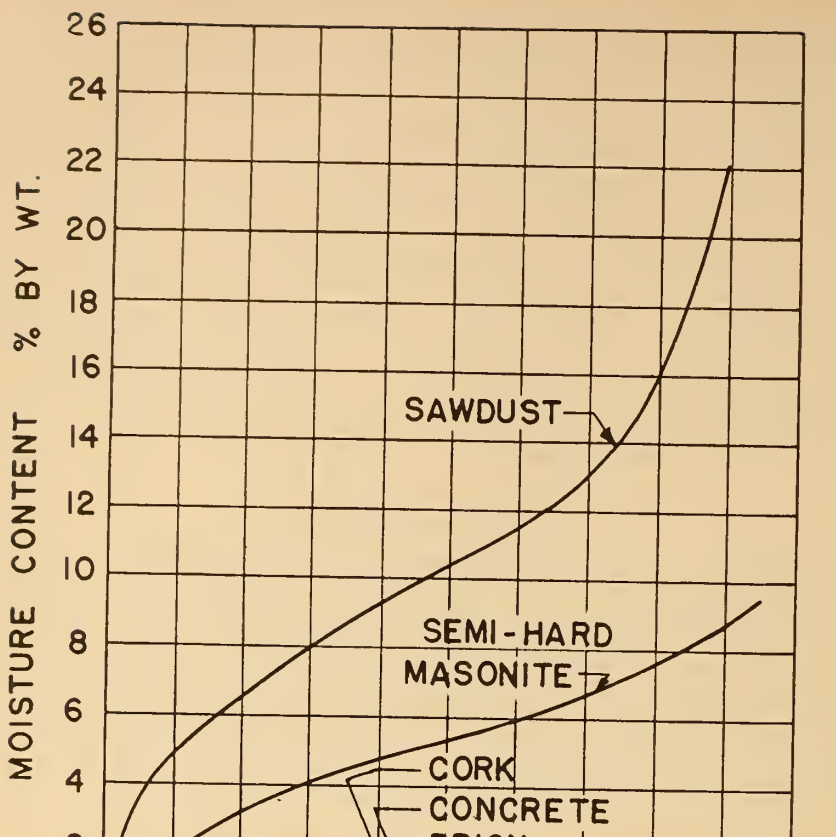

Fig. 8—Moisture taken up by various building materials at different relative humidities. (Data taken from Johansson (12)).

concrete, plaster and mortar. It is present everywhere, to some degree, and its presence is necessary for many of the deteriorating reactions which can take place in a wall, notably freeze-thaw breakdown, and corrosion.

It is responsible for the swelling and shrinkage of wood, as well as of other materials, and is frequently involved in the breakdown of finishes and coatings of various kinds, particularly those which are installed as protection against it. Despite the frequency of its occurrence and the difficulties for which it is responsible, it continues to be treated by the engineer largely as a "hydraulic" fluid moving under the influence of gravitational forces, and as a convenient fluid to use in the transport of heat and as an intermediary in the conversion of heat into work.

Applied scientists in soil science, especially in agriculture, have made the greatest advances toward an adequate understanding of the action of water in materials (8) (9). Much remains to be learned, and it will be necessary to go increasingly to the fields of chemistry and physics for assistance. Several books would be required to refer even briefly to all the scientific information pertinent to the role of water in building problems. Yet it is possible to sketch briefly the picture as it presently appears.

The engineer is not well prepared by his day-to-day experiences in dealing with water from the hydraulics point of view, for an understanding of the large forces brought into play when water becomes finely divided, as in the wetting of materials. Although familiar with the meniscus which forms at the water surface in a capillary tube, and the explanation for its occurrence, he is seldom led to consider the implications of this when the capillary system becomes very fine.

Table 1 shows the relationship between capillary bore, tendency to water rise or negative hydraulic head, pF, and relative humidity over the meniscus, in capillary tubes. The basis for the calculation of these values may be found in tex on physical chemistry or on soil The extraordinary range of values the potential capillary rise mak it convenient to use a logarithm scale. The one now frequently use in soils work is the pF scale intr duced by Schofield which is give by the common logarithm of th potential water rise in centimetr (10).

As the capillary bore decrease the curvature of the meniscu becomes sharper and the surfac forces become larger, as is reflecte in the higher potential capillar rise. Correspondingly, the vapou density, and therefore the vapou pressure at equilibrium over th curved surface, is decreased ov that which would exist over flat water surface at the same tem perature. This can be expressed als in terms of relative humidity a equilibrium over the curved surface

The water at the curved surface i sometimes said to be under tension and the tendency to rise is referre to as capillary suction. These terms although of value initially for comprehension of the phenomenon, are actually a hindrance to proper appreciation of the forces acting. Capillary potential is to be preferred, as a term, to capillary suction. It implies not only the tendency to capillary rise, but also the state of the water at the curved surface which is at a depressed free energy level by virtue of the forces acting on it.

Many of the common building materials: wood, brick, stone and concrete, have pore structures in the form of cells, tubes and spaces between particles as between packed spheres. While the shape, size arrangement, distribution, and degree of interconnection of these pore structures may vary widely from one material to the other, they are capable of acting like capillary tubes and of taking up water and holding it under conditions of *negative hydraulic head* (3) (11).

A necessary condition to capillary rise of water is that the material involved shall be one which is wet by water, indicating forces of attraction between the water boundary and the material surface. When the material is one which is not wet by water, the forces are repulsive, the curvature of the meniscus is reversed and, instead of capillary rise, capillary depression is produced.

Adsorption

Some further understanding may be achieved by considering the sorption of water molecules on the surfaces of certain materials. Strong

'orces of attraction are exerted by the surfaces of certain materials on water molecules. Such materials will readily adsorb water molecules from the atmosphere. When the surface is completely covered by a single packed layer of molecules a second and a third and then many layers of molecules will form in succession, each layer less tightly held than the preceding one.

When the material is one which presents a large effective surface area, the amounts of water which may be taken up and held may be as much as 10 to 40 per cent of the dry weight of material. The molecules in the first layer being strongly attracted, are at a low free energy level, with each succeeding layer, less strongly held, at higher and higher free energy levels.

When the space over the material is saturated with water vapour, the adsorption process will continue until the final molecular layers are at the energy level of the water vapour in the space, that is, at the energy level of a flat water surface at the same temperature. When the space is only partially saturated with water vapour, which is then at a lower energy level, the sorption process will stop sooner, at a point where the energy level of the sorbed water is equal to that of the partially saturated vapour in the space.

By this time, however, all the very fine capillary structure may be filled with water molecules, while the larger pores may be only partially filled, with all water surfaces at curvatures representing equal free energy levels throughout. The equilibrium vapour pressure, or the corresponding relative humidity in the space over the water surface may be used as a measure of the free energy level. The free energy level can also be expressed in terms of the curvature of the surface in a capillary tube, or of the height to which water would be lifted in a capillary tube, for the same free energy level.

Water can be adsorbed on a surface-active material under forces different than those in a capillary tube. Its free energy level can still be expressed in terms of the rise in an equivalent capillary tube, if desired. As the amount of adsorbed water is increased, capillaries begin to be filled and movement of liquid through them becomes possible under differences in free energy level. There is still no agreement as to the possibility of movement of the adsorbed layer, before any capillaries are filled, without an intermediate change to the vapour state. As the pores become filled flow under positive hydraulic head becomes possible.

TABLE 1.—Capillary Potentials for Water in Ideal Capillary Tubes

pF	Capillary diameter inches	Equivalent Negative hydraulic head, ft.	Relative humidity, %
0	1.2×10^{-1}	3.28×10^{-2}	
1	1.2×10^{-2}	3.28×10^{-1}	
2	1.2×10^{-3}	3.28	99.99
3	1.2×10^{-4}	3.28×10	99.92
4	1.2×10^{-5}	3.28×10^{2}	99.27
5	1.2×10^{-6}	3.28×10^{3}	93.00
6	1.2×10^{-7}	3.28×10^{4}	48.43
7	1.2×10^{-8}	3.28×10^{5}	0.07

The great virtue in these concepts lies in the fact that they make possible the adoption of a single continuous scale for potential, over the whole range from negative to positive hydraulic heads, from adsorbed films through to complete saturation. This, in turn, makes possible a rational approach to a study and understanding of the problems of when, where and at what rate water will move, whether it be present in the vapour or the liquid state, or both.

The equilibrium moisture contents taken up by various materials when in equilibrium with water vapour in the air at various relative humidities, are shown in Fig. 8. As may be noted by reference to Table 1, a 95 per cent level of relative humidity corresponds to a pF of 4.6, a capillary diameter of 3×10^{-5} in. or a negative hydraulic head of 1,300 feet. The weight of water taken up by the various materials of Fig. 8 at 95 per cent humidity reflects directly the volume of the pore space which has been filled by water at a free energy level equivalent to that in a capillary of 3×10^{-5} in. diameter.

As the humidity is raised above 95 per cent, larger and larger capillaries become filled and increasing amounts of water are taken on. By the time the humidity reaches 100 per cent, the negative hydraulic head will be zero. Observe that the relative humidity varies substantially only over a portion of the range of negative hydraulic heads of interest, at the "dry" end of the scale, furthest from saturation. Techniques have been developed for measurement of these potentials over practically the whole range (11), and much data relating potentials to moisture contents is available for soils. Little application of these techniques has as yet been made to other materials.

Moisture Migration

It follows from the above discussion that moisture will tend to migrate in a material until the potential is equalized throughout.

Further, if two materials containing moisture are placed in contact, the moisture will be redistributed between them until the potentials are equal. If no continuous capillary paths are provided so that movement of liquid through the capillaries is not possible, vapour transfer may take place, until the conditions for equilibrium at equality of potential are established.

When data on potentials at various moisture contents are obtained for building materials it will be possible to predict quantitatively many such equilibrium conditions. It has already been found for example, that in a particular brick-mortar combination, equilibrium was established at a 1 per cent level of moisture content by weight in the brick with 10 per cent moisture content in the mortar[1].

When coefficients of permeability are known, as well as the potentials, we may predict not only the direction of moisture migration, but also its rate. Again, considerable data is available in the soil science field, but relatively little for other materials, over the range where the capillaries are partially filled and liquid movement can occur. Much work has been done, however, on vapour flow through building materials.

Permeabilities for vapour flow have been measured, and Babbitt (13) and others (22) have shown how such data may be used to predict condensation in walls, and to determine approximately the vapour barrier required. This work has to be greatly extended to cover a wider range of materials, and to include moisture movement in the range of higher humidities. Logical

[1]Observations made by the Division of Building Research, National Research Council.

extension of this work to higher humidities brings in consideration of liquid movement through capillaries as well as vapour movement.

Potentials arising in other ways than those discussed also have to be considered. Chemical potentials existing between solutions of different salt concentrations separated by a membrane cause a flow of water through the membrane to the solution of higher concentration. This will be recognized as osmosis. When water is forced through a porous medium, an electrical potential known as a streaming potential can be developed.

It is well known that when electrical potentials are applied under certain conditions, water can be caused to move. This action is now referred to as electro-osmosis. Winterkorn (14) has suggested a close analogy between electro-osmosis, and the movement of liquid water under a temperature gradient which he calls thermo-osmosis. Several investigators have shown that moisture does migrate under a thermal gradient, in the direction of lower temperature (15) (16), but there is not yet agreement on whether it migrates as liquid to the cold side, as proposed by Winterkorn for soils, or only as vapour.

There is evidence that substantial vapour movement may take place in sawdust under a temperature gradient and that this is accompanied by a return flow under capillary potential and by a substantial movement of heat as latent heat in the vapour (17). There is also evidence that appreciable vapour movement can take place in soil in the direction of decreasing temperature, with return capillary flow in the reverse direction (18).

Some work has been done on the change in dimension of materials with change in moisture content. This has been confined largely to wood and wood products, which take on substantial amounts of water vapour from the air, and which experience appreciable dimensional changes as a result (19). Some data are also available on brick and on concrete (20). Much more data are required.

Efflorescence

Two interesting cases of moisture migration may now be discussed. Both involve efflorescence, the appearance of salts on a masonry surface. Efflorescence can be a serious problem when it spoils the outside appearance of walls, or results in disruption of coatings. It occurs as a result of the transport of dissolved salts by liquid water movement to a surface at which evaporation can take place, leaving the salt incrustation on the surface. As such, it is therefore a ready-made indicator of water migration. It can be eliminated either by controlling the water, or by avoiding if possible the soluble salt in the masonry. There is some indication that salts not present in the original masonry may be formed when certain materials are brought together.

Several experimental masonry huts under observation at Ottawa during the winter of 1951-52 showed marked efflorescence effects, with the disappearance and reappearance of the surface salt deposit at frequent intervals[2]. The disappearance of salt always coincided with wetting by rain, confined almost entirely to the east side of the huts. The reappearance of the efflorescence coincided largely with improvement in the general drying conditions provided by the outside air, following wetting and frequently followed a moderate reduction in temperature.

Except under heavy rains, all water falling on the outside of the wall was absorbed. It seems likely that the same salt was involved in successive reappearances. The reappearance of salt following a reduction in temperature could be evidence of liquid movement to the outside, brought about by a temperature gradient, as proposed by Winterkorn. Yet evaporation must have occurred to cause the salt to appear.

It is likely that lowered night temperatures reduced the dewpoint sufficiently to create drying conditions during the day, and that the process was one of evaporation of water at the surface, reducing the moisture content and thus the capillary potential there, and bringing about an outward liquid migration. Two things seem certain: the salt can only be carried by liquid, and is only caused to appear as an incrustation by evaporation of the water from the solution.

Efflorescence may be commonly observed in the Ottawa district, and probably elsewhere, on brick masonry walls in areas immediately under pre-cast concrete window sills. It seems the concrete and brick in combination may provide more soluble salts than are present in masonry alone. The localization of the effect may, however, come about because frequent wetting is also confined to the area under sills.

Projecting sills and ledges hold substantial amounts of snow. The window and the sill are frequently more highly conducting thermally than the rest of the wall. The outside surface temperatures may therefore be high enough to produce melting of the snow. Solar heat gain, however, is a much more probable cause of melting where there is exposure to the sun. The sol-air temperature is shown in Fig. 4 for 52° N. latitude for a surface of medium color and for an arbitrarily selected but representative winter temperature variation. A sol-air temperature of 35° is attained although the air temperature averages only 7° F. throughout the day.

Analysis of the periodic heat flow shows that under these conditions a plain concrete wall will attain a surface temperature of 33½°, sufficient to cause melting of the snow. The water so formed probably penetrates the sill, and enters the brickwork on its way to the surface, carrying salts which are deposited on evaporation.

It will be apparent that the approach to moisture migration which has been developed and so far largely applied only in soil science, can be extended to a study of a wide range of moisture problems in buildings, with great profit. There are many implications for new attacks on the problems of waterproofing, efflorescence, paint peeling, spalling and other forms of deterioration brought about by freezing, as well as many other problems in which water is involved. Experiments must be carefully planned to take into account the possibility of any or all of the phenomena described. This applies equally to experiments on heat flow when water is present.

[2]Observations by the Division of Building Research, National Research Council

Moisture in Walls

There are several possible phases of the problem of moisture in actual walls. First, water may be present as a result of in-situ manufacturing and wet weather during construction. This frequently leads to moisture problems during the first year or two of operation of a new building. Evidence seems to establish definitely that a wet wall can be expected to transmit water more readily than a dry one. Once the high level of construction moisture has been reduced, a more or less normal condition for a particular building can be expected. Wall

moisture can then originate within the building, usually by transmission of water vapour into the wall followed by condensation, or from outside the building from rain or melting snow.

The use of a vapour barrier to control vapour flow into a wall is now well established for wood frame walls. The same reasoning and the same techniques are presently applied, largely by analogy with wood frame walls, to insulated masonry constructions. It is not yet conclusively shown that this is entirely satisfactory.

The problem is complicated in masonry walls by several factors. The total water passing through a proper vapour barrier in one winter represents an increase of moisture content of about 0.25 per cent in an outer 4-in. brick withe, while several times this amount of moisture may readily be added in a single rain. When a vapour barrier is used, the wall can lose moisture only to the outside. In summer, hot sun following a rain drives moisture as vapour to the inside of the wall, and condensation behind the vapour barrier can occur.

Consideration of these and other problems has led several people to question the soundness of certain features of present practice in masonry wall construction. Difficulties are frequently encountered whenever the wall construction is such as to provide unbroken capillary paths from the exposed weather surface to the inside of a wall. The cavity wall with properly designed metal ties is one answer to this.

Cavity walls incidentally were intended to cope with moisture problems and not to provide improved thermal properties, as is commonly supposed in Canada. The cavity wall as usually designed has several undesirable features. Cavities are created by separating the main structural membrane into two or more membranes, tied together to act as the main structural unit. Temperature variations will usually be exaggerated, leading to increased differential thermal expansions between the separate withes.

The outer withe, usually of a capillary material, is also subjected to exaggerated changes in moisture content relative to the others. If the material exhibits moisture expansion, further differential movements may result. Hot sun on a wetted outer withe can still drive water as vapour back into the inner withes, producing wetting by condensation there. For this reason it has been recommended that cavities should be ventilated to outside, by air passages through the outer withe. If placed at different elevations, these would promote air circulation to carry off vapour to the outside, under wet-hot summer conditions of the outer withe.

Such ventilation would also be compatible with the winter requirements for elimination of vapour entering from inside, by venting to the outside. The winter thermal performance of the wall would also be affected, perhaps quite seriously, and special consideration of thermal properties would become necessary. The summer problem of heat gain might under certain conditions be improved by ventilation of the cavity to outside.

The use of waterproof membranes over or in masonry construction, in the outer portion of a wall, while effective in preventing liquid movement from outside, may also dam up water by condensation behind such membranes in winter, and lead to other difficulties, perhaps even spalling.

Fundamental principles for moisture control may now be set out:—

1. Vapour flow from inside the wall in winter must be restricted by vapour barriers or otherwise, at a plane sufficiently warm to prevent condensation on the warm side of such barrier.
2. Walls must be capable of limiting the entry of water from outside into capillary material in the main part of the wall, while permitting the flow of water vapour to the outside under winter conditions.

In addition, it would appear to be desirable to require a minimum of potential water storage capacity on the outside of the wall, or if such potential capacity exists, to separate it capillary-wise from the inner portions of the wall, and to minimize by venting the transfer of vapour to the inside under summer conditions.

Reconciliation of Heat, Material and Moisture Requirements

Johansson ([21]), in Sweden, has this to say, in translation,—

"However, it is clearly unwise to allow walls, whether of brick or porous cement, to be exposed to heavy rain. They absorb water like a blotting paper, and it would therefore be a great step forward if an outer, water-repelling screen could be fitted to brick walls, with satisfactory characteristics from the point of view of appearance, mechanical strength and cost.

"This screen could be applied so that water vapour coming from within is automatically removed by ventilation of the space between wall and screen.

"If a rain screen of this type is used, the thermal resistance of the wall can be considerably increased for only a slight increase of expense, by employing one of the highly porous, thermally isolating materials now obtainable. With a highly porous layer between the actual wall and the rain screen, the house would retain its good characteristics as regards heat capacity, sound isolation and fire risk. At the same time it would be guaranteed free from moisture, even in the worst weather, and moreover be extraordinarily well isolated thermally."

The approach to wall design as presented by Johansson, is perhaps an idealized one, to be modified to conform to many practical considerations. It is perhaps not the only idealized approach possible, but so far as can be predicted, it can be made to satisfy simultaneously all the various requirements, and it is possible of achievement. It permits a wider selection of materials, since the number of properties which any particular material or element must provide can be reduced.

Consider a wall which consists basically of a structural masonry panel. It is to be used as the inner part of the wall. Plaster finish may be applied directly to it on the inside. Selected largely for its strength properties, it will therefore tend to be high in thermal conductivity, and to experience only a small drop in temperature across it under heat flow conditions.

The vapour barrier can therefore safely be placed outside it, since the wall is to be insulated. The temperatures at the outside of the main panel will be sufficiently high to eliminate the possibilities of condensation of vapour from inside in winter. Further, the vapour barrier can now be of the film type, applied directly to the outer surface of the panel, on a large, accessible flat surface, uninterrupted by structural members.

Insulation and an outside covering have still to be added, and must be fastened to the structural panel while still maintaining the efficacy

of the vapour barrier. These can now be very light, the insulation can be of rigid form, and the outer weather screen can be light in weight. It can be of sufficient strength only to maintain itself against weather forces. The weather screen can, if necessary, have low moisture storage properties, thus reducing the tendency to vapour flow into the wall in summer.

The main structural material is now maintained at conditions deviating little from those indoors, which will usually be determined by considerations of comfort of occupants and therefore regulated within narrow limits. It is relieved of all but small temperature and moisture variations and gradients, and will not be subject to freezing action.

A much wider range of materials can now be considered since the durability requirements are greatly relieved. The main panel, being highly conducting, will maintain by conductivity in the plane of the wall, very uniform inside surface temperature conditions, without the usual cold spots caused by high-conductivity ties, beams, bolts, etc. Further, the effects on surface temperature of any ties or fastenings passing through the main insulation will also be greatly reduced. This is of particular importance in buildings constructed for high indoor humidities.

Detailing around openings is not necessarily complicated and can be greatly simplified. Window design can now be approached in a more fundamental fashion by substituting transparent sections in both the main panel and the weather screen. The use of heavy, thermally conducting sills and other high heat paths presently associated with windows can if desired, be largely avoided.

One warning must be given. The main panel must be sufficiently highly conducting in relation to the main insulation, so that the vapour barrier on the outer or cold side remains properly located, thermally, in the wall. Further, the creation of air spaces on the warm side, by additional sheathing, will result in objectionable temperature reductions at the vapour barrier, as well as substantial variations in room-side surface temperatures caused by convection in the air space.

Even these difficulties can be avoided if heat is added to the main panel, or into the bottom of the warm-side air space if one is used. A further extension of this could result in the production of a wall in which room-side surface temperatures are kept equal to room temperature throughout, with no thermal exchange between the wall surface and the room.

Conclusion

The fundamental requirements of walls in general have been discussed. While there are many possible considerations, these can be reduced to nine major ones. These must not be dealt with independently, since they are highly inter-related. Features introduced in a design on a limited basis to overcome one difficulty may create other more serious problems.

The role played by water in association with building materials has been emphasized. Much useful direction can be obtained from the information and techniques already developed in soil science. There is great need for a proper appreciation of the capillary movement of water, and for a comprehensive treatment of it which properly relates vapour movement, combined vapour and capillary movement, and saturated flow. Experimental studies in this field must take proper account of the various ways in which potentials to produce migration of water may arise.

The importance of temperature and moisture conditions together in determining the durability required of materials to be used in various ways and at various locations in a wall has been stressed. The conditions under which a particular material will be required to perform can be greatly influenced by the properties of the individual components selected, and by the ways in which they may be associated in the wall.

The proposed wall design, in principle, satisfies the major requirements by the use of several components, avoiding as far as possible the use of more than one component to satisfy a single requirement. The structural strength and rigidity are provided in one main structural panel with the vapour barrier, insulation and outside weather screen provided in separate components. Each is relieved, so far as possible, of the functional requirements of the others. The approach recommended is realistic in that it accepts limitations in the properties provided in the available materials, and attempts to use them so as to achieve the best results.

There is another idealized approach, quite widely supported which assumes that a single material can be found which will permit the construction of a simple, low cost, monolithic wall satisfying all the requirements. This approach is not realistic, since this material ideally ought to exhibit no thermal expansion, no moisture expansion, be impermeable to moisture, provide resistance to heat flow as well as strength in reasonable thicknesses, and be otherwise stable and durable.

The greatest obstacle to the acceptance of the wall construction recommended for consideration will be in the changed exterior appearances which will result if the proposals outlined are carried to their logical technical conclusion. However, Nature's laws are immutable whereas many ideas on aesthetics are not. In the meantime, there are many engineering-type structures in which these principles may be followed without difficulty so long as the inside weather is reasonably within the range of human comfort. There are many types of buildings in which moderately high humidities must be carried where, so far as can presently be seen, serious moisture problems can only be avoided readily in this way. When, however, special conditions are to be met which depart markedly from those assumed here, such as might be the case in a cold storage building, an entirely different solution may be indicated.

It is proposed that the overall requirements can best be met in this manner. This is in contrast to another idealized approach, quite widely held, which envisages the development of a monolithic wall of a single material, which will satisfy simultaneously all the requirements

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(*Continued on page 706*)

Development of Power from Atomic Energy in Canada

by

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In considering the use of atomic energy for the development of power, two aspects should be considered. First, there is the functioning of a nuclear reactor with respect to its fuels and products and to one or two of the problems involved in adapting it to produce power, and second, probable attainable costs. The conclusion is that this generation may well see the large-scale application of atomic energy for power development.

The Reactor

There are many kinds of reactors in existence and projected. They all consume nuclear fuel, or fissile materials, such as certain isotopes of uranium or plutonium. Most of them require a material called a "moderator", which is not consumed, but which may be a major part of the capital cost. Also, they all produce heat and new elements, the most important of which for power purposes is probably plutonium. To an engineer, the most outstanding characteristic common to all types is the enormous amount of heat liberated per pound of fuel consumed. This may be of the order of ten thousand times as much as from coal. In a power reactor, this heat would be used to generate steam, and hence electricity, with conventional equipment.

The kinds of reactors may be classified according to the kind of fuel they use, the type of nuclear reaction involved, the kind of moderator, and the main product. The earlier United States and British reactors use natural uranium, which is relatively cheap, for fuel, thousands of tons of graphite as a moderator, and primarily produce plutonium. They are large and the heat they generate is wasted. Much smaller reactors for power generation can be and have been made, using so-called enriched fuel; however, these are expensive to build and to operate. Fuel is termed "enriched" when fissile material has been added to it artificially. While reactors using highly enriched, or pure fissile, fuel are hardly likely to compete with other types for central station power plants, these may be practicable for applications where the cost of power is not a primary consideration, such as in submarines and long-range aircraft. There does not appear to be any economic justification at present for this country to undertake the construction of the enormous plant required to produce enriched fuel on a large scale.

Mr. MacKay's paper, another of those presented at the Halifax annual meeting, applies the discussions which have been going on concerning the technical and economic practicability of atomic power to Canada's case. Engineers do not do enough speculation — dreaming, if you like — and need a paper like this now and then to stir them up. Mr. MacKay's conclusions may be right or wrong, but without such educated guess-work from those best fitted to guess, there will be no atomic power.

The type of reactor used at Chalk River uses natural uranium for fuel and heavy water as a moderator. This produces an efficient type of reactor from a nuclear viewpoint, which is moderate in size and relatively economical to operate. Most of the comments in the remainder of this paper will refer to this type of reactor.

A further class of reactor is called a "breeder". A fraction of 1 per cent of natural uranium is the fissile isotope uranium-235, the remainder being the non-fissile isotope uranium-238. The operation of a reactor depends on the presence of a fissile substance in suitable quantities, suitably distributed in the moderator. In a reactor operating on natural uranium the uranium-235 is consumed, but the excess neutrons from the chain reaction convert some of the non-fissile uranium-238 into a new fissile element, plutonium. Thus, while one kind of fuel is consumed, another kind of fuel is produced to replace it. If more fuel is produced than is consumed, the process is called "breeding". Theoretically, breeding is possible in certain kinds of reactors, but such a high efficiency is difficult to attain. A normal medium-power reactor could not be expected to produce as much plutonium as the uranium-235 it consumes, most of the loss being due to absorption of neutrons in the cooling system and walls of the reactor core. The main point is that there really is not any great economic difference between a reactor which is just breeding and one which just is not. They correspond roughly to two power plants, one of which operates at just over, say, 30 per cent thermal efficiency and the other at just under this arbitrary figure.

A point which is worth noting is that the plutonium produced remains in the fuel and contributes to the nuclear reaction to an increasing extent as the original fissile material is used up. This greatly extends the amount of energy which may be extracted from the natural fuel, without any chemical or other reprocessing. The importance of this is obvious; at Chalk River considerable effort has been devoted to developing methods of obtaining more energy from the fuel. To date it has been found practicable to get many times as much energy from the uranium fuel rods as was possible three years ago. Due to partial

TABLE 1.—Capital Cost—125,000 kw. Atomic Power Generating Station

	Total	Cost per kw.
Atomic power steam generator	$20,000,000	$160
Conventional turbo-generating equipment	10,000,000	80
Transformation	6,250,000	50
	$36,250,000	$290
For Comparison		
Approximate cost of hydro-electric stations in Ontario (1950)		$215/kw.
Approximate cost of modern steam plant in United States		$160/kw.

breeding, there is always a valuable amount of plutonium left in the exhausted fuel, which can be recovered by chemical processing.

The newest Chalk River reactor is designed to produce plutonium and still provide unique facilities for research, much of which will be invaluable in developing power reactors. Owing to the present stage of technology, its heat will be wasted, but plutonium is at present a valuable product. The demand for plutonium for military purposes may taper off eventually, but it is probable that there will always be a use for it for special-purpose, compact, power reactors, and for as yet unforeseen new developments.

Another class of products of a reactor is the group of radioactive isotopes of ordinary elements which at present provide potent new research tools. An example is the radioactive cobalt which has gone into the much-publicized "cobalt bombs" at hospitals in Saskatoon, London (Ontario) and elsewhere. These are produced by exposing particular elements to the relatively small amount of surplus neutron radiation not required to maintain the nuclear reaction. The introduction of too much neutron-absorbing material into the reactor would stop the reaction, and, indeed, is used as one of the principal means of controlling the reaction. Although a good deal has appeared in the press about radioactive isotopes — and they are extremely important — it seems unlikely that they will become a major source of revenue in power production, unless some entirely new use not at present envisaged is developed.

The fission process leaves a residue of highly active fission products in the fuel. These must be stored for many years behind heavy radiation shielding until their activity decays sufficiently to render them harmless to human beings. Some are extremely toxic in almost incredibly small quantities, lethal doses being as little as one micro-gram. At present they are considered a serious nuisance, but there is a good possibility that uses may be found for some of them which will make their recovery profitable.

To summarize the foregoing, reactors using natural uranium as fuel and heavy water as moderator produce heat and plutonium. The latter may either be left in the reactor to produce more heat and more plutonium, or it may be removed and separated if, as at present, there is a demand for it.

A characteristic of nuclear reactors is that, for a given type of reactor within wide limits, the size is only slightly dependent on the power or rate of heat release. The size is critical for other reasons, and is something which must be calculated closely before the reactor is constructed. Since size and cost go hand in hand, it follows that a low-powered reactor is uneconomical. There is some indication that it will be economical to build units at least comparable to steam boilers with an equivalent evaporation rating of 2,000,000 lb. per hour, or about 500 megawatts of heat. It is difficult to conceive of atomic-powered automobiles or even railway trains except through the intermediary of electric power transmission, but ships powered by atomic energy may well be practicable in the not too distant future.

The problem of using the heat of a reactor for power purposes becomes primarily that of removing, say, 500 megawatts, which is nearly two billion B.t.u./hour, from a volume which might be a cylinder a dozen feet in diameter with about the same height. This must be done without introducing materials which will absorb more than an absolute minimum of the neutron radiation, and at the same time maintaining temperatures sufficiently high for efficient conversion to electrical energy by conventional means.

Structural materials used in the core must meet two strict limitations. They must absorb the least possible amount of neutron radiation and they must not be adversely affected by the neutron bombardment to which they are subjected. Practically, these requirements limit structural materials to a few metals such as aluminum, magnesium, zirconium and lead, and their quantities are limited to the minimum possible. Low temperature reactors, where the heat is wasted, make use of aluminum. For higher temperatures, zirconium is promising, but its use is relatively new and much is still to be learned about its technology and its behaviour in a reactor.

The same limitations must be met by the heat transfer medium required to remove the heat from the reactor core. Ordinary water is frequently used, as in the existing reactor at Chalk River, but the neutrons it absorbs are ones which otherwise could be used to produce plutonium or other isotopes, resulting in an inefficient reactor from a neutron economy viewpoint. This effect becomes more pronounced as the power is increased, necessitating greater volumes of coolant in the reactor core. The new Chalk River reactor will use heavy water cooling, which, although expensive in the first instance, results in the greatest overall long time economy of operation. Liquid metals have obvious advantages for high temperature work, but have the same order of neutron absorption as ordinary water. Gas cooling may not be ruled out. The choice of heat transfer medium and the conditions under which it is operated becomes a complicated problem in economics, physics and engineering.

One of the greatest difficulties in reactor development is the length of time required to complete each reactor. While much progress can be made through theoretical studies and tests of mockups of components, the real advances must be based on actual experience. It is necessary to build reactors in order to learn how to build better ones, a slow and costly process.

Costs

In discussing the economics of atomic power, the position is somewhat analogous to that of James Watt had he been asked to compare the economics of steam ships with sailing ships. No one has yet attempted to design a power reactor which might compete economically with central steam stations; it was recently stated by an American authority that this would be impossible in the present state of technology. Existing plutonium-producing reactors have all been designed to such stringent restrictions, real and suspected, that it is certain that their costs are higher than are really necessary. But in a few years

xperience in reactor operation will ıave doubled, and much of the new xperience will be of a kind that vill enable the study of cost reduc- ion to be made intelligently.

For want of a better starting point, the cost appraisal will be based on the estimated costs of the reactor now under construction at Chalk River. This reactor is expected to cost about $30,000,000. It is designed as a "many purpose reactor", that is, to provide for research and for isotope production, as well as for plutonium production. There will be much extra space in the building for experimental equipment and laboratories, and the whole layout is much more costly than that of a reactor designed solely for producing heat and plutonium. Because there are very few data on the reliability of many specialized components, these are duplicated and triplicated, and the parts of the building that house them are subdivided with thousands of tons of reinforced concrete shielding to guard against eventualities which might have no counterpart in a power reactor. Some of these safeguards may prove to be unnecessary but their elimination can only be based on operational experience. The most expensive single component is the heavy water, and it is certain that the cost of this can be reduced if it is recognized that there will be a continuing demand for it. As has been stated before, the cost is not very closely associated with the heat output.

Conceivably, the fuel elements of this reactor could be developed to operate at a temperature sufficient to raise steam for a somewhat old-fashioned type of turbo-electric generating plant, perhaps with the help of an externally-fired superheater using conventional fuel at very high efficiency.

Taking all these factors into consideration, it seems reasonable to assume that an atomic powered steam generator capable of producing 500 megawatts of heat could be designed and built a few years from now for $20,000,000 of today. The power plant using this steam generator might attain a thermal efficiency of 25 per cent to give an electrical output of 125,000 kw.

The capital cost picture might then appear as indicated in Table I.

These figures exclude transmission and distribution costs, which would tend to favour the atomic power station, since there is greater latitude in the choice of its location.

Obviously, based on these figures, no one is going to build atomic power stations if hydro power with no fuel costs is available. However, the Hydro Electric Power Commission of Ontario will have very nearly run out of useful hydro sites when the St. Lawrence power development is completed, at which time they expect the demand to just about equal the new supply. Their new steam stations, designed as peak load stations, are soon expected to carry a good deal of the base load, so at least in Ontario competition with steam and not hydro power should be considered.

In the following analysis of operating costs, the cost of the uranium is assumed to be as at present. It is also assumed that it can be consumed for a somewhat greater energy release than has been attained up to the present, but not more than seems likely to be attainable. Most of the uranium used at Chalk River now comes from Great Bear Lake and from the Belgian Congo. Both of these are rich but limited deposits, and it has been argued that when these are finished it will be necessary to go to lower grade deposits and to pay more for the uranium. But uranium is a very abundant metal. There is said to be more heat value in the uranium in a ton of ordinary granite than there is in a ton of coal, although, of course, the energy in the latter is much more accessible. Geologists state that the world's total estimated energy reserve in uranium is several times that in coal. It seems entirely reasonable to assume that in the years to come more rich deposits will be found, probably in Canada, or else means will be found to work the lower grade deposits in a manner which will compete with the steadily rising costs of coal. Incidentally, Dr. Lawrence R. Hafstad, Director of the Division of Reactor Development, United States Atomic Energy Commission, is reported to have stated recently "I hope, sooner or later, our country will be in the position of declaring that for stationary power plants and large blocks of power, we cannot afford to use petroleum. U-238 ought to be good enough". It should be borne in mind that the demand for power is expected to exceed the possible supplies on the continent some time between 1975 and the year 2000 unless entirely new sources of energy are developed.

TABLE 2.—Annual Operating Costs—125,000 kw. Atomic Power Generating Station

Amortization at 10 per cent/year on $36,250,000	$3,625,000
Fuel, operating and maintenance	2,000,000
	$5,625,000
Power generated	750 million kwh.
Cost per kwh.	7.5 mils

For Comparison

Average cost of production of privately-owned steam stations in the United States (1950)—5.32 mils per kwh.

The estimated annual operating costs of an atomic power generating station are shown in Table II. The period for amortization has been taken as being somewhat shorter than for a steam power plant owing to obsolescence of some of the components. The cost of operation and maintenance is a guess, but is set considerably higher than would be expected for a steam station.

From this table it could be concluded that the atomic power station would have some chance of competition with steam, even if no revenue were obtained from the sale of plutonium. A reasonable market for this by-produet would strongly favour the atomic power station. Data on the operating costs of modern steam stations in Canada have not been obtained, but they could be expected to be somewhat higher than in the United States, due to the greater distance coal must be transported in most cases. In remote areas, such as regions in northern Canada, the disparity in fuel costs would still further favour atomic power.

It is easy to argue over these figures since they are really only guesses at what is considered to be possible within a few years. Allowance is made for the normal reduction in costs between something in the experimental stage and the same thing after it has been developed for production. It is not intended to imply that an atomic power plant could be designed immediately which could compete with steam power, unless a substantial price for plutonium were guaranteed. But, in conclusion, it is submitted that power from atomic energy is an economical possibility in Canada, and that this country will soon be in an excellent position to carry out its development. √

NATURAL RESOURCES OF THE

Many Canadians, otherwise intelligent, regard our North Country as perhaps romantic but virtually useless. They may have heard of Yellowknife or of Norman Wells, but these they regard as totalizing the North. We suspect that there is a good deal of this kind of ignorance even among engineers. General Young's paper, presented at the annual meeting at Halifax in May last, should do much to dispel it.

Bruce Hutchison once wrote a book about Canada, aptly titled "The Unknown Country". Of this unknown country of ours the most unknown part is the Northwest Territories and the Yukon. This is true even among engineers, who as a profession are contributing greatly to the development of this vast region, and to many the "Territories" mean little more than the locations of a few fabulously rich mines. That this lack of knowledge exists is not surprising, because the region is remote and sparsely populated; that it should be corrected is important, because the region is vast and rich.

The land and fresh water area of the Yukon Territory is a little over 200,000 sq. mi., 5.4 per cent of the whole of Canada, and the land and fresh water area of the Northwest Territories is in excess of 1,300,000 sq. mi., 34 per cent of the whole of Canada. Together, these two Territories comprise just about 40 per cent of the country's total area. In contrast to this, look at the population figures. By the census of 1951 there were 9,096 persons in the Yukon and 16,004 persons in the Northwest Territories. This makes a total of just over 25,000 for both the Territories, less than one-fifth of one per cent of the Canadian total, and only one person for every 60 sq. mi. Of the 9,000 people in the Yukon, 7,500 are white, 1,500 are Indians and 30 are Eskimos. Of the 16,000 people in the Northwest Territories, only 5,340—just one-third—are white, 6,400 are Eskimos and 4,260 are Indians.

Much of this area, but by no means all of it, lies in the Arctic. There are varying definitions of the Arctic; one generally accepted is the region where the average mean temperature of the warmest month of the year does not exceed 50° F. Thus, the southern boundary of the Arctic coincides very closely with the tree line. In the Yukon and in the western portion of the Northwest Territories the tree line lies a short distance south of the Arctic coast, but going east it moves steadily farther south, running into the northeast corner of Manitoba just south of Churchill. All of the Yukon and of the Northwest Territories south of the tree line is subarctic.

The climate in many parts of northern Canada is different from what many people imagine it to be. It is true that the winters are cold, but in subarctic regions, such as the Mackenzie Basin and the Yukon, the summers are pleasantly warm. In Fort Smith, for example, which is typical of the region where Yellowknife lies, the average daily mean temperature in January is 16° F. below zero, nearly 30° F. below the Ottawa January average of 12°F. above, but in July the average is 60°F., only 10°F. below the 70°F. average in Ottawa. Furthermore, Fort Smith has a record high temperature of 103°F.! The situation in the Yukon is not much different. At Mayo Landing, which is typical of the Keno Hill mining region, the average mean temperature in the warmest month is 58°F. above and in the coldest month 13°F. below zero. When one moves eastward to the Arctic barren lands of Keewatin District, it is considerable colder. At Chesterfield, on the west coast of Hudson Bay,

Giant Yellowknife Gold Mines, Yellowknife. Bunkhouses, cafeteria, and staff houses are in the foreground, and the mill is in the centre of the picture.

NORTHWEST TERRITORIES AND THE YUKON

by

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the average mean temperature during the warmest month is 49°F. above zero and during the coldest month 27°F. below.

Another interesting fact is that snowfall as well as rainfall is light in much of this area. Fort Smith averages only 42 in. of snowfall a year, and at Yellowknife it is much the same. In contrast Ottawa has 82 in. At Mayo Landing the snowfall is 38 in., but in the eastern Arctic it is higher; Chesterfield averages 57 in.

What adds to the severity of the northern winter is, of course, its length. Fort Smith has an average frost-free summer period of only 57 days, Mayo Landing 66 days, and Chesterfield 55 days, compared with 148 frost-free days in Ottawa. So far as plant growth is concerned, however, the short season is to a considerable degree offset by the long hours of sunlight, particularly as one goes farther north. Moreover, while the long and cold winters obviously require special outdoor clothing and considerable expense in house heating, comfortable living is easily achieved.

The facts just mentioned obviously have a bearing on development in northern Canada, but they are dwarfed in economic importance by the dominating aspect of that region, which is its geological structure. The eastern and central portions of the mainland area of the Northwest Territories, and much of Baffin Island, are covered by the ancient rock of the Precambrian Shield. The Mackenzie Basin is an extension of the Central Plains. The western boundary of the Northwest Territories and almost all of the Yukon Territory lie across the Cordilleras and their flanks. Since the Precambrian Shield and the Cordilleras are the two great metal bearing regions of North America, and since the Central Plains are the great oil bearing region, the Northwest Territories and the Yukon are potentially one of the great rich mineral areas of the world. Up to the present their remoteness, and to some extent the rigorous nature of the climate and the toughness of the terrain, have deferred the development of these riches, but there is little doubt that in a few decades a very substantial proportion of Canada's mineral wealth will come from these areas.

Current mining production in the Northwest Territories covers gold at Yellowknife and its vicinity and uranium at Great Bear Lake. Gold production in the Northwest Territories started in 1938; in 1939 it amounted to $1,800,000 and by 1952 had risen to $8,400,000. Figures for uranium are not available. Petroleum is produced at Norman Wells, but only in sufficient quantity for markets in the Mackenzie District.

In the Yukon current production is centred on gold, silver, lead, zinc and a little coal for local use. Almost all of the gold comes from the historic creeks of the Klondike, where it is won by colossal dredges which contrast strangely with the panning of the days of '98. The production in 1952 was valued at $2,700,000. Silver, lead and zinc come from very rich deposits in the vicinity of Keno Hill. The 1952 output of silver was valued at $3,300,000, lead at $2,950,000 and zinc at $1,900,000.

Camp and tank farm at Norman Wells, N.W.T.

Aerial view of Fort Good Hope, N.W.T., showing gardens in foreground 20 miles south of the Arctic Circle.

Important as the present production is, the really exciting side of the picture lies in the projects now under exploration and in the outlook for the future. Taking first the Northwest Territories: present plans indicate a substantial increase in the production of the operating gold mines over the next few years, and any marked improvement in the price-cost relationship of gold would almost certainly bring several additional mines into production. Nevertheless, the most interesting prospects are in base metals. For example, a large number of claims have been staked in a highly promising lead-zinc deposit at Pine Point on the south shore of Great Slave Lake, and while it may be several years before a decision will be reached as to whether or not a mine will be developed, the present prospects look good. If a mine does come into production at Pine Point, it will be one of the biggest lead-zinc mines in North America. All of those interested in the development of the Territories hope that this will occur and that it may bring a railroad to the shore of Great Slave Lake, creating there a new community and a new industry, important not only to the Territories but to the whole of Canada.

Other interesting base metal prospects lie on both the north and south sides of the East Arm of Great Slave Lake and in Keewatin District, where nickel deposits have been found at Ferguson Lake and at Rankin Inlet. Interest in the Keewatin District has been further stimulated by the large scale geological survey undertaken in that area last summer by the Department of Mines and Technical Surveys. Helicopters were used to cover a total area of 57,000 sq. mi. and much ground favourable for prospecting was located. In general, it is no exaggeration to say that important mining prospects may develop at any time almost anywhere between Hudson Bay on the east and Great Slave and Great Bear Lakes on the west, and from the 60th parallel to the Arctic Ocean.

In addition to metals, oil has recently become the subject of intensive exploration in the Northwest Territories. During the last 18 months the wave of petroleum exploration which had rolled northwards in Alberta has surged over the boundary into the Territories. Petroleum and natural gas exploration permits granted or applied for in the Northwest Territories since the fall of 1951 now cover an area of 35,000,000 acres, which is greater than the areas of New Brunswick, Nova Scotia and Prince Edward Island put together.

Turning to the future prospects of the Yukon, spectacular expansion of production is now taking place in the Keno Hill region. The figures just given for the 1952 output of silver, lead and zinc were substantially higher than those for 1951, and there is every indication that 1953 will show a further increase. Many interesting base metal prospects are being explored throughout the Yukon, one of the most promising being a nickel-copper discovery at Kluane Lak close to the Alaska Highway. Th St. Elias range, in which this dis covery lies, gives promise of holdin other important copper deposit: There are also base metal prospect at various points in the Selwy mountains on the eastern boundar of the Territory. Iron ore deposit exist in this range and are believe to be large; while they are not o immediate economic importance their long run value may be great Exploration for oil is being carrie on along the northern section of th boundary between the Yukon an the Northwest Territories.

Possibly one of the most import ant resource developments in th Yukon during the next decade wil be in the field of hydro-electri power. A Canadian company i currently investigating the possi bility of developing a large volume o power from the headwaters of th Yukon River and certain of it tributaries. This power, which migh amount to 5,000,000 hp., would b developed and utilized in Canada It would be available to the expand ing mineral activities in the regio and would give them much en couragement, but the major part o it would be devoted to various electro-metallurgical and electro chemical processes using ore brought in by sea. If this development should materialize, it would bring a tre mendous increase in economic acti vity and in population to the Yukon and to northern British Columbia.

So far only mineral resources have been mentioned. There are other important resources in these regions, although they are of less significance to engineers. In the Northwest Territories there are two industries in addition to mining which produce in sufficient volume to export their products to the "outside", as the rest of Canada is picturesquely called. These are fishing and fur trapping. There is fur trapping also in the Yukon, but of considerably less importance than in the Northwest Territories.

Other economic activities in the Northwest Territories and in the Yukon, such as agriculture, horticulture, lumbering and coal mining, produce solely for local markets. There are numerous good hydro-power sites which can be developed when needed for the mining industry, but there are no areas other than the headwaters of the Yukon which are likely to develop sufficient power to attract industries using imported ores.

Coming back to the subject of mineral development, which has

een and will continue to be the ellwether of economic progress in he Territories, one of the problems hat have to be surmounted is the lifficulty of transportation. It is rue that the airplane has done vonders in opening up the country, particularly for prospectors, and it vill continue to play a dominating ·ole in this field. In the Northwest Territories, because of the plethora of lakes in the Precambrian Shield, planes can take prospectors into remote areas, provision them, and even bring in such equipment as drills. In the Yukon the prospector is less fortunate, because lakes in the Cordilleras are few and far between. Once resources have been proved and production is planned, whether the property lies in the Shield or in the Cordilleras, surface transportation becomes essential both for moving heavy equipment into the area and for moving out the product, unless it be gold, which can profitably be carried by air.

White River Bridge, Mile 1169, Alaska Highway.

In surface transportation lies the principal difficulty of northern development. Water transportation is slow and limited to a short season, and thus involves the costly storage of large inventories. Railroads and roads are expensive both to construct and to maintain, and the terrain sometimes makes long detours necessary. Economies can sometimes be achieved by crossing rivers by ferries in summer and ice bridges in winter, but this means a substantial period during the freeze-up and the breakup when the road is useless. Winter transportation by tractor train is feasible, but costly. Air transportation is, of course, feasible during both winter and summer, but excepting where landing strips are available for wheeled aircraft, it is interrupted during the freeze-up and breakup.

Since the end of the war the federal government has taken substantial steps to improve transportation facilities in these areas. It paid two-thirds of the cost of the Alberta section of the 385-mile Mackenzie Highway from the Peace River district to Great Slave Lake, and the whole cost of the Northwest Territories section, amounting in all to $2,800,000. The government also built the Whitehorse-Mayo Road, 247 miles long, connecting the Keno Hill mining region with the Alaska Highway. The cost including ferries was $4,450,000. Considerable assistance has been given to the construction of local mining and other roads in the Northwest Territories and the Yukon. Other governmental contributions to transportation include the construction of airports, docks, and similar facilities.

The government has also aided mineral development by the construction of two power plants, one on the Snare River to supply the Yellowknife area and the other on the Mayo River to supply the Keno Hill area. The rates charged for power from each of these plants are calculated to amortize the cost of the plants over 20 years, but the mining industry benefits by a rate of interest lower than what it would otherwise have had to pay as an alternative to having to provide the capital itself.

In addition to these various forms of direct assistance, the government has also helped in the construction of community facilities, such as water and sewerage systems, schools, and hospitals in centres such as Yellowknife. A good community life is possible in most centres in the north. For example, at Yellowknife there are excellent educational, medical and recreational facilities. Many people who are contemplating a job in the Territories may feel that they will have to forego, both for themselves and their families, many of the intellectual and social pleasures to which they have become accustomed. With the possible exception of some outlying camps still in the process of development, that is far from the truth.

What effect has this mineral development had on population growth and on the development of representative government ? In the Yukon the picture has been influenced by the fact that the peak of population was reached at the time of the gold rush from 1898 to 1900. At the time of the 1901 census, although the population was already on the decline, there were 27,219 people in the Territory. By 1921 the population had declined to 4,157, and by 1941 it was only 4,914. The large population at the beginning of the century caused the Territory to achieve during 1900-1910 a fully elected Territorial Council sitting in the Territory, and also representation in the House of Commons. As the population declined the number of members in the Territorial Council was reduced, but its fully elective character has never been changed. With the increase in population from 4,914 in 1941 to 9,096 in 1951, the size of the Territorial Council was increased from three members to five members.

In the Northwest Territories, on the other hand, the connection between mineral development, increase in population, and growth of representative government has been more direct and impressive, because prior to the 1930's the sparse and widely scattered population based on a trapping economy needed little government other than game regulations and policing. Mineral developments started in the Northwest Territories in the 1930's. Pitchblende was discovered at Great Bear Lake in 1933 and first produced in 1935. Gold was discovered at Yellowknife in 1933 and first produced in 1938. In the 20 years from 1911 to 1931 the population of the

Territories rose from 6,507 to 9,316, an increase of 2,809 or 43 per cent. During the following 20 years from 1931 to 1951, when the mineral developments were taking place, the population rose from 9,316 to 16,004, an increase of 6,688 or 72 per cent. More significantly still, during this 20 years the white population rose from 1,011 to 5,340, an increase of 428 per cent.

This rapid population increase, particularly in the white population, has brought with it significant changes in the system of government. Prior to the general election of 1949 the Northwest Territories had no representation in the federal House of Commons, but the Redistribution Act of 1947 enlarged the constituency of "Yukon" to include the Mackenzie District west of the 109th meridian and renamed the constituency "Yukon-Mackenzie River". By the Redistribution Act of 1952, residents of the Mackenzie District will have a member of parliament after the next election. "Mackenzie River" has now been separated from "Yukon" and enlarged to include the whole of the Mackenzie District.

Important developments have also taken place in the Territorial government. The administration of the Territories is in the hands of the Commissioner, who acts under instructions from time to time given by the Governor in Council or by the Minister of Resources and Development. The legislative body is the Northwest Territories Council, and until eighteen months ago it consisted of six members, all of whom were appointed by the federal government. In the summer of 1951 the membership was enlarged to eight, with the provision that five should be appointed and three elected from three constituencies which together cover the whole of the Mackenzie District.

It is also laid down in the Northwest Territories Act that the Council must meet at least twice a year, once in Ottawa and once at some point in the Northwest Territories. The first session of the enlarged Council was held at Yellowknife in December, 1951, the second at Ottawa in July, 1952, and the third at Fort Smith in December, 1952.

Engineers, and particularly young engineers, should consider the north country when planning their future. It was the pioneer spirit of our ancestors, continually striving against the rigours of the frontier, which gave to Canadians much of their vigour, common sense, and toughness in the face of difficulties. The gradual disappearance of the frontier and the increasing urbanization of our population have undoubtedly brought many advantages, but they have unfortunately also tended to diminish our spirit of adventure, our willingness to embark into unknown fields. If we should lose that spirit it would indeed be unfortunate. The north is one part of Canada which is calculated to keep it alive.

It is in these northern territories that much of our future development must take place, and unless we are to be caught short, we have little time to lose in embarking on it. The demand for raw materials is increasing sharply, a fact which recently has been given particular emphasis by the report of the Paley Commission issued last year in the United States. If the forecasts contained in this report prove to be at all accurate, and there is no reason to believe that they will not, the demand for Canada's natural resources during the next two decades will rise by leaps and bounds. Remember that much of the country described in this paper has not yet even been prospected, let alone developed. Remember, too, that several years must elapse, perhaps between five and ten, between the discovery of a rich deposit and the time when a mine is developed. It is clear, therefore, that if we are to satisfy these rising demands in time, there is plenty of scope—right now—for people with vision and adventure.

FUNDAMENTAL CONSIDERATIONS IN THE DESIGN OF EXTERIOR WALLS FOR BUILDINGS

(Continued from page 698)

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Refrigeration and Storage of Fish in Trawlers

by

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A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada at Halifax, May, 1953.

Six years of research have shown that ice remains the logical choice for refrigeration in deep sea fishing vessels. Woodlined pens do not permit proper refrigeration. With inefficient icing, even a small percentage of spoiled fish can mean loss of consumer confidence.

Cold wall jacketed and insulated fish holds, with watertight metal linings, require only half the amount of ice. They are superior to the insulated non-refrigerated metal lined type, and should be installed on all new fishing boats.

The refrigeration of holds of deep sea fishing vessels presents problems quite different from refrigeration installed ashore. The following is a report of work on this subject carried on over the past six years. Because of the scope of the study the results can be presented here in outline only, but the complete details of any phase of our work are available to those requesting such information.

The projects could not have been completed without the co-operation of National Sea Products, Limited, owners of the vessels on which the installations were made, who bore all major construction costs.

A Typical Fish Hold

A fish hold on a 120-foot trawler is a work room about 33 ft. long, varying in breadth from about 24 ft. at the underside (deckhead) of a crowned deck, to possibly 12 ft. at the floor of the hold, and with a height varying from 12 ft. along the centre line of the boat to some lesser figure as one moves away from the centre line. Thus walls and floors blend into one and the same curved surface, which in ship's parlance is called the "ceiling". This hold is permanently penned off along either side, usually about eight pens to the side.

In addition, the central aisle or "run" in the hold can be penned off at short notice by the hold workers when large quantities of fish have to be stowed. Further, each pen is fitted with shelf board supporting angles at roughly equal vertical spacing. Shelf boards are laid across these angles to support the fish and ice. The greater the number of shelves, the thinner are the layers of fish, and the less the pressure on the fish at the bottom of any one layer.

Naturally, the greater the number of shelves, the greater is the work required of the fisherman. This hold will carry about 240,000 lb. of well-iced unfilleted fish, when filled to the hatches. A hold so filled

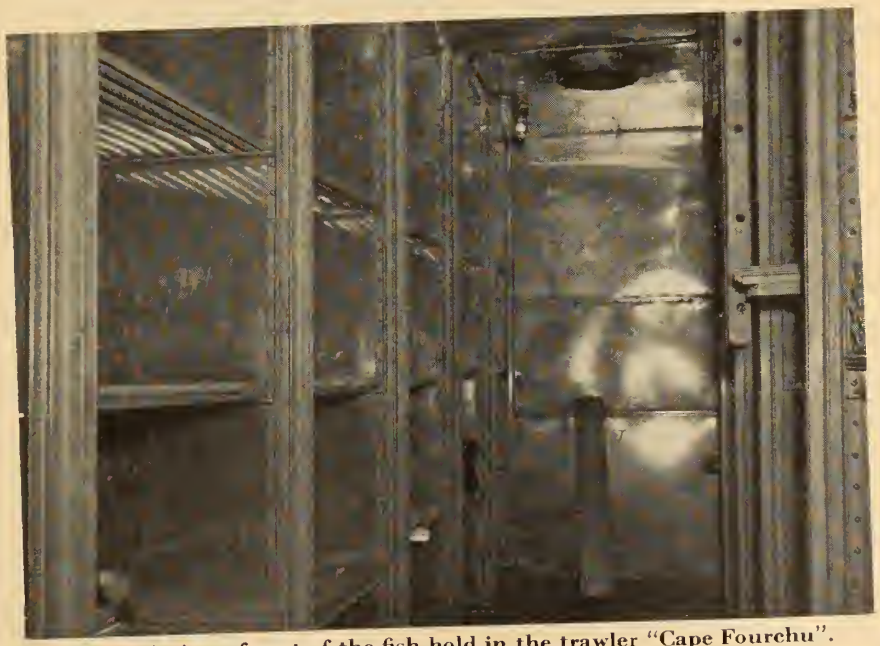

Fig. 1. A view of part of the fish hold in the trawler "Cape Fourchu".

* In the absence of Mr. MacCallum, on leave with the Food and Agriculture Organization of the United Nations on an assignment in Yugo Slavia, this paper was presented by Mr. Gudni Gunnarson, M.E (Chem.), Jr.E.I.C., Engineer, Atlantic Fisheries Experimental Station.

represents a tremendous amount of work accomplished in a relatively short time, and under extremely rough working conditions. Materials and apparatus used in such work must be foolproof and sturdy, and must require no maintenance.

Total Refrigeration Load

We can estimate the total refrigeration load in tons of crushed or flaked ice required to combat heat flow into a fish hold (leakage load), and to take care of the product load arising from the stowage of warm fish. For this purpose, typical temperatures are assumed for summer conditions.

Engine room air . . . 105°F.
(Engine room bulkhead forms one end of fish room)
Forward accommodation air . . . . . 85°F.
(Forward bulkhead forms other end of fish room)

TABLE 1.—Calculated Ice Consumption in Tons Aboard Medium Sized Wood Constructed Canadian Atlantic Coast Fishing Craft for Six-Day Period

Source of heat flowing into hold	Non-insulated craft	Insulated craft (four inches of corkboard equivalent on underside of deck and on end bulkheads of hold; two inches of corkboard equivalent on sides of hold)	Coldwall or jacketed and insulated craft. (Insulation and cold wall neutralizing all conduction heat gain into holds)
Heat transfer through deck	3.6	1.1	—
Heat transfer through hull	5.0	2.5	—
Heat transfer through bulkheads	2.8	.8	—
Warm air infiltration, heat from lights and workers in hold	2.9	2.9	—*
Initial cooling of hull	1.0	1.0	—*
Theoretical ice requirements to cool cargo of 200,000 lb. round fish from 60°F. to 32°F. plus 25% surplus**	20.9	20.9	20.9
TOTALS	36.2	29.2	20.9

*—Cold walls, floors, and decks possess sufficient refrigeration capacity to take care of these heat loads.

**—An estimate of the extra ice used for "insurance" that some shall remain at time of discharge.

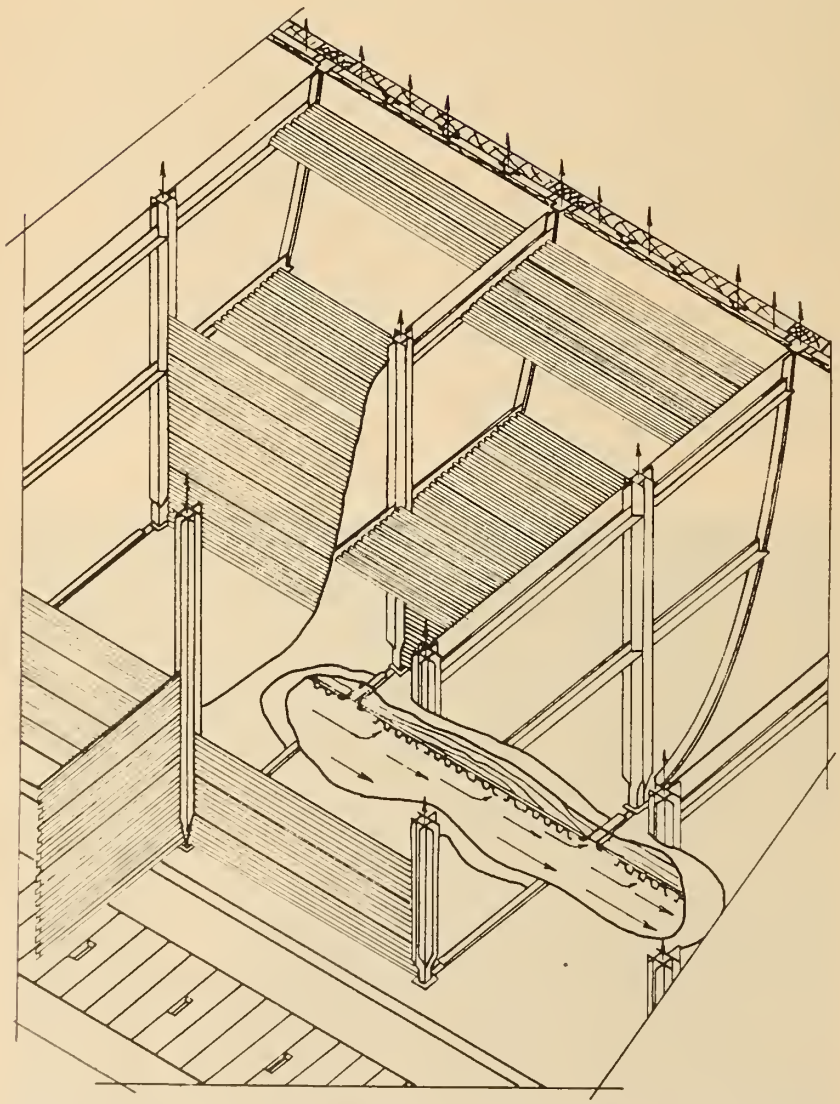

Fig. 2. Isometric view of lower portion of several fish pens in the hold of the "Cape Fourchu".

Deck . . . . . 87°F.
Deckhead . . . . . 47°F.
General outside air (in shade) . . . . . 72°F.
Water . . . . . 65°F.
Fish at time of icing . 60°F.

Based on these assumptions, the calculated requirements in tons of ice over a six-day period for a typical 6,000 cu. ft. capacity fish hold of dimensions 22 ft. x 33 ft. x 10 ft. are found in Table 1 for a craft of wood construction for the cases where the hold is: (1) Uninsulated, and not artificially refrigerated, (2) Insulated only, and (3) Insulated and cold wall jacketed.

Handling the Refrigeration Load

Often as much as 50,000 lb. of fish are stowed in a fish hold in eight hours. This quantity must be cooled to 32°F. almost within this period because the product is very perishable. The only practical way in which all this fish can be so cooled without freezing is with fine ice. For the medium size wood vessel, about 21 tons of ice are required to satisfy the product load on an average summer trip, which leaves an equivalent of about 15 tons of ice to be provided to take care of the leakage load.

This heat flow can be taken up with ice, it can be prevented or limited by insulation, or it can be looked after by artificial refrigeration. Table 2 shows the thicknesses of ice required to protect the product in the first two cases. It would appear a simple matter to ensure an adequate body of ice around the

riphery of the hold, but experience as shown that the icing is not done ell enough, and that some fish ach shore in a poor state of reservation.

Since loss of confidence of the ltimate consumer is far more costly an refrigeration, and since only a nall percentage of poor quality sh can bring about this loss of onfidence, it is essential that *all* sh be adequately refrigerated. Par-ial protection of the catch against xterior sources of heat can be chieved by installing coils under the leck, or by blowing refrigerated ir into the hold. Complete pro-ection can be achieved by jacketing he hold and blowing refrigerated ir through this jacket.

The capacity of the refrigeration equipment required for the jacketed and insulated hold referred to in Table 1 can be determined by taking the difference between the totals of columns three and four of Table 1, together with (1) the additional refrigeration required to maintain the hold at a temperature of about 34°F., rather than about 40° to 45°F. which is the average air temperature in an uninsulated non-refrigerated hold, and (2) sufficient refrigeration to counter-balance the heat generated as the result of operating blowers in conjunction with a finned tube evaporator bank.

These last two requirements amount to about 5.7 tons, which places the artificial refrigeration requirements at the equivalent of (29.2 − 20.9) tons + 5.7 tons = 14.0 tons of ice melted over a six-day period. This is equivalent to an hourly rating of 28,000 B.t.u. and allowing for 16 hours of compressor operation each day, calls for a condensing unit of about 42,000 B.t.u. per hour capacity while operating with a low side refrigerant temperature of about 20° F.

TABLE 2.—Calculated Thicknesses of Crushed Ice Required to Combat Leakage Heat into Fish Holds over a Period of Six Days

Locality of Ice	Thickness of ice melted (inches)	
	Wooden Vessel	
	Uninsulated	Insulated*
Above top layer of fish in pens	4	1½
Against back walls of pens (sides of vessel)	3	1½
Against engine room bulkhead of hold	5	2
Against forward bulkhead of hold	4	1¾

*—The following thicknesses of corkboard were assumed in the calculations:
Between deck beams . . . . . 4 inches
Against hold side walls . . . . . 3 inches
Against end bulkheads of hold . . . . . 4 inches

Included in each of the above totals is ¾-in. of ice which would be required to contribute to the cooling of the fish found immediately adjacent. In all calculations, thicknesses are based on the density of fine ice, not block ice.

Experimental Work

In all, experimental construction has been carried out on four boats—two fishing schooners and two trawlers, while observations have been made on these and on about a dozen other trawlers. The hold of the first schooner was insulated with four inches of cork under the deck and on both bulkheads.

The side walls were jacketed, the jacket wall being ⅞ in. tongue and groove spruce over 1 in. nailing strips and hard aluminum sheet over the wood sheathing. All joints in the aluminum alloy were lapped and nailed. The same alloy was used over the insulation placed under the deck and on the end bulkheads. In the former case, the aluminum alloy sheet was unbacked, while in the latter case it was backed by ⅞ in. tongue and groove spruce.

The hold of the second schooner was completely insulated with expanded rubber under hard aluminum sheet with nailed, lapped joints. The deckhead and bulkheads each received 4 in. rubber, and the side walls and the floor each received 2 in. The aluminum sheet along the side walls and floor and in end bulkheads was supported on ⅞ in. tongue and groove spruce laid next

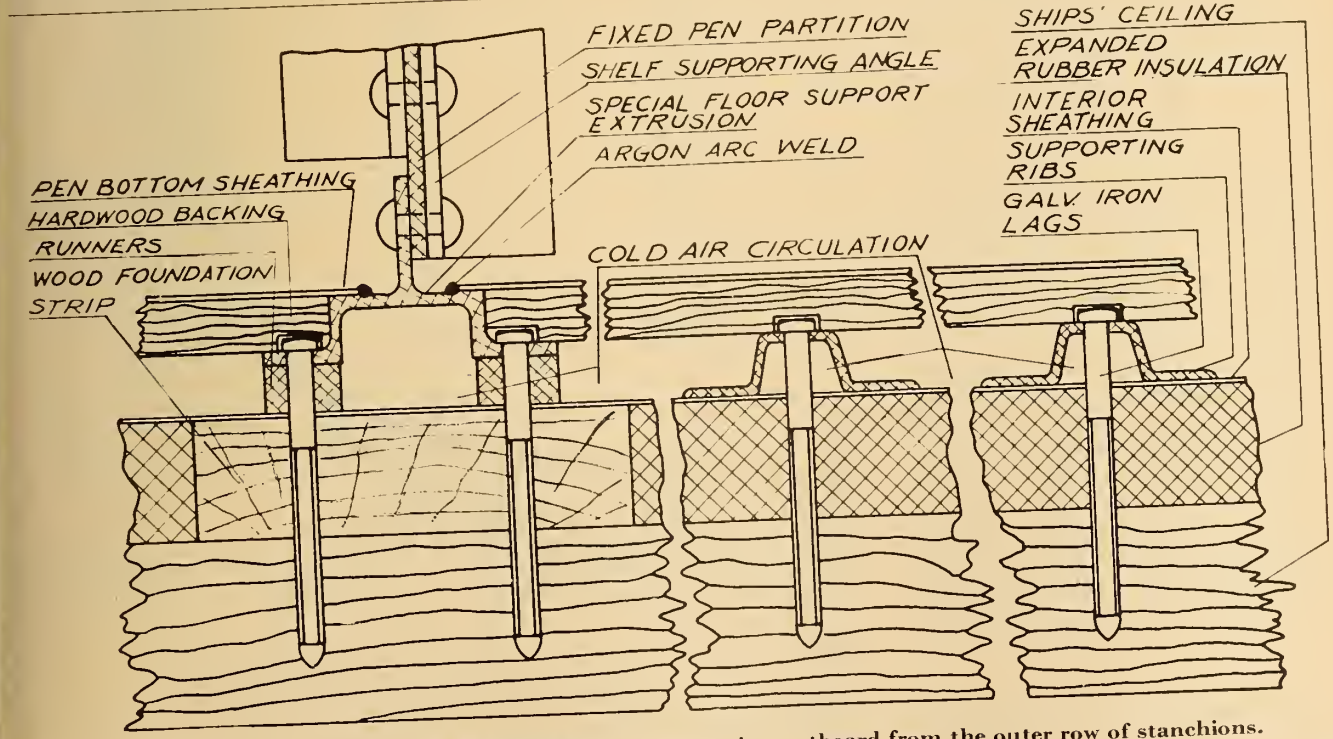

Fig. 3. Section A-A of Fig. 5 showing floor construction outboard from the outer row of stanchions.

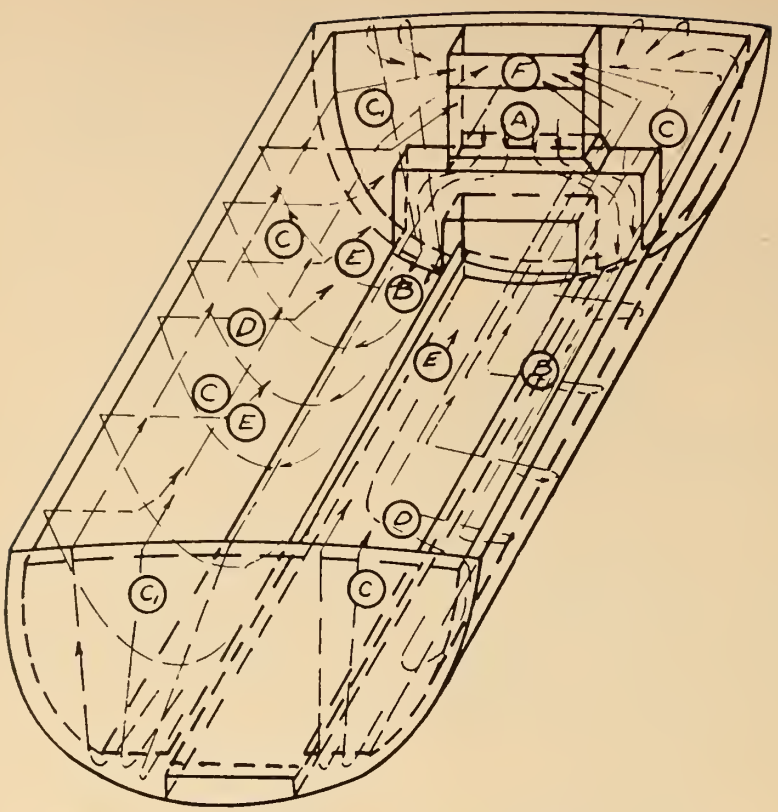

Fig. 4. Diagrammatic sketch of cold air circuit within jacket in the fish hold of the trawler "Cape Fourchu".

to the insulation. The aluminum sheet under the deck was unbacked.

The two trawlers were almost identical in hold fittings. Both were completely insulated with expanded rubber and completely jacketed by means of aluminum sheet argon-arc welded to aluminum members which in themselves were hollow and refrigerated. An interior view of one of the holds is shown in Fig. 1.

Figure 2 is an isometric sketch of the lower part of several fish pens. The cut-away views show the circulation of cold air behind pen bottoms and back walls, and the insulation between this cold air and the "ceiling" of the hold. The following insulating thicknesses, in inches, of expanded rubber were used: sides of hull, 2; deckhead, 4; end bulkheads, 4.

Figure 3 is a detail of floor construction, showing the provision made for the circulation of cold air beneath and behind each pen. The complete refrigerated air circuit is shown in Fig. 4. Two blowers mounted at F, above the evaporator coils at the after end of the hold, force the cold air, at about 30.5°F., out of the coils at A, and along the trunks built beneath the pen floors on either side of the hold as at B.

The air is then pushed up the back walls of the pens, as shown by the arrows at C, due to the difference in pressure established by the blowers, assisted by the reduction in the density of the air due to its rise in temperature. From the same source at B, cold air is supplied to the end bulkheads at C_1 (Fig. 4); to the stanchions as shown in Figs. 2 and 5, and to the deck beams and frame space ventilation circuit illustrated in Fig. 5. The air returns to the blowers within the deckhead jacket at D and E (Fig. 4), entering the fan compartment at F (Fig. 4). About 4,600 cu. ft. of air per min. is recirculated.

A Freon-12 condensing unit was installed in the engine room of each trawler along with all necessary marine accessories, and with alternating current power supply and motors for driving the blowers, which were located directly opposite on the fish room side of the engine room bulkhead. The defrosting arrangement provides for the direct by-passing of superheated Freon-12 gas to the evaporator coils. A back pressure control,

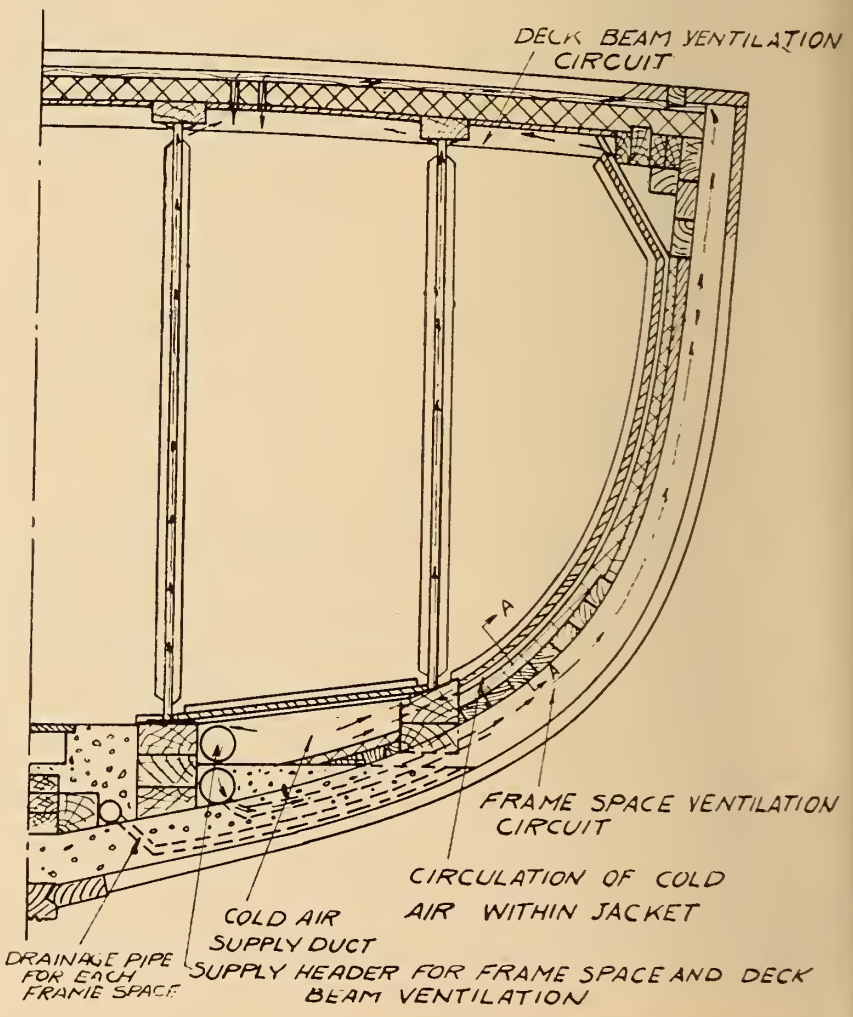

Fig. 5. Athwartship half-section through fish hold of "Cape Fourchu".

operating a magnetic starting switch, controls the operation of the compressor. The system was designed for continuous operation of the blowers, and these are controlled by manually operated switches.

Tests and Results

(a) *On Techniques for Application of Artificial Refrigeration and Insulation.*

It was found on the schooners that cooled fish lying against pen bottoms and back walls could be landed without a rise in temperature if special attention were given to the icing, the results being similar whether the side walls were insulated or jacketed. However, when the crews pursued their own techniques for icing these same areas, the low temperature was not held in fish stowed against insulated walls, but *was* held in fish stowed against jacketed walls.

It was found, too that the ambient air temperature under the insulated deck of the non-refrigerated hold was about 42°F., causing rapid melting of the ice placed over the top layer of fish and against pen boards. The air temperature in the jacketed hold was found to be about 35°F. and there was very little melting of top ice. The net result of the schooner experiments was the demonstration that "insurance" refrigeration was needed to take care of leakage loads at their source, and that this could

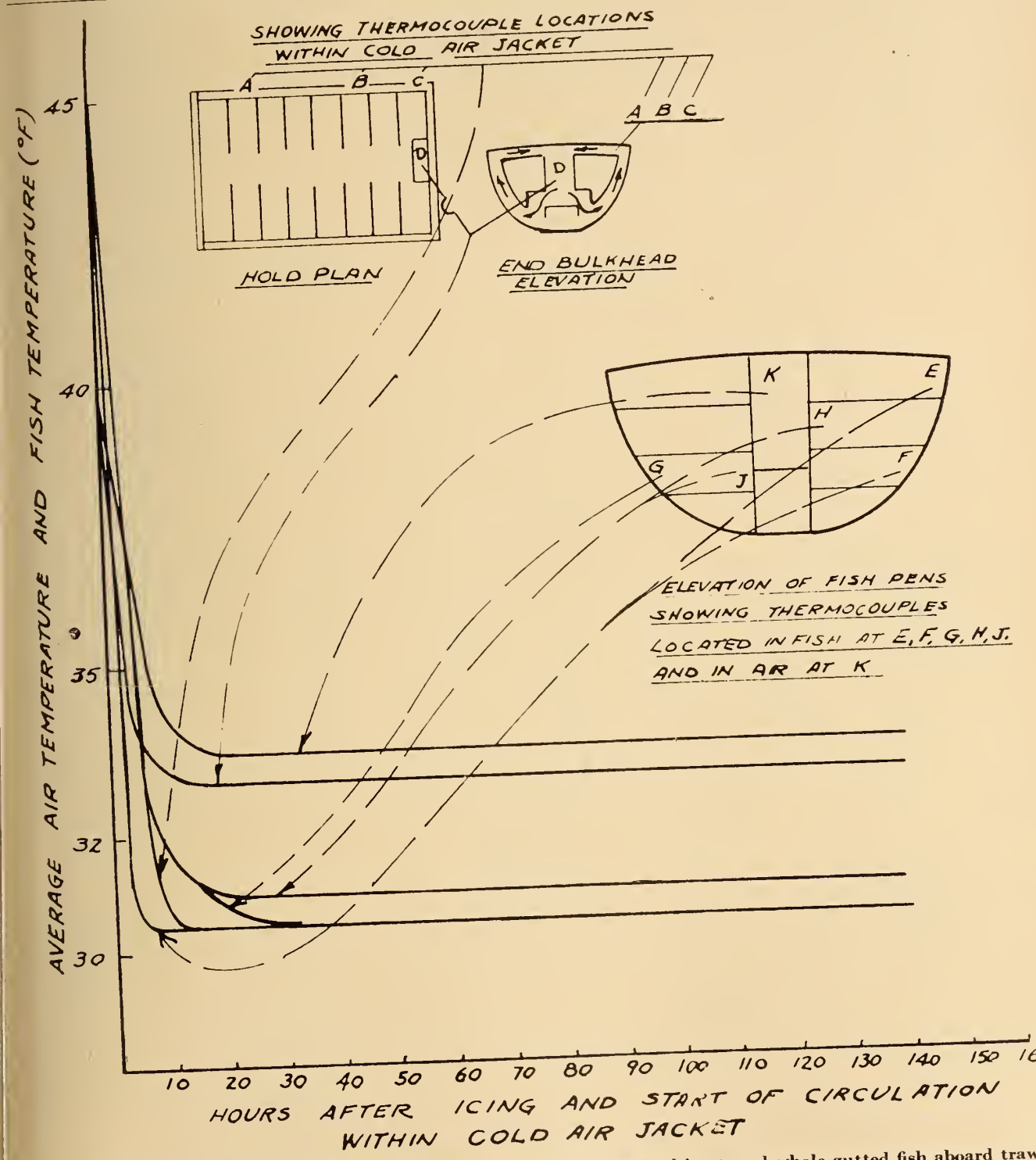

Fig. 6. Temperatures recorded within cold air jacket in hold proper and in stowed whole gutted fish aboard trawlers "Cape Fourchu" and "Cape Scatari".

be provided best by the jacketed system.

The efficiency of the jacketed design was demonstrated very thoroughly by the more elaborate and carefully executed design for the trawlers. Typical hollow wall air temperatures are depicted by curves A, B, C, and D of Fig. 6. The average return air temperature at D is shown to be about 2½° higher than the temperature of the re-cooled air as it passes points A, B, and C of the circuit. Air temperatures at corresponding stations A, B, and C within the jacket were similar and averaged 30.5°F.

This similarity of readings might be expected, as air flow tests made throughout the jacket near the completion of construction, had shown uniform flow at these stations. Curve K shows the average hold temperature to be 33.5°F. for the same period. Observed fish temperatures under these conditions are represented by curves E, F, G, H, and J of Fig. 6. All of these fish were cooled in ten hours or less. None of the fish was warmer than 31°F. thereafter.

Operation of the compressor with a fairly wide differential setting of the back pressure control, and failure to keep the blowers in constant operation, both tend to cause a wide variation in hollow-wall air temperature. But even when the latter temperature was allowed to fluctuate over a 3° to 5°F. range, the fish maintained a temperature with less than 0.5°F. variation.

Ice Consumption

The compressor on each trawler operated about 50 per cent of the time. Under this arrangement, sufficient refrigeration was provided to lower the temperature of the layer of ice lying against the metal skin of the pens just enough to cause it to stick to the aluminum sheet. This proved sufficient to preserve ice throughout the trip. The actual skin of ice was observed at the time the fish were unloaded. As long as ice can be kept against back walls, fish stowed in these areas cannot warm up.

Due to the desire on the part of the skippers to make certain that no fish were lost while the crews were becoming familiar with the amount of ice necessary for proper handling of the fish in these fish holds, more ice was used during the first summer of operation than was needed to satisfy theoretical requirements. However, it is estimated that each boat used about 48 per cent less ice than would have been required for equivalent icing results on an uninsulated, non-refrigerated craft having the same size hold.

(b) *Hold Linings*

Mechanically constructed joints in metal hold linings of the schooners were found unacceptable from the standpoint of water-tightness. The argon-arc welded joints employed on the trawlers were much superior, and it is felt that coupled with a more flexible design for fish pen construction, to be described later, this method of fabrication will be entirely satisfactory for future boats. Our study of the gauges of lining material is not yet complete.

Besides the aluminum alloy under practical test in the boats referred to above, smaller quantities of stainless steel and Monel are soon to be tested under equally rigorous conditions.

The extruded aluminum alloy pen and shelf boards, supporting angles and stanchions used on the trawlers appear to be standing up well to wear and to the stresses of service.

Electric Power Requirements

These form the major stumbling blocks in the way of mechanical refrigeration for boats already in use. About 10 kw. are needed for refrigeration services. The schooner and trawler with respective generating capacities of about 2 to 5 kw., and 10 kw. each in auxiliary and tail shaft generators, have a mere minimum of electrical energy for normal boat use.

The designer thus has two problems: (1) to make an installation at a cost which can be borne by the

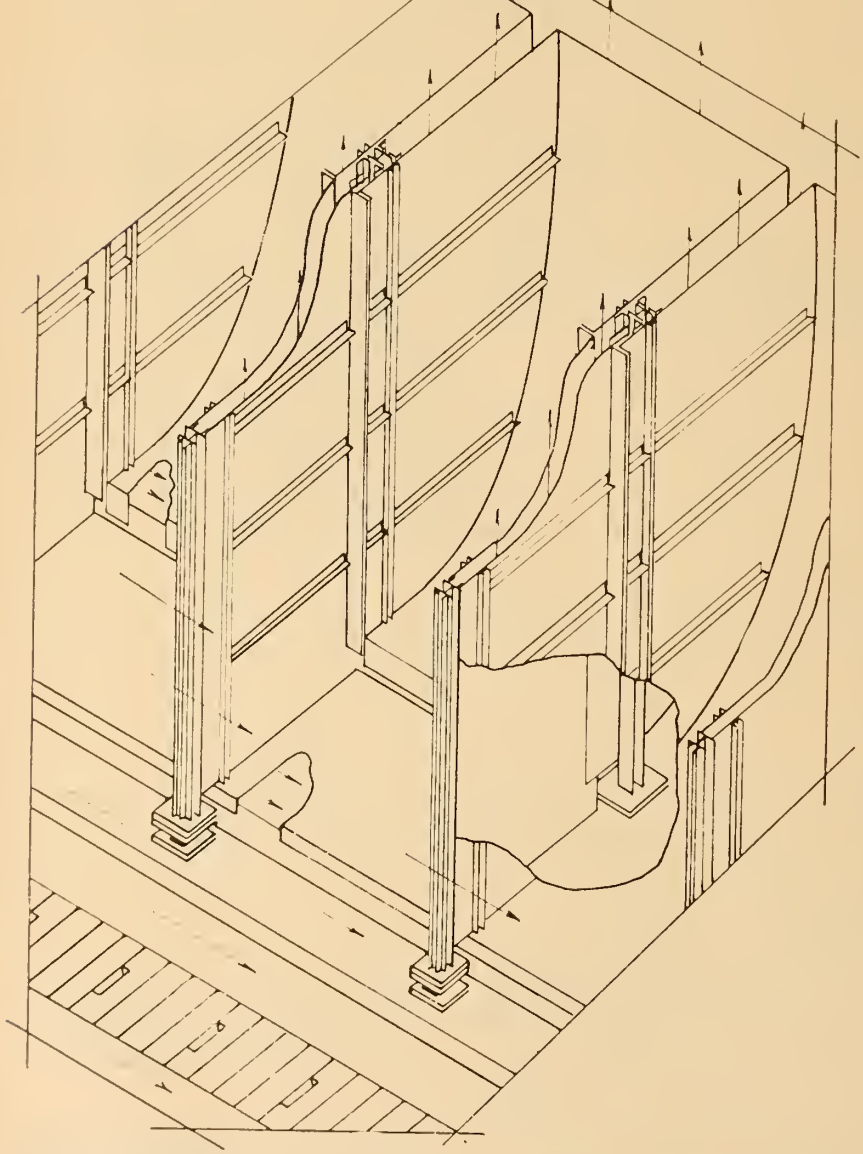

Fig. 7. Isometric view of pen design suggested for future construction.

oat, and (2) to find space for the istallation. The successful solution f both does not necessarily mean iccessful operation of the installa- ion. An additional diesel generating et must be operated almost con- inuously, adding to the work of he engineer, and providing a source f noise which cannot be tolerated uring foggy weather.

As an attempt to overcome these lrawbacks, a large tail shaft genera- or could be installed to carry the efrigeration load, as well as the ormal boat load when the main ngine is operating. Such a unit would have great usefulness on a rawler, but much less on a schooner where the main engine is idle for a great deal of the actual fishing period. Besides adding to the cost of the installation, this unit would add to the load on the main engine, which is never a wise or popular move.

The costs and difficulties of an electrical installation aboard schoon- ers for purposes of mechanical refrigeration proved to be so high that we doubt the wisdom of such an investment. One's money might be recovered from an installation in a trawler not more than five years old. For new construction of trawlers of about 100 ft. and longer, it appears to be economically sound and basically necessary to refrig- erate.

For a new boat, we would suggest the installation of a 20 kw. tail shaft generator and a 20 kw. auxili- ary diesel generating set, each capable of handling all lighting, pumping, and air compressor loads as well as the refrigeration load. These can be installed at somewhat less cost than the customary 10 kw. tail shaft and auxiliary diesel generators, and an additional diesel generating set of 10 kw. capacity to handle refrigeration require- ments only.

Fish Pen Construction

In comparing costs of wood and metal holds, one can be deceived by the low initial cost of wood and the high cost of metal. The metal constructed fish pens, described earlier, cost four times the equiva- lent of wood construction on a material basis alone. Construction costs are much higher for metal than for wood. However, mainten- ance costs for well designed, heavy gauge metal pens should be negli- gible. Presupposing this, the yearly cost of a metal hold installation based on full depreciation of the investment over 20 years, would be about 20 per cent higher than that for the wood hold.

The foregoing has shown, how- ever, that metal pens permit us to properly refrigerate a fish hold. Wood pens do not. When wood is used, pen sides are placed in direct contact with either cement finished or caulked plank "ceilings". False pen bottoms are not used because they are not watertight. This auto- matically makes artificial refrigera- tion of pen bottoms and back walls impossible for practical purposes.

We are now in a position to assess the merits of metal lined fish holds. The two metal lined trawlers have been inspected from time to time in connection with serviceability, strength, resistance to wear, and ease of cleaning, each factor being associated with some phase of the original design and construction features. The information and ex- perience obtained indicate that fu- ture plans could be profitably directed to the construction of "unit" pens of solid metal compo- nents. It would seem definitely worthwhile to build and to test this type of pen in actual fishing opera- tions.

Pen shells of heavy metal sheet construction could be utilized in the fish hold. These pens, as shown in Fig. 7, could be made in the shop in two sections, which could be assembled with bolts aboard ship. To facilitate original installation, as well as to permit periodic or arbi- trary inspection of the ship's side behind the pens, the row of stan- chions next to the "run" of the hold could be designed for easy removal, the outer rows being per- manently fixed in position.

In essence, each pen when in place is a large metal box, appropri- ately shelved, and supported away from the ship's "ceiling" and deck, and watertight as far as leakage through pen sides and backs is concerned. Structurally, these pens are separate units and thus not subjected to strain by the "working" of the boat. The pens are supported off the ship's "ceiling" by spacers and, by proper design at areas of contact with the stanchions, are restrained from moving. If spacers are varied in size to make up for changes in the shape of the fish hold, pens of uniform size and shape can be built.

At the worst, two or three dif- ferent sized pens might have to be designed for a fish hold. Construc- tion costs are minimal because: (1) standardization of pen compo- nents is achieved, and (2) all fabri- cation is done in the shop. Drainage from the pens is toward central gurry troughs, hence the wood "ceiling" and insulation are not subjected to wetting. This permits the use of low priced, commercial insulation.

Cold air can be circulated be- neath and up the back, in front of and over the top of each fish pen, as well as between all the pen par- titions. Finned evaporator coils or cold plates, located at one end of the hold, can be used to refrigerate this air. In this arrangement, the fish hold is refrigerated much as the conventional holding rooms on shore, with the exception that there is positive cold air circulation through- out either the "open" or the "closed" jacket.

In the case of the conventionally refrigerated hold, where pipe coils or grids are installed under the deck, the fish pens can be refrigerated exactly as boxes piled in a shore storage, in such a manner that circu- lation by convection is permitted around a group of the containers. The new pen can be worked by the fishermen exactly as the con- ventional pen.

Any trawler hold can be fitted with these pens, even after con- struction of the boat is completed. However, the most economical way would be to have the trawler deliv- ered with properly specified fish hatches and stanchions in place, but with none of the other metal work in the hold started.

Conclusion

A study has been made of the possible means of handling the product and leakage loads in the refrigeration of fresh fish at sea. It has been shown that ice is still the logical choice to take care of the product load. In solving the problem of control of leakage heat, it has been demonstrated that a cold wall jacketed and insulated fish hold, possessing a watertight metal lining is superior to the insu- lated, non-refrigerated, metal lined hold.

The quality of fish landed by boats with these jacketed holds is governed only by the handling and icing of the fish, since heat leakage into the hold is stopped completely. For this reason, such refrigeration and hold facilities should definitely be considered for all new boats, bearing in mind the size of the craft, the type of fishing in which it is to be engaged, and the probable length of trips. Pen construction and pen facilities should be provided on the basis of past experience, and this would indicate a preference for the type of pen described immediately above. ✓

High Temperature Hot Water Boiler Plant at Dartmouth

by

J. G. Frost, M.E.I.C.

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Three years ago the author's firm was requested by The Central Mortgage and Housing Corporation to design the complete heating system for a housing development, to be constructed at Tuft's Cove, Dartmouth, Nova Scotia. The project consists of eighty-one apartment buildings, containing a total of five hundred and twelve apartments. The buildings are of two and three storeys in height, and the apartments vary in that they contain, in addition to the usual living room, kitchen and bathroom, either two or three bedrooms. The development is on rolling terrain, mostly rock, with the buildings at varying elevations. The whole project is intended to provide quarters for married personnel of the Navy, and is operated by them. Nova Scotia coal was stipulated as the fuel to be used.

The heating of the buildings proper was designed as a standard two pipe, forced flow, hot water convector system. The piping layout was carefully studied to allow the contractor to make the greatest possible use of prefabrication. It was felt that the economy which could be obtained in contract prices warranted careful study of the runs and risers, since the buildings and the rooms were much alike. Actual practice in the installation has indicated the value of the care taken.

The means of getting the heat from the central boiler plant to the apartment buildings was also the subject of much discussion. It was requested that the heating mains be run in tunnels, to avoid unsightly overhead piping on posts. The project was to be made as attractive as possible with mass housing, and the landscape people were quite definite on the subject.

A study of the terrain in which the heating tunnels were to be constructed showed that gravity flow of the condensate in a steam system was an impossibility, no matter where the boiler plant was located. The profile of the roads and cross sections through open spaces between the buildings gave no better result. It appeared that a large number of condensate return pumps would be needed, probably not less than one for each building.

This meant that at least eighty-one units would be required, with their attendant maintenance and operating cost. The distances to be traversed in the development indicated that steam at fairly high pressure would be needed which, in turn, dictated a pressure reducing station for each building or at least for each group of buildings, with duplication of piping in some measure if the latter were chosen. If low pressure steam were to be used, the pipe sizes would have to be very large to have some pressure available at the extremes of the system.

High Temperature Hot Water System Chosen

Consideration of these factors led to the conclusion that a system of heat distribution, much in vogue in Europe, had considerable merit. This was high temperature hot water. It is well known that, provided pressure be maintained, water temperature can be raised well above that at which it boils at atmospheric pressure. 125 lb. per sq. in. was proposed as the steam pressure necessary to get the heat to the extremes of the development.

The question arose: why not use water at about this pressure? A closed system would be provided: no return pumps or reducing valves would be needed; the heat exchangers in the buildings to provide hot water for heating would be approximately the same as for steam. The auxiliaries in the boiler plant would be reduced to circulating pumps with some means of make up to the boilers. It was finally decided that water at 350°F. (125 lb. per sq. in.) presented the best possibilities.

Investigations along these lines continued, and a search for a boiler to produce the hot water was undertaken. Several of the leading boiler manufacturers were consulted as to the best unit for the job. European literature was scanned and several solutions were offered. Most were of the forced circulation type boiler, but unfortunately none of these units had been built or used in Canada previously. The question

This paper describes a heating installation for a group of 81 two-and-three-storey apartment blocks from a central heating plant.

The European design chosen in this case, using high temperature hot water, represents one of few such installations placed in operation in Canada, and shows economies in first cost and in operation and maintenance.

expansion of water at these elated temperatures had to be considered. A look at this problem showed that the required expansion tank would be of significant proportions and of considerable expense to build, house and maintain.

The search then started for a boiler which had the ability to produce very hot water and which contained expansion space as well. Public funds were involved in this project and experimentation was impossible. Solutions offered to the problem looked as though they would cost more than the savings effected by using hot water in place of steam. The final answer was found in the ancient and honourable horizontal return tubular boiler, which, with some modifications, could provide a large expansion space above the water line for expansion, and which would be an economically competitive unit.

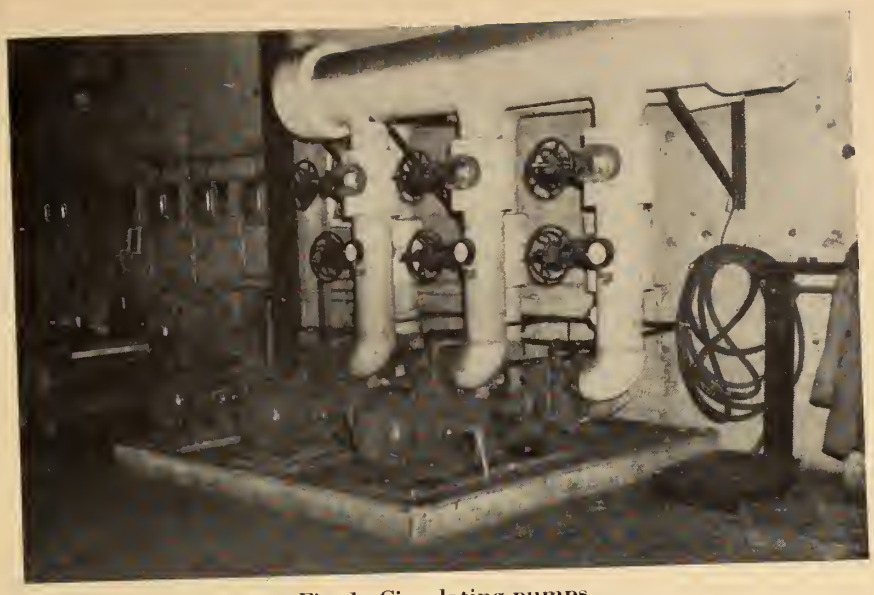


Fig. 1. Circulating pumps.

Boiler Plant

From this point design proceeded without great difficulty. Winter heat losses and estimated domestic hot water demands showed that approximately 800 horsepower of boiler capacity would be required, and good design made a standby unit necessary. Accurate information as to the summer demand for domestic hot water was, and still is, unobtainable for this type of housing. Estimates indicated however that provision for about 200 horsepower would be necessary. The boiler selection was finally made on the basis of 250 hp. HRT boilers to operate at a maximum of 180 per cent of rating, or 400 hp. each.

Three units were provided, one to act as a standby. Since the heating load is usually steady without violent fluctuations in demand, underfeed stokers offered the most economical answer to fuel firing, and were so specified. Calculations of the expansion of water at 350°F. showed that the boilers would provide the necessary expansion space with about the normal water line or a slightly lower one. Distribution of the return water and tapping of the boiler for supply water was carefully studied to avoid short circuiting.

For this development, the supply

Fig. 2. Front view of 250 hp. H.R.T. hot water boilers.

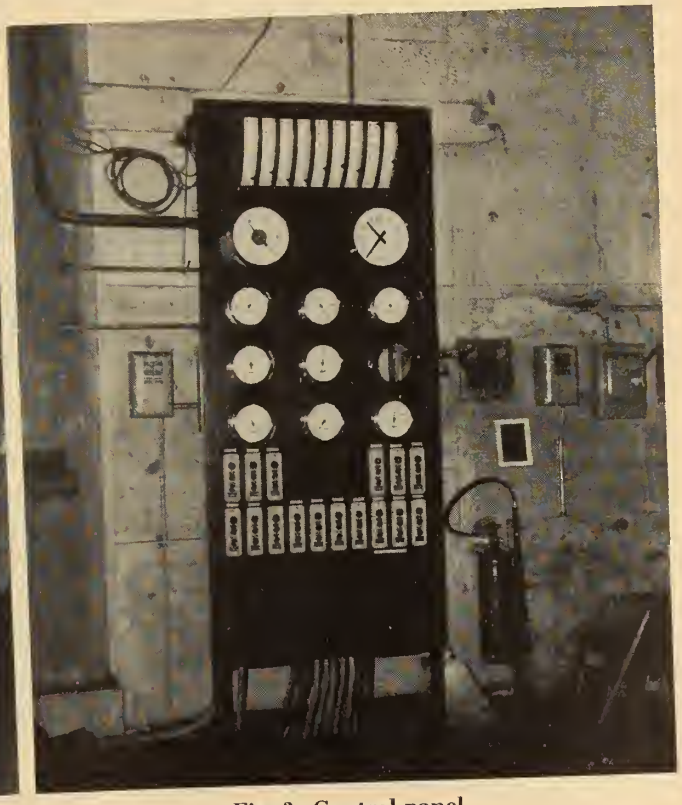


Fig. 3. Control panel.

was taken off the boiler at the side below the water line, and the return was fed to the boiler in the usual way, from the top down, but with a long interior distributing pipe. In the boiler itself, the top row of tubes is one row lower than is usual for a normal HRT unit, and the water line is considerably lower than usual. The velocity in the mains is approximately three feet per second. Water leaves the plant at 350°F. and the designed temperature drop is 100°F. In actual practice, the observed temperature drop is approximately 60° to 70°F.

As the layout developed, it was early decided that the system should be kept as closed as was possible with steam use kept to a minimum. This in turn would keep make-up and consequent corrosion to a minimum. All auxiliaries would therefore be electrically driven, and steam in the expansion space would serve to maintain pressure only. At this point any resemblance to a steam station ceased. Boiler water levels had to be maintained level with each other, involving steam and water balance pipes interconnecting the boilers. Much study was given to the piping around the boilers and the end result provides simple connections much like that around a battery of hot water boilers operating below boiling temperature. Shut-off valves are provided between boilers on both steam and water sides for isolation purposes. Headers are provided to which the tunnel mains connect.

Auxiliaries

Make-up is provided from a tank standing over two pumps, each pump having a capacity of twelve gallons per minute at 300 feet head, one being a standby for the other. These pumps are electrically driven. Circulation through the tunnel mains is provided by three centrifugal circulation pumps, each of 450 gallons per minute capacity at fifty feet head. These constitute the major auxiliaries in the boiler plant, apart from the coal and ash handling installation, draft fans and stoker drives. The circulating pumps were selected for high temperature operation and have water cooled bearings.

The coal handling plant was designed to use run-of-mine coal from railroad cars, and consists of the usual track hopper, coal crusher elevator and conveyor to a steel suspension type bunker, having a capacity of some 250 tons. It is fed to the stoker hoppers by coal spouts, in which are installed chain operated coal flow meters. Ashes are handled by a pneumatic conveyor system to an ash receiver outside the building. Due to the desire to keep boiler water make-up to a minimum, the vacuum for the ash conveyor is induced by means of a Roots type blower. An air washer is incorporated into the return air circuit, to clean the air of dust completely to avoid troubles with the blower.

Since the plant is quite close to the apartment units and reasonably close to a major air field, the boiler stacks are low and of the venturi type with dust collector ahead of the induced draft fan. The discharges from these collectors discharge to the ash conveyor and ejector points are also provided at the rear of the boilers adjacent to the cleanout doors behind the bridge wall.

The piping installation in the tunnels presented no particular problems. As would be expected the supply and return lines are both of the same size, 8 inches diameter at the boiler plant. At some points in the circuit it was possible to arrange for reverse returns, and advantage was taken of this wherever possible. Expansion in the mains is absorbed by slip type packed expansion joints.

It is interesting to note that pipe costs in the boiler room and in the tunnels will work out lower for high temperature hot water than for steam, when power for the circulating pumps is approximately equal to that for the boiler feed pumps. The piping system can be designed so that pipe friction losses and therefore power for pumping, balances the power required for boiler feeding.

It should be noted that no water treatment is required with the closed hot water system, except for the small amount required to treat the make-up. Blow-down at frequent and regular intervals is unnecessary. Some difficulty was experienced at the start of the operation of this plant to keep the operators from blowing down the boilers. Eventually it was seen to be a waste of deaerated water, which did little or no good and at the present time blowing down occurs rarely.

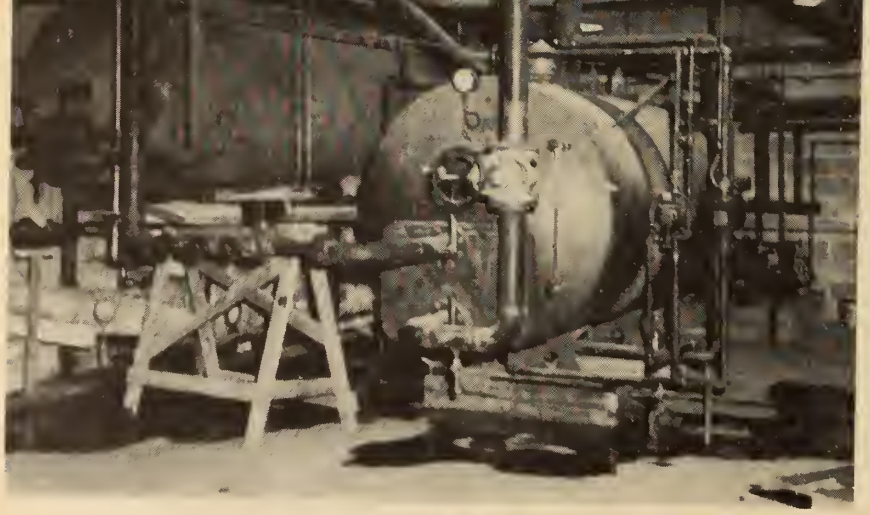


Fig. 4. School boiler room showing evaporator (right) and hot water tank (left).

Controls

The control instruments provided with this boiler plant are mounted on a single panel, and show the operating pressure at each boiler, supply and return temperatures in the mains leaving the boiler room. A water velocity indicator indicating the flow of water in the supply main is combined with a low flow alarm. These, together with flue gas thermometers, draft gauges and a remote reading outdoor thermometer constitute the instruments provided on the panel. Recording CO_2 meters are provided at each boiler to give some combustion control.

All motors in the boiler plant have remote control push buttons on the control panel. It should be noted that provision for the equivalent of the usual "steam flow-air flow" type of control is not possible with

ormally available equipment to measure heat produced. Investigation was made into equipment to provide efficient combustion control, but the cost was so far out of line that the idea was dropped.

Heat is provided for each building heating system through a heat exchanger connected to the mains in the tunnels. The heat exchangers heat the water in the building systems to a maximum of 180°F., which is circulated through the convectors by the usual circulator. A self-operated shut-off valve is provided to cut the flow from the mains when the building heating water rises above 200°F., as a safety device to prevent boiling this water.

The domestic hot water for each building is also provided by a 100 gallon storage heater, with a heating capacity of 80 gallons per hour. The heating medium is the boiler water from the tunnel mains operating through a tube bundle in the storage heater. This would appear to be somewhere nearly correct since there have been no complaints due to a lack of hot water. Some trouble has been experienced with the self-operated control valves for the domestic hot water, which has resulted in complaints because the water was too hot.

The building heating systems are controlled by outdoor master thermostats, five in all, which set the submaster thermostats, one of which is located in each building. Each submaster thermostat operates a control valve on the heat exchanger, to maintain the water supplied to the building at the set point determined by the outdoor temperature.

Each building is provided with an indoor thermostat, connected in such a way that it can only reduce the temperature in the building. In this way it is not possible to grossly overheat the buildings, as so often happens. Some complaints have been heard of cold apartments where the temperature has been read at 80°F. and there have been some legitimate complaints requiring adjustment of the controls. The control system is air operated from a compressor located in the boiler room, with the control tubing running in the heating tunnels.

Evaporator Used for Extension

After the plant was completely designed and under construction, it was decided to provide the project with a school. This was to be constructed from drawings of a standard school built for the Department of National Defence. The system of heating in this building was by steam at low pressure and no change was desired to the layout because of the cost of changes. At the same time it was desired that the school be heated from the central boiler plant. The original heating system showed one boiler for heating the building, with a second unit providing hot water for domestic use.

The solution of the problem of having to heat from the central plant was found in an evaporator, which operates in reverse of the usual heat exchanger. It uses water at 350°F. in a tube bundle to make steam in a steel shell at a maximum of 15 lb. per sq. in. The usual return pump and other boiler trimmings are found on the evaporator which has provided satisfactory heating in the school building throughout the past winter. The system appears to operate well and the operating staff are quite intrigued by their boiler which uses hot water as fuel and makes steam. The domestic hot water is provided by a large storage heater using water from the tunnel mains as the heating medium.

Savings

This is one of the few high temperature hot water boiler plants of any magnitude to be placed in operation in this country. It should be repeated that there is nothing particularly unusual in the plant itself, since it is quite common on the other side of the Atlantic and is coming into use in the United States. There is apparently considerable economy in first cost, and greater economy in operating and maintenance cost over steam plants of equivalent size and pressure. Its use, where little or no steam is required for process work would appear to be definitely justified.

The life of boilers and piping would appear to be greatly lengthened over that of equivalent steam plants, due principally to the closed water system. This latter statement is a belief based on experience with hot water heating systems operating at the more usual temperatures. Here it has been noted that steel heating boilers stand up for much longer periods before replacement is necessary, and that piping in hot water systems shows little or no corrosion after forty years and more of operation.

The project as a whole was designed by the architectural staff of The Central Mortgage and Housing Corporation. The prefabrication principles which underlay the heating design were well worked out by the contractor, and extended by him to the equipment rooms in the buildings. Most of the piping in the buildings was prefabricated in a shop on the site, leaving a minimum of welds to complete the connections. √

A Report of the

ANNUAL MEETING

HALIFAX

MAY 1953

will appear in the July issue of the *Journal*

Underpinning on the Toronto Subway

by

R. Harding Scrivener, M.E.I.C.

Rayner Construction, Limited, Toronto.

In 1950 when Rayner Construction, Ltd., was preparing its estimate prior to bidding on Sections 3, 4 and 5 of the Toronto Transportation Commission's subway, several interesting engineering problems arose. One in particular really captured the imagination of the company's engineering staff as a type any engineer would enjoy solving. It was a problem in underpinning.

Northward from Pleasant Boulevard, the subway leaves an open cut section to dip beneath the surface, emerging again some 2,000 feet further on in another stretch of open cut. This underground portion of the subway passes directly beneath a 700-ft. city block between St. Clair Avenue and Heath Street, filled with large commercial buildings. According to the specifications, the reinforced concrete subway structure, 35 feet wide and reaching a depth of 45 feet below the surface, was to be built directly under many of these buildings, but in no way was the work to interfere with these buildings or with their regular use. Directly across the path of the subway for a distance of 700 feet lie one apartment building, two theatre auditoriums and one theatre mezzanine, as well as a portion of a high theatre wall, two smaller buildings and two large stores. An idea of the size and scope of this operation may be gained from a study of Figs. 1 and 2.

The TTC required that:

a. The buildings must be supported without any part of their weight being carried by the subway structure.
b. The system of underpinning used must be of a permanent nature and therefore in conformity with the local building code.
c. Business must be kept "as usual." Any interference with the use of the buildings by their occupants would not be tolerated.

But to the contractors there were three other requirements more important than those just mentioned. First, the method must be completely safe; second, it must be economical; and last, but most important, it must not complicate the building of the subway structure. Thus, the solution of this problem required real ingenuity in order to satisfy customers, store-owners, theatre managers, apartment dwellers and the TTC.

After examining and rejecting several schemes, a system of underpinning these buildings was settled upon which would, it was felt, be basically simple and would satisfy every requirement when put into practice. In fact, it was the only one of those considered which promised to be satisfactory.

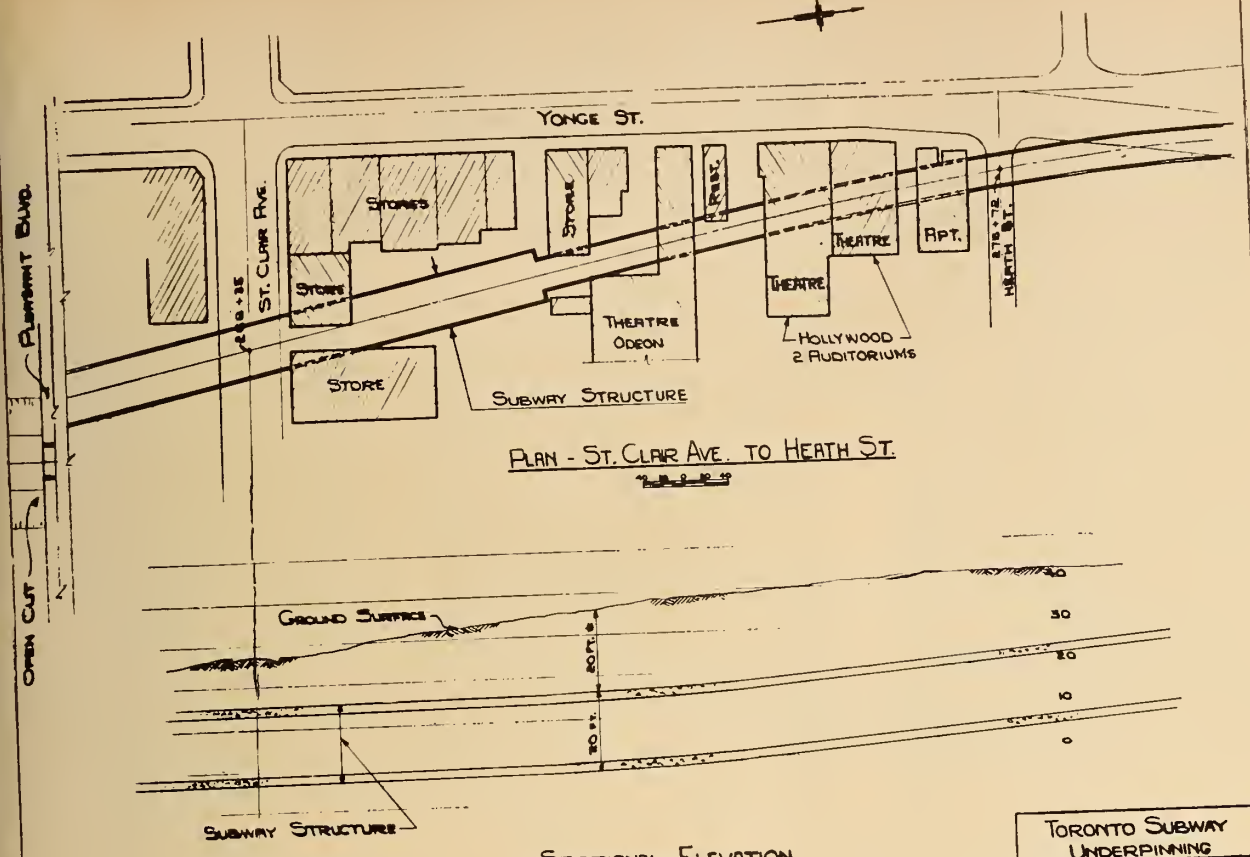
The solution to the problem lay in building two continuous parallel concrete walls the full 700-foot length of the city block, their height to be from ground level to three or four feet below the bottom of the subway structure, and their distance apart to be the outside width of the subway. With steel placed across the tops of these walls to support buildings and to act as struts, the ground between them could be excavated and the subway built in the clear. This arrangement is shown in Fig. 3.

The advantage of this method was that it would not only carry the buildings immediately over the subway, permitting unobstructed excavation, but that it would also give firm and unyielding support to the ground on each side of the subway. Thus, at one stroke, the underpinning of many individual buildings, floors and footings lying inside the "slip line" of the subway excavation would be eliminated. It is believed that the adoption of this method led to savings in cost and in time.

It was a lengthy step from this early conception to the final, completed design from which costs were estimated. The first move was to gather data on the structural details of each building. From a few drawings and from numerous examinations of the buildings themselves, the probable weight of the structures to be carried was estimated. The addition of live loads and snow loads completed the building load picture.

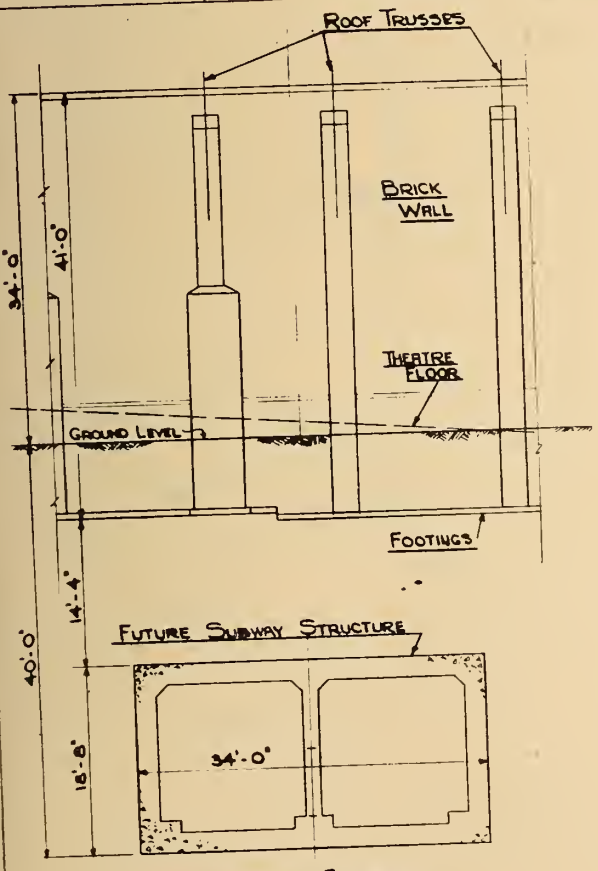
The next step was to determine the stresses produced in the parallel concrete walls by the lateral earth pressures which would develop as

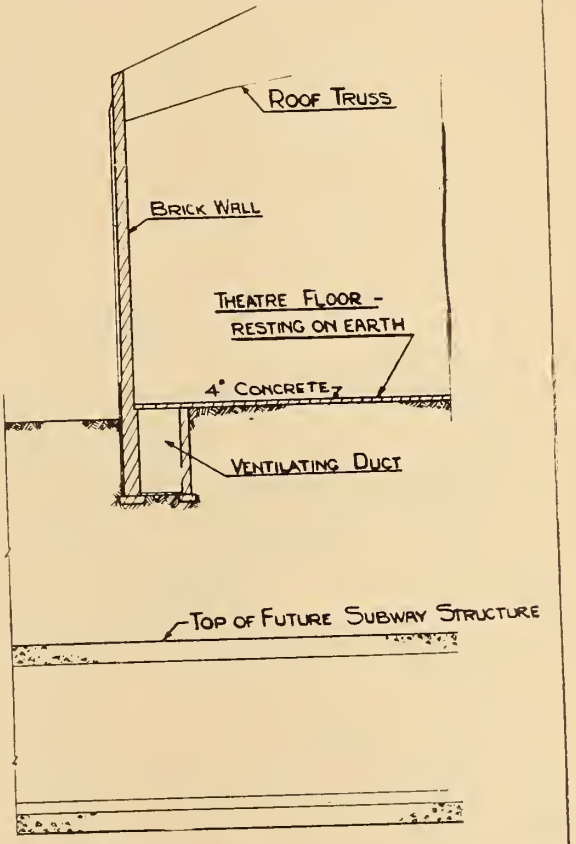
Transit subways in developed areas always require extensive underpinning operations to protect adjoining structures. Toronto's subway is no exception to this rule. This paper presented before the Toronto Branch on April 13, 1953, describes the methods used by one contractor and is noteworthy because it outlines in more than ordinary detail the various steps contributing to success.



TORONTO SUBWAY UNDERPINNING
RELATION OF BUILDINGS TO SUBWAY STRUCTURE

FIG. 1





TORONTO SUBWAY UNDERPINNING
SUBWAY PASSING UNDER THEATRE

FIG. 2

the earth between the walls was excavated to make way for the subway structure.

Estimation of these stresses was complicated by the number of intermediate strut levels required to keep the walls separated. Hence, the stress condition in the walls corresponding to each stage of the excavating operation was plotted graphically.

By combining the vertical and lateral stresses the amount of reinforcing steel and the concrete strength required for each part of the wall could be arrived at. It will be noted that the wall thickness was uniformly two and one-half feet. This is greater than was actually needed to meet stress requirements, but it gave the minimum space in which the men excavating the wall could work effectively.

Following the design of the concrete walls, the numbers and sizes of steel beams required to carry the building walls and floors were selected. Here it was necessary to determine the most likely combination of maximum dead and live loads. Some buildings, such as apartments and stores with small changes in live load, did not offer any particular problem. But in the theatres, the permissible deflections had to be sharply limited, otherwise the wide fluctuations in live load might cause undesirable flexing of the structure.

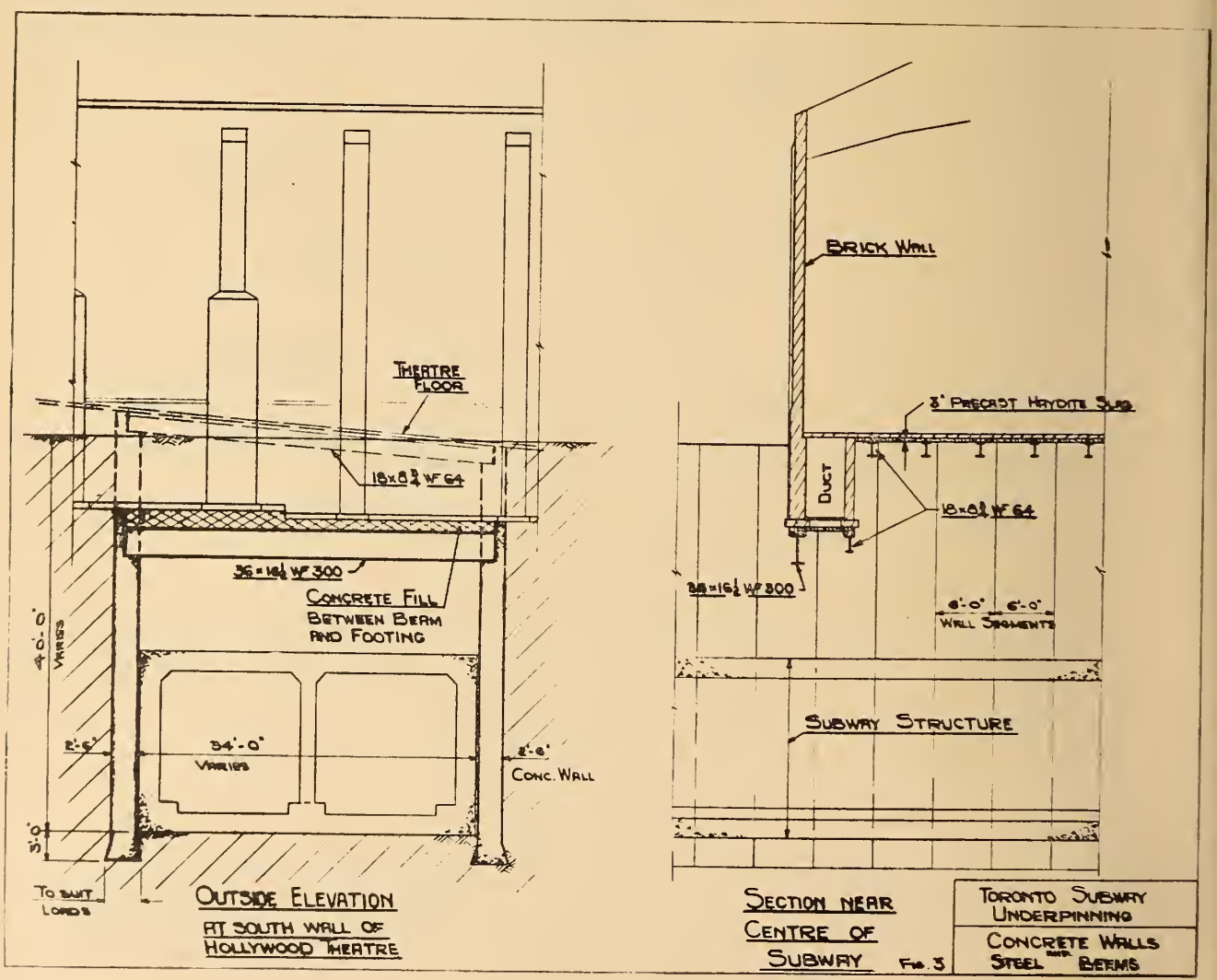
The details of the concrete walls and the steel beams were worked out with their actual building and installation always in mind. Simplicity and ease of installation were a "must". It has been asked why concrete beams were not used instead of steel.

This idea was considered but rejected, since precast beams would be too heavy to handle easily and beams poured in place could not be loaded for weeks after pouring. This would have seriously delayed and complicated the work.

Typical of the walls and beams which were finally used are those beneath the floor of one of the theatre auditoriums. These are shown in Fig. 3. It will be noticed that the concrete floor is supported on small, precast, lightweight concrete beams. This special support was considered necessary in view of the uncertain strength and condition of the existing concrete floor. Further, the use of light precast beams was important to economy of operations, as they were cheap to prepare and easy to install. No other method of carrying the floor investigated was any cheaper or as safe and workmanlike.

Safety was the prime factor in this operation, consequently very special precautions to ensure against any slip-up were taken. Prior to commencing operations, each building was thoroughly studied, a detailed report of its condition made and numerous photographs of its interior and exterior taken.

Since it was not hard to imagine that the slightest error could have had very serious consequences, each step in the underpinning was carried out with great care and under constant supervision. For instance



neath buildings soil pressures were duced by belling the bottoms of e concrete walls. This was to lp prevent excessive initial settlement and also to prevent soil displacement under the walls when xcavation was completed. Such isplacement would have permitted e walls to settle.

Also in the interests of safety, alls were carried three feet below ubway grade to be sure that the round under the footings was not isturbed during excavation, and hat sufficient earth would remain o prevent inward movement of the alls until the regular shores could e installed. As it turned out, this xtra three feet of wall depth had nother important function, in that t stopped the soft material encountered over part of this area rom flowing beneath the walls and so undermining them. Additionally, the individual wall sections were both keyed and dowelled together to insure resistance to vertical and lateral shearing forces.

As even the slightest movement of building walls had to be avoided, their vertical positions were checked by instrument continuously at several points. These control points were selected and their elevations determined before work began. Furthermore, the position of these control points was checked continuously during every step of underpinning, and the amount of deflection finally jacked into the steel beams was just sufficient to maintain these points at their original elevations.

Finally, after underpinning any component of a building, the vertical position of the original reference points was checked for at least a month.

These measurements were plotted graphically, thus permitting any large changes to be noted at once, and also to determine the rate and trend of any gradual movements. After a few days of slight change, the structure generally became stable.

While it is one thing to visualize and to design a method of underpinning to meet a specific condition, it is quite another to put that method into effect. It was important that this operation should proceed smoothly and without unhappy incident, therefore, rather selected and refined methods were used in the field. Fortunately, the methods finally evolved worked well, combining a high degree of safety with economy. The success of any underpinning operation is decided in the field: the best system can come to grief if not properly carried out.

Building concrete walls on either side of the subway was the first field operation. These walls were made in six- or eight-foot sections, extending from the surface to three feet below the bottom of the subway structure. Each section was heavily reinforced and dowelled into the adjoining ones.

To build an eight-foot length of wall, a solidly sheeted shaft, eight feet long by two feet six inches wide inside, with one long inside edge coincident with the neat line of the subway structure was sunk. Then the shaft was excavated to three feet below grade, the reinforcing steel and dowels placed and the whole filled with concrete.

An eight-foot undisturbed space was left between this completed shaft and the next. Upon completion and concreting this second shaft, a gap was left when moving to the next shaft. Later, when the original shaft concrete had had sufficient time to set the by-passed sections of wall were excavated and concreted, thus making a continuous structure.

The first shafts, being a "trial run", so to speak, were excavated in an open area, but immediately, trouble developed. When the first six shafts were only ten feet above final grade, bad ground was encountered—a combination of fine silty sand and a heavy flow of water. This material flowed into the shaft as fast as it could be removed, soon bringing the whole operation to a halt. Obviously, not only was no headway being made, but further excavation would only cause the surrounding ground to sink.

Since it was necessary to develop some fast and efficient means of continuing the shaft excavations, a series of ground control experiments was commenced. First, forcing a steel shield down through the quicksand ahead of the excavation was tried. This failed. The sand continued to boil up from the bottom as if the shield didn't exist. Then, well-pointing the bottom was tried, but in that cramped area not enough points could be used to be effective without interfering with excavation.

It was concluded that the last ten feet of the excavation would have to be lined with vertical tongue and groove sheeting, jetted and driven well below the bottom of the shaft. Since to have driven this sheeting inside the existing shaft linings would have drastically reduced the cross-section of the concrete wall, it was necessary to retimber the bottom 15 feet of the existing holes and to enlarge them by one foot on all sides. This plan is illustrated in Fig. 4.

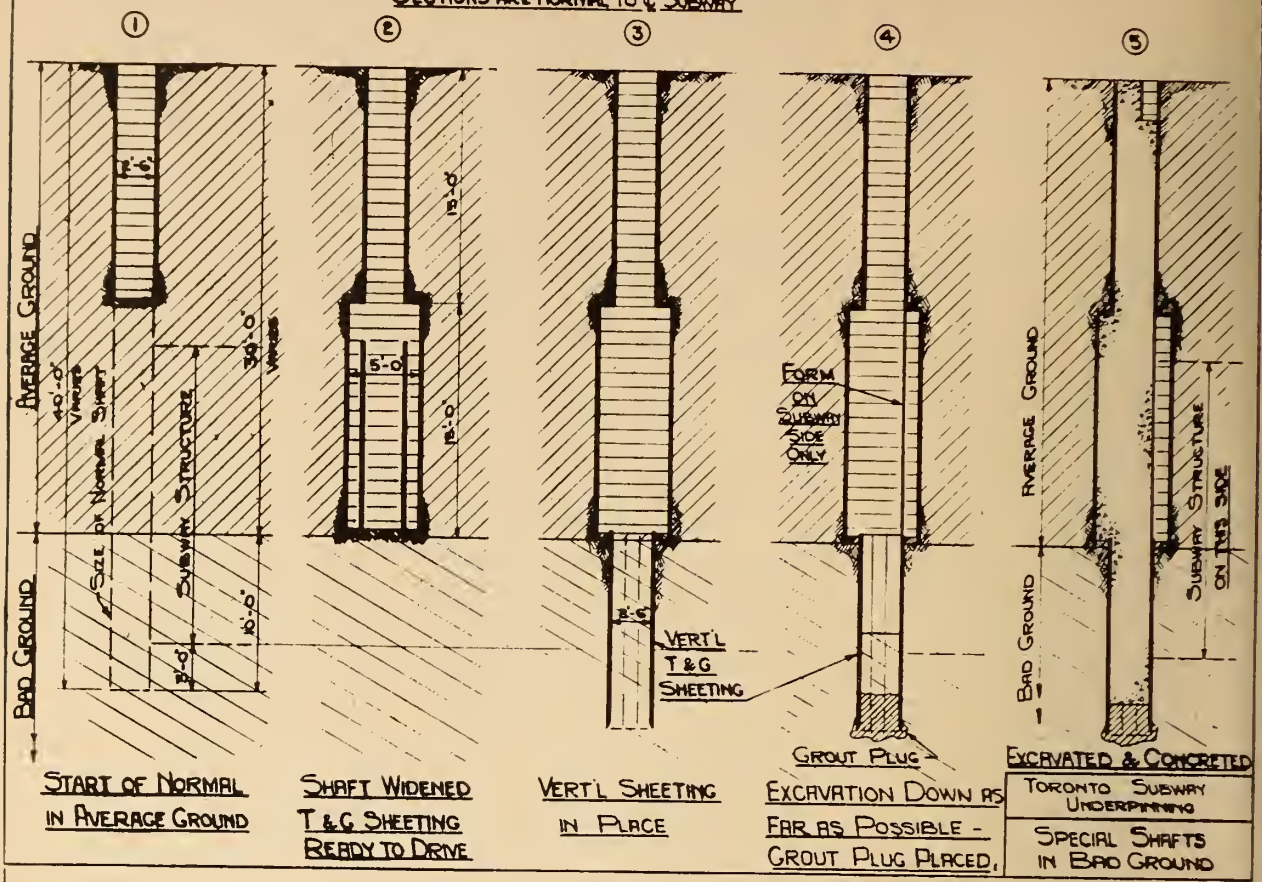
Once the shafts had been enlarged, the vertical sheeting was placed and driven. Protected by this sheeting, another six feet was excavated, but the upward flow of sand and water again halted operations. At this point, the outside pressure was sufficient to force earth down under the toe of the sheeting and upward into the shaft. Forcing the holes down by fast digging was tried, but the flow was so heavy grade could not be reached this way.

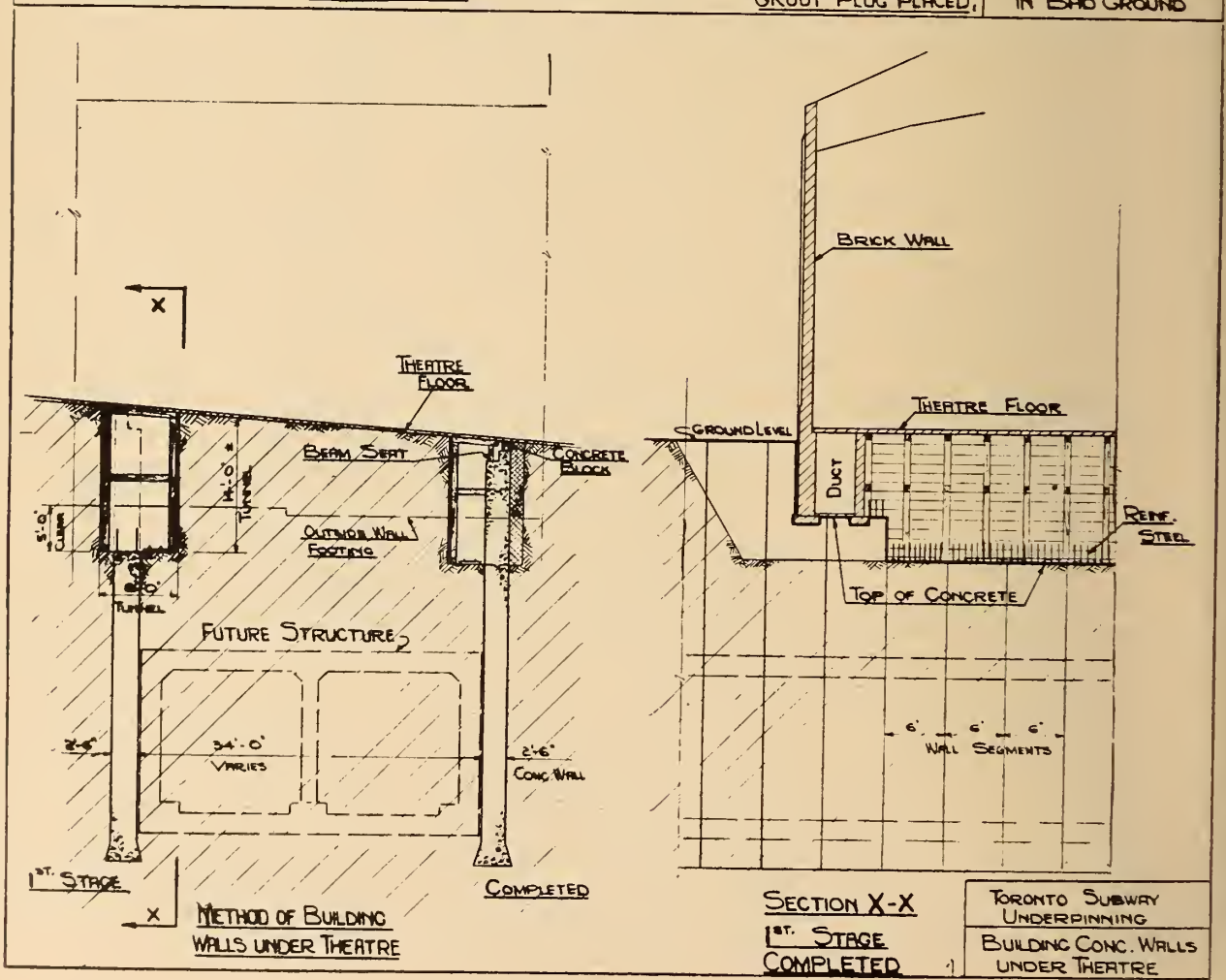
The next move was to try to consolidate a plug of sand across the lower end of the vertical sheeting with injections of calcium chloride and sodium silicate. This was a complete failure. Then cement grout was injected into the sand. This formed into solid pencils, but did not solidify the whole area. However, it was felt that with some improvisation, this at least offered a chance of success. Experimentation showed that the grout could be dispersed evenly through the sand, thus plugging the bottom of the vertical sheeting. It was also found that the properties of the solidified sand could be controlled so that, while it was strong enough to act as a plug, it could still be trimmed easily with a pneumatic clay spade. In this way, all the unsolidified material above the plug was removed. In some instances, grout was injected through the sides of the sheeting to control leaks. Having overcome these initial difficulties, the concrete walls could be built much faster than necessary to keep ahead of the steel beam placing operation.

To build the concrete walls under buildings, tunnels were driven under walls and floors, working from both sides of the building at once.

Each tunnel followed the line of a wall and was wide enough to facilitate the removal of excavated material and the placing of concrete. The wall was at first concreted only up to the tunnel floor level. When the wall was completed under the building up to the tunnel floor, the rest of it up to within two feet of the building floor was poured as one continuous length the full width of the building. The space between the concrete wall and the underside of the floor was filled with concrete blocks. The arrangement of the tunnels relative to the buildings and underpinning walls is shown in Fig. 5.

Once the concrete walls became


FIVE STAGES IN SINKING SPECIAL SHAFTS IN BAD GROUND
IN AVERAGE GROUND, SHAFT IS 2'-6" WIDE FOR FULL DEPTH
SECTIONS ARE NORMAL TO ℄ SUBWAY
①
②
③
④
⑤
AVERAGE GROUND
BAD GROUND
2'-6"
40'-0" VARIES
SIZE OF NORMAL SHAFT
SUBWAY STRUCTURE
30'-0" VARIES
10'-0"
12'-0"
5'-0"
16'-0"
2'-6"
VERT'L T&G SHEETING
FORM ON SUBWAY SIDE ONLY
GROUT PLUG
SUBWAY STRUCTURE ON THIS SIDE
EXCAVATED & CONCRETED
START OF NORMAL IN AVERAGE GROUND
SHAFT WIDENED T&G SHEETING READY TO DRIVE
VERT'L SHEETING IN PLACE
EXCAVATION DOWN AS FAR AS POSSIBLE - GROUT PLUG PLACED.
TORONTO SUBWAY UNDERPINNING
SPECIAL SHAFTS IN BAD GROUND


X
THEATRE FLOOR
BEAM SEAT
CONCRETE BLOCK
14'-0" TUNNEL
5'-0" CLEAR
OUTSIDE WALL FOOTING
8'-0" TUNNEL
FUTURE STRUCTURE
2'-6"
34'-0" VARIES
2'-6" CONC. WALL
1ST. STAGE
COMPLETED
X
METHOD OF BUILDING WALLS UNDER THEATRE
BRICK WALL
GROUND LEVEL
THEATRE FLOOR
DUCT
REINF. STEEL
TOP OF CONCRETE
6' 6' 6'
WALL SEGMENTS
SECTION X-X
1ST. STAGE COMPLETED
TORONTO SUBWAY UNDERPINNING
BUILDING CONC. WALLS UNDER THEATRE

continuous under a building and reached up to the underside of the floor, installation of the steel beams which were to carry the building over the future excavation was begun at once. The beams which were to carry the outer building walls were installed first. Work went on simultaneously at each wall.

Before a beam could be inserted under a wall, it was necessary to transfer the weight of the wall from the original earth to a series of needle beams evenly spaced beneath and at right angles to it. The needles were inserted one at a time and their outer ends caught up on small cribs. By jacking at one end of the needle, it could be preloaded sufficiently to take its part of the load. These needles were usually 12 x 12 wide flange beams, about 20 feet long.

By repeating this operation as often as 12 times per wall, the whole wall weight was eventually transferred to the needles and the space below it excavated to receive the main steel beam.

As this beam had been placed close to the building wall before work started, it was already between the wall and the needle cribs. Once all the needles were in place, it was a simple matter to jack the beam sideways to a position directly under the wall. With the steel beam in position under the building, its end seats in the beam recesses of the concrete underpinning walls were prepared.

Then a series of heavy jacks, one beside each needle, was placed on top of the steel beam, and with these jacks the weight of the building wall was transferred. This time the shift was from the needles to the steel beam. The space between the jacks and needles was filled with concrete from the top of the beam to the underside of the wall. The upper two inches of this concrete was hammered dry-pack.

As soon as the beam alone carried the wall, the needle beams and jacks were withdrawn and work on the final step commenced immediately. Concrete was poured into the remaining space between wall footing and beam top, where the needle beams and jacks had previously rested. The concrete between beam and wall was now continuous. The result was a wall securely carried on a properly preloaded beam.

While the preceding operation was simple enough, the very number of elements of which it was made up constituted a considerable hazard and increased the chance of accident. Thus, while the numerous safety devices outlined earlier may seem to indicate overcaution, it is not hard to understand why they were felt to be necessary. Of special value were the instrument checkpoints, graphically charted. This step is strongly recommended for any similar job.

The floors of all the buildings were merely thin layers of concrete poured directly on the earth or on a bed of cinders. The heaviest floors were those in the theatres and they carried the seating arrangements directly. These were about four inches thick and only one was reinforced.

These floors were underpinned with a series of 18- and 24-in. beams, set at five- or six-foot centres and spanning the space between the two concrete walls. As the existing floors could not be counted upon to span six feet safely, a 3-in. thickness of light-weight reinforced concrete slab was inserted under the whole floor area.

As with all underpinning operations, the support system for floor areas was installed in small sections, the support for each section being made permanent before proceeding to the next. Generally, work was inward from the two tunnels previously constructed while building the concrete walls.

A seven-foot strip of floor adjacent and parallel to the outside wall was first excavated and temporarily supported on light-weight concrete slabs and wood posts. Steel beams were then placed in position (see Fig. 3) and wooden wedges driven between them and the precast slabs. The wedges were then adjusted to maintain the floor at correct level, and gradually replaced by grout. This procedure was repeated until the whole floor area was supported. Frequent occurrence of internal partition footings and of drains was a nuisance in this operation.

Some buildings projected only seven or eight feet over the subway structure; here a different technique was used to transfer their weight to the concrete retaining walls. Instead of using steel cross-beams, the top of the concrete retaining wall was cantilevered inward toward the centre of the subway.

These reinforced cantilevers were placed at intervals along the building wall. As with the steel beams, the floor itself was carried on precast slabs.

An important point in the successful use of these reinforced cantilevers is that space must be provided for the insertion of jacks between the underside of the building wall and the tops of the cantilevers. This permits the cantilevers to be preloaded sufficiently to balance exactly the weight of the wall, and also makes allowance for the fact that the cantilevers do not all deflect equally.

The methods devised to meet the problem of underpinning these heavy buildings were all completely successful; operations proceeded steadily without incident. Component operations were simple and safe, and the contractor had full control of the structures at all times.

There were no failures, no evidences of overloading, nor other unexpected developments. The initial outlay on planning and design was repaid many times over by the economies achieved from smooth and efficient operation in the field.

In summing up, one cannot stress too strongly the primary rule —there can be no guesswork in underpinning. Each step must be carefully analyzed, not only from the viewpoint of its effect on the structures involved, but also from that of practicability. And finally, once a procedure has been decided upon, it must be followed to the letter. √

Future Annual Meetings of the Engineering Institute:

QUEBEC, QUE.—May 12, 13, 14, 1954
Chateau Frontenac

TORONTO, ONT.—May 11, 12, 13, 1955
Royal York Hotel

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

The President at the Coronation

The Institute was greatly honoured by an invitation for the president to attend the Coronation, with a seat in the Abbey. Mr. Ross L. Dobbin who took over the presidency on May 22nd has accepted, and will be in England before this issue of the *Journal* appears.

The Royal Command to so important an event is perhaps the greatest honour and finest recognition that has been given the Institute and the profession in Canada. Members throughout the world will be pleased that Mr. Dobbin has been able to attend.

The officers of the various British institutions of engineers have arranged an elaborate program of events for Mr. Dobbin, including the Queen's garden party, Trooping of the Colours, the Royal Aeronautical Society's garden party, the Royal Tournament, reception at the Royal Institute of British Architects, the Institution of Mechanical Engineers Annual Conversazione, Institution of Civil Engineers Annual Conversazione, the Derby, and so on. He will also be the guest of the Lord Mayor of Belfast for a time.

This Royal Command document has been photographed and a reproduction appears in this issue.

President R. L. Dobbin boarding his plane at Dorval, Que. en route to the Coronation.

Distinguished Visitors

During May Headquarters was honoured by visits from two distinguished engineers, one from France and one from England. Officers of the Institute and other members entertained them at luncheon at the University Club.

J. Foster Petree is editor of the long established publication "Engineering", and also is president of the Newcomen Society of Britain.

Armand Mayer is a French engineer, long associated with the development of soil mechanics. He has been sent to Canada by the Cultural Relations Branch of the French government. He spoke at Institute Headquarters to a group of soil mechanics specialists and also attended the annual meeting of the Institute at Halifax.

Cover Picture

Our cover picture this month shows one of the aircraft used to serve the mining development south of Great Slave Lake, N.W.T. (See article on page 703).—*Photograph by George Hunter, Ottawa.*

The President Finishes His Travels

No other president has faced the task that has just been accomplished by J. B. Stirling. The continuing growth of the Institute in members, branches and activities has brought about a new set of conditions with regard to presidents and branch visits.

Today there are 46 branches and four branch sections. Mr. Stirling visited them all. As well he visited 16 universities and spoke to two Rotary Clubs. He represented the Institute at the UPADI conference in New Orleans, the Centennial of Engineering in Chicago and the annual meeting of the Royal Architectural Institute of Canada at Toronto. He presided at 11 meetings of Council and attended 6 meetings of the Finance Committee.

His travels in Canada included such faraway places as Prince Rupert, B.C., Prince Albert, Sask., and St. John's, Nfld. His total mileage was over 30,000, a truly impressive figure.

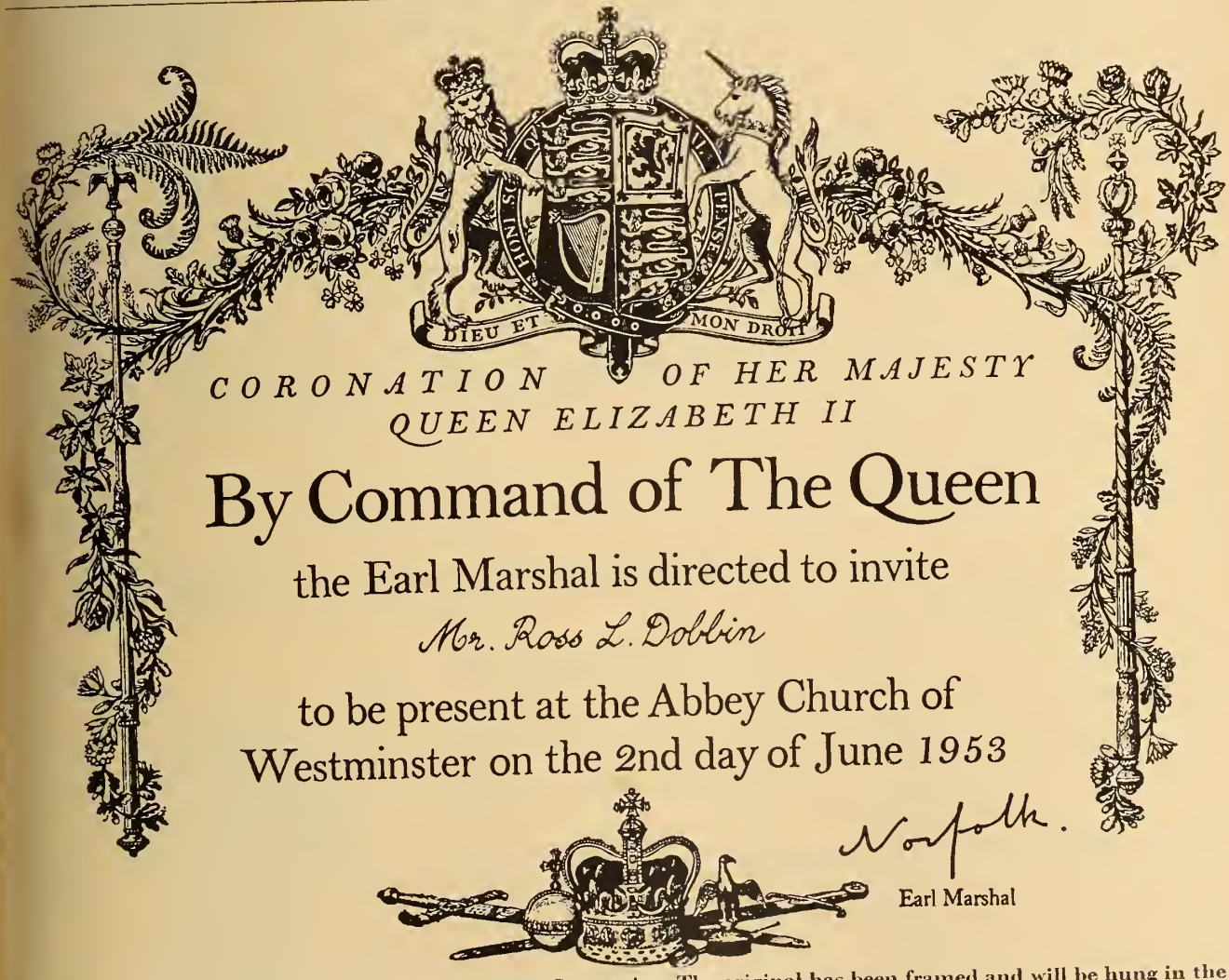
Not all members of the Institute appreciate what it means to be President of the Institute. He appears once at each branch and naturally a member thinks of him in terms of that branch. It is only when one sees the extensive layout of branches and the overall picture that the real immensity of the task can be sensed. The profession of engineering owes a debt to these men, that cannot be repaid. They are true disciples of the cause, doing a work for the engineers that cannot be done under any other circumstances.

Much is heard these days about publicity and public relations for the engineer. Perhaps no other means available to the profession provides as much good publicity as does the work of the president. Almost every daily newspaper in Canada has carried something about the Institute during Dr. Stirling's year of office. Clippings from hundreds of papers come to Headquarters, so many in fact that it is impossible to file them or to do more than give them a hasty glance.

As well as the daily newspapers there have been dozens of radio references to his visits and to his remarks, and there have been complete broadcasts. The college press too has given him much notice. It is doubtful if any person in Canada has been photographed more frequently in one year and has seen his own face in the newspapers more often than has our president.

It is ironical that a man who has so little taste for publicity should find himself so much in the public eye. He has accepted the situation in the hope and belief that it all might add up to "good press" for the profession. And so it has, much to the delight and gratification of members from coast to coast.

The latest branch visits have included Arvida, Shawinigan Falls, Sherbrooke and Quebec. As well a return visit was paid to the Maritimes to inaugurate a branch at New Glasgow, N.S. It took five days to visit St. John's, Nfld. and to in-



Reproduction of the president's invitation to the Coronation. The original has been framed and will be hung in the Headquarters Building.

augurate a branch at Corner Brook, Newfoundland.

The reports on these various visits will appear in News of the Branches, but it is worthy of note in this column that all meetings were outstanding. At the inauguration of the North Nova Scotia Branch at New Glasgow there were 60 present, and it was a gala occasion. An Institute banner and a cheque were presented by the chairman of the Halifax Branch, G. F. Bennett, to the chairman of the newest branch, Fred Morrison.

At the inauguration at Corner Brook, the president was accompanied by the assistant general secretary, Colonel H. G. Thompson, and of course, Mrs. Stirling, who has not missed a single branch visit, this too setting up a new record.

It has been a great year!

"We Can't Afford to Go on Wasting Our Limited Stock of Brain Power"

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This week the National Manpower Council handed to President Eisenhower a report which has a bearing on the standard of living and the personal safety of every American. Entitled "A Policy for Scientific and Professional Manpower", it is the first comprehensive study of the current shortage of engineers, physicists, teachers and physicians. The report also suggests remedies for these shortages.

The council, established at Columbia University in the spring of 1951, is an outgrowth of Dwight D. Eisenhower's tenure as president of Columbia. Although the general had gone to Europe by the time the council actually set up shop, it was "Ike's baby". Financed by a grant from the Ford Foundation, the council is composed of twenty leaders of industry, labor, education and the professions, under the chairmanship of James D. Zellerbach, president of Crown Zellerbach Corporation.

The council's report is detailed and lengthy, adding up to a fair-sized book. But it all comes, essentially, to this: that the United States is wasting scientific and professional brain power with astonishing profligacy, that it can't afford to go on doing this, and that something not only ought to be done about it but can be. Not enough young men and women mentally equipped for training in the sciences or the professions are getting such training; not enough of those who do get such training are being properly utilized. The result is shortages which hamper not only our defense program but also our national industrial and economic development.

How serious are these shortages? On engineers, the council quotes an estimate that the end of 1952 found this country with 25,000 fewer new engineering graduates than it should have had. The teacher shortage is measured by the fact that an all-time high of 65,000 elementary teachers had "emergency" teaching licenses at the end of 1952. No one seems able to agree on the present extent of the shortage of physicians, except that there is one. The President's Commission on the Health Needs of the Nation guessed at the end of 1952 that by 1960 the shortage would be somewhere between 22,500 and 45,000 doctors. As to physicists, while the lack here is relatively small numerically, the problem is especially critical "because of their great importance for national security"—meaning the atom bomb, among other items. Actually, the council notes, we need first of all, more reliable knowledge of our human resources. Its first recommendations are that four tions, universities, voluntary . Government agencies give m attention to obtaining such infor tion.

The council urges continued pu support of student deferment fr the draft, but calls for eliminatio draft exemptions based upon dep dency—this to plug a loop whereby some students have p layed their deferments into exer tions by getting married. The rep holds that Reserve Officers Train Corps directives might be ma more flexible so that highly quali graduates could pursue postgra ate studies before entering act military service. Marked impro ment in elementary and second education is needed, the cour continues, and more scholarship a fellowship programs are essent As to better use of existing ma power, the council calls on indus and government to re-examine th policies and eliminate wasteful tal "hoarding". It also urges the Pre dent to initiate a review of legis tion and administrative proced on recall of military reservists there will be a better division scientific and professional ma power between military and civili requirements.

A talent shortage cannot solved with the relative ease of, f example, a shortage of iron ore where the problem is to find a n ore bed and then go mine it. T Manpower Council's report, ho ever, serves to re-emphasize t severity of the problem, to clari the need for an end to our curre waste of talent, and to point t way—several ways, in fact—towa increasing our supply of profession and scientific manpower.

Technical Sections at Winnipeg

For many years the Winnipeg Branch has operated, very successfully, an electrical section. Encouraged by its success and by an expanding interest in civil engineering a civil section was formed in February.

The first report shows the organization and the first activities. Here are the ones responsible for the section:

Chairman, N. S. Bubbis; vice-chairman, W. B. White; executive, W. L. Wardrop, A. F. Thomson, J. C. Trueman, H. Brekke, E. H Martin, S. J. Borgford, Keit Ebbern, Angus Laughlin.

Already two meetings have bee held and it is planned to meet a least monthly. So far the attendanc has averaged 100.

Winnipeg is a rapidly expandin city. It is apparent that the branc is expanding with it. No doub other branches will be encourage by Winnipeg's example. There ap pears to be room for one or mor technical sections in severa branches.

A. E. Flynn is C.I.M. President

Canadian Institute of Mining and Metallurgy Elects Prominent E.I.C. Member as President for 1953-54

Arthur E. Flynn, M.E.I.C., professor of mining engineering at the Nova Scotia Technical College in Halifax, N.S., is the newly-elected president of the 55-year-old Canadian Institute of Mining and Metallurgy for the year 1953-1954.

Mr Flynn was born in England but received his early education in the United States before returning to his native country for specialized training at the Finsbury Technical College and the Royal School of Mines. He earned his A.R.S.M. and D.I.C. degrees by 1912 and proceeded to gain professional experience in England, Germany and Spain. He was then attracted to Cobalt, Ont., and its new development. While there, he designed and built the mining laboratory of the Haileybury School of Mines and served as one of its first instructors.

After spending two years in mining pyrites at Goudreau, Ont., and a year with the Hardinge Company at York, Penn., he was offered the mining engineering post at the Nova Scotia Technical College.

Since then, Mr. Flynn has played an important role in the development of the mining industry in Nova Scotia. He served for five years, in conjunction with his teaching duties, as development engineer for the Nova Scotia Department of Natural Resources. He has also made extensive research in the utilization of minerals in the Province, and has contributed many authoritative and invaluable papers on mining and metallurgical topics.

Mr. Flynn is a past chairman of the Halifax Branch of the Engineering Institute and a former councillor representing that Branch. He also served on the Council of the C.I.M.M., later becoming vice-president for the Maritimes as well as chairman of their Coal Division in 1948-1949. He is a Member of the Nova Scotia Advisory Board on Mineral Development and of the Board of Governors of Nova Scotia Technical College. In 1930 he was awarded the Leonard Medal of The Engineering Institute of Canada.

This certificate commemorates the Institute's participation in the Centennial of Engineering at Chicago in September 1952. It now hangs on the wall at Headquarters.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

1852 CENTENNIAL of ENGINEERING 1952

By Action of the Board of Direction

American Society of Civil Engineers

This Certificate of Appreciation is presented to

Engineering Institute of Canada

for its part in the celebration of the

Centennial of Engineering, 1952

This united effort demonstrated the importance of the art of engineering to the advancement of civilization.

For the Board of Direction:

John McCarey
Executive Secretary

Walter L. Huber
President

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Education's Place in a New Age

by Bertrand Russell

This article appeared first in the *Saturday Night* of March 7, 1953. It appears in *The Engineering Journal* through the courtesy of the original publisher and the author.

Engineers have become accustomed to adverse comments relative to the extensive development of the technical sciences at the expense of the social sciences. Here is an article that places the two in proper perspective without too seriously criticising either. The author is both a scientist and a philosopher—one of the world's greatest. He states the case with clarity, understanding and insight. Engineers will enjoy it greatly.—EDITOR.

Young people who are not completely frivolous are apt to find in the world of the present day that their impulses of good will are baffled by failure to find any clear course of action which might diminish the perils of the time. I will not pretend that there is any easy or simple answer to their bewilderment, but I do think that a suitable education could make young people feel more capable of understanding the problems and of critically estimating this or that suggested solution.

There are several reasons which make our problems difficult to solve, if not to understand. The first of these is that modern society and modern politics are governed by difficult skills which very few people understand.

The man of science is the modern medicine man. He can perform all kinds of magic. He can say, "Let there be light," and there is light. He can keep you warm in winter, and keep your food cool in summer. He can transport you through the air as quickly as a magic carpet in the Arabian Nights. He promises to exterminate your enemies in a few seconds, and fails you only when you ask him to promise that your enemies will not exterminate you. All this he achieves by means which, if you are not one in a million, are completely mysterious to you. And when mystery-mongers tell you tall stories of future marvels you cannot tell whether to believe them or not.

Another thing that makes the modern world baffling is that technical developments have made a new social psychology necessary. From the dawn of history until the present century the road to success was victory in competition. We descend from many centuries of progenitors who exterminated their enemies, occupied their lands, and grew rich. In England this process took place in the time of Hengist and Horsa. In the United States it took place during the eighteenth and nineteenth centuries. We therefore admire a certain sort of character, namely the sort of character that enables you to kill skilfully and without compunction. The milder believers in this creed content themselves with inflicting economic rather than physical death, but the psychology is much the same.

In the modern world, owing to increase of skill, this process is no longer so satisfactory. In a modern war even the victors suffer more than if there had been no war. To the British, who are enduring the results of complete victory in two great wars, this is fairly obvious. What applies in wars, applies also in the economic sphere. The victors in a competition do not grow so rich as both parties could by combination.

The half-unconscious appreciation of these facts produces in intelligent young people an impulse towards general good will, but this impulse is baffled by the mutual hostility of powerful groups. Good will in general—yes; good will in particular—no. A Hindu may love mankind, but must not love a Pakistani; a Jew may believe that men are all one family, but dare not extend this feeling to the Arabs; a Christian may think it his duty to love his neighbor, but only if his neighbor is not a Communist. These conflicts between the general and the particular seem to make it impossible to have any one clear principle in action. This trouble is due to a very general failure to adapt human nature to technique. Our *feelings* are those appropriate to warlike nomads in rather empty regions, but our technique is such as must bring disaster unless our feelings can become more cooperative.

Education, if it is to be adapted to our modern needs, must fit young people to understand the problems raised by this situation. The imparting of knowledge in education has always had two objects: on the one hand, to give skill; and on the other, to give a vaguer thing which we may call wisdom. The part of skill has become very much larger than it used to be and is increasingl threatening to oust the part devote to wisdom. At the same time it mu be admitted that wisdom in ou world is impossible except for tho who realize the great part played b skill, for it is increase of skill that the distinctive feature of our worl

During the late war, when I dine among the Fellows of my College, found that those who were scientifi were usually absent, but on thei rare appearances one got glimpses o mysterious work such as only ver few living people could unders'and It was the work of men of this sor that was the most decisive in th war. Such men inevitably form kind of aristocracy, since thei skill is rare and must remain rar until by some new method men' congenital aptitudes have been in creased. There is for example great deal of important work whic can only be done by those who ar good at higher mathematics, and th immense majority of mankind woul never become good at higher math ematics, even if all their educatio were directed to this end. Men ar not all equal in congenital capacity and any system of education whic assumes that they are involves a possibly disastrous waste of good material.

But although scientific skill is necessary, it is by no means sufficient. A dictatorship of men of science would very soon become horrible. Skill without wisdom may be purely destructive, and would be very likely to prove so. For this reason, if no other, it is of great importance that those who receive a scientific education should not be *merely* scientific, but should have some understanding of that kind of wisdom which, if it can be imparted at all, can only be imparted by the cultural side of education.

Science enables us to know the means to any chosen end, but it does not help us to decide what ends we shall pursue. If you wish to exterminate the human race, it will show you how to do it. If you wish to make the human race so numerous that all are on the very verge of starvation, it will show you how to do that. If you wish to secure adequate prosperity for the whole human race, science will tell you what you must do. But it will not tell you whether one of these ends is more desirable than another. Nor will it give you that instinctive understanding of human beings that is necessary if your measures are not to arouse fierce opposition which only ferocious tyranny can quell. It cannot teach you patience, it cannot

ch you sympathy, it cannot ch you a sense of human destiny. ese things, in so far as they can taught in formal education, are ost likely to emerge from the rning of history and great litera- re.

Familiarity with great literature s been one of the nominal aims of ucation ever since the time of isistratus. The Athenians pur- ed this aim wisely: they learnt omer by heart, and were therefore ble to appreciate their great drama- sts in spite of their being com- mporary. But modern methods ve improved on all this. I was ven when I was very young a little ook called "A Child's Guide to iterature". In this book the child, uided by some preternatural in- elligence, asked about the great nglish writers in correct chrono- gical sequence beginning, "who as Chaucer?" I regret to say that never got any further in this little ook. If I had, I should have been ble to say just the sort of thing hat Examiners wish you to say vithout having read a single word of ny of the authors concerned.

I am afraid that the needs of examinations and of an unduly extended syllabus have made this way of studying literature all too common. You may be the better for reading Chaucer, but if you do not read him, knowing his dates and what eminent critics have said about him does you no more good than knowing the dates of some obscure nobody.

The good that is to be derived from great literature is not derived with any fulness except by those who become so familiar with it that it enters into the texture of their everyday thoughts. I think it is an admirable thing when children at school act a play by Shakespeare. There is then an obvious reason for getting to know it well, and the enterprise is cooperative rather than competitive. I am quite sure that to take part in acting *one* of Shakespeare's good plays is a better way of acquiring what is valuable in a literary education than the hasty reading of the whole lot. In former generations English-speaking people acquired the same sort of training in prose through familiarity with the Authorized Version of the Bible, but since the Bible became unfamiliar nothing equally excellent has taken its place.

In the teaching of history as opposed to literature a smattering can be of great utility. For those who are not going to be professional historians, the sort of thing that in America is called a survey course can, if it is rightly done, give a valuable sense of the larger process within which things which are near and familiar take place.

Such a course should deal with the history of Man, not with the history of this or that country, least of all one's own. It should begin with the oldest facts known through anthropology and archaeology, and should give a sense of the gradual emergence of those things in human life which give man such a place in our respect as he may deserve. It should not present as the world's heroes those who have slaughtered the greatest number of "enemies", but rather those who have been most notable in adding to the world's capital of knowledge and beauty and wisdom. It should show the strange resurgent power of what is valuable in human life, defeated time and again by savagery and hate and destruction, but nevertheless, at the very first possible opportunity, emerging again like grass in the desert after rain. It should, while youth leaves hopes and desires still plastic, fix those hopes and desires not upon victory over other human beings, but upon victory over those forces which have hitherto filled the life of man with suffering and sorrow—I mean, the forces of nature reluctant to yield her fruits, the forces of militant ignorance, the forces of hate, and the deep slavery to fear which is our heritage from the original helplessness of mankind. All this a survey of history should give and can give. All this, if it enters into the daily texture of men's thoughts, will make them less harsh and less mad.

One of the great things that education can and should give is the power of seeing the general in the particular, the power of feeling that this, although it is happening to *me*, is very like what happens to others, what has happened through many ages, and may continue to happen. It is very difficult not to feel that there is something quite special and peculiar about one's own misfortunes, about the injustices that one suffers, and the malevolence of which one is the object, and this applies not only to oneself as an individual but to one's family, one's class, one's nation, and even one's continent. To see such matters with impersonal justice is possible as the result of education, but is scarcely possible otherwise.

All this education can do, all this education should do; very little of it education does do.

The *Journal*...Thirty-five Years Ago

The second issue of *The Engineering Journal* was in June 1918. The feature article is "General Specification for Steel Highway Bridges". In those days the Institute was active in the preparation of specifications and standards, and this article was prepared by the Institute's committee. It was submitted to and approved by the annual general meeting of 1918. The members of the committee were P. B. Motley, chairman, H. B. Stuart, H. P. Borden, F. P. Shearwood, G. H. Duggan, W. Chase Thomson, secretary, W. A. Bowden, J. G. Legrand, Geo. W. Craig, F. D. Cole, E. G. W. Montgomery, H. A. Icke, M. A. Lyman, A. H. H. Harkness and C. N. Monsarrat. What names those were to everyone within the field of structural engineering!

Wartime Complaint

The editorial leader is titled "Conscription and the Engineer". It is a strong protest against non-engineers being given important posts in engineering units. It just goes to show that the complaints of the last war had nothing original about them. They were but the echo of the first world war, albeit, the efforts of the Wartime Bureau of Technical Personnel did bring about a substantial improvement. Here are some quotations from the editorial.

"In the early days of the war, before the significance of the struggle was understood, no one of us experienced surprise or abhorrence when we learned of military preferment on the basis of political control or family connection. In these days of strain and stress we are just beginning to realize the great sacrifices of life and material which have come about almost directly through the most unaccountable stupidity of our nation, in tolerating for so long the control of politicians in the administration of public affairs, and more particularly in the control of matters relating to the war. Individually we effervesce and boil, but collectively we are inactive and supine.

"Disturbing rumours have come

to our ears from time to time of late with respect to preferment in military appointments, and these should be investigated. Time and again we have been told of responsible appointments in Engineering Corps being given to the less qualified, while the more experienced are passed by. To be more specific, we hear of men of the legal profession, without administrative or engineering training of any kind, being appointed as Engineers officers, while trained men of the engineering profession, men of affairs, men who have had charge of operations, who have had supervision of workers, and have had superior training in engineering, are left in the ranks.

"These rumors necessarily force on us the query as to what is being done with the trained engineers, chemists, and other scientists who come under the draft. Only a few days ago we learned of a trained chemist and physicist, a doctor of Philosophy of an American University, and Canadian in essential employment in the Government service in Ottawa, who has been drafted. And we are told that chemists cannot be secured to carry on the work of munition manufacture and to perform the work of essential industries in the country. Is this man, are these men, being dumped into the great body of recruits without selection and without classification? Are they being placed in positions where their training and experience can be utilized? Recent inquiries lead us to believe that these highly trained men are being neither sought out nor utilized."

Reports from Councillors

In the early issues it was the custom to run messages from the different councillors. In each case a photograph of the councillor accompanied the short report. In the June 1918 issue there were photographs and reports from these councillors—J. R. W. Ambrose, Toronto; L. B. Elliott, Edmonton; Peter Gillespie, Toronto; D. O. Lewis, Victoria; J. H. Kennedy, Vancouver; E. G. Matheson, Vancouver; Horace Longley, Woodland's Point, N.B.; William Pearce, Calgary; H. R. Safford, Montreal; J. G. Sullivan, Winnipeg; James White, Ottawa; and G. A. McCarthy, Toronto.

Many of these messages are just as important today as they were thirty-five years ago. Some of them have a special significance in view of the changes that have taken place and others because of the changes that have not taken place.

Peter Gillespie's message was as follows:

"Claims of individuals and of associations to public recognition must be based on service rendered. In the past the members of the Canadian Society of Civil Engineers have performed services which have merited recognition and many tangible monuments attest this in the history of Canada's development. There is, however, a line of collective activity to which the Institute and its branches might devote more attention. I refer to those questions of governmental policy, municipal, provincial and federal, properly coming within the purview of the engineer and on which disinterested and authoritative advice is often welcomed by those who control and always recognized by press and public".

Horace Longley says "Whatever grievance we engineers have had that the profession lacked recognition from the public, has been swept away by the great event that is shaking the world. It is every engineer's duty to maintain the status we now enjoy and also to improve it."

All messages are influenced by the war. H. R. Safford states it in terms readily understood by the profession—"We seem to be passing through a period when the entire world is being stressed to nearly its Elastic Limit. Social, Industrial and Political structures are being tested severely by stresses for which they do not appear to have been designed and it is apparent that the formulae previously used were inadequate and erroneous because they failed to embody many heretofore unknown factors and they gave false values to many known factors. The World's Calculus will be revised and rewritten with new formulae and in this work the engineer has an opportunity to play an important part. His mental training and education are built upon an exact science, not idealism, and his mind, therefore, follows the lines of analytical thought and honesty of purpose, the two essentials in developing such formulae. It is an opportune time for him to aggressively interest himself in this study and to unselfishly and patriotically devote all that he can to help write new specifications and prepare new standard plans for these future structures to insure, in the finished work, accuracy, strength, and, above all, peaceful permanency".

Civic Affairs

Many presidents of the Institute even up until today have included in their utterances to branches the suggestion that greater recognition will come to the profession if the engineer participates in public affairs. This message runs throughout the pages of the *Journal* even in 1918. For instance, Councillor D. O. Lewis of Victoria says,"To occupy in the community that position to which we are entitled by reason of our great service in the advancement of civilization, we must take a more active part in public affairs. Such a course will contribute to the common good and result in a fuller measure of recognition than in the past."

News of the branches continues to offer interesting items.

Ottawa Branch

In the light of all the discussions there have been in recent years about the apportionment of the waters of the St. Mary's and Milk River, it is interesting to see that exactly the same subject was before the International Joint Commission in 1918. Although the apportionment and storage of these waters was under discussion at that time, it is only within recent years that the St. Mary's River Dam has been constructed and the storage realized.

The report goes on to mention the creation of the Dominion Power Board under the chairmanship of the Hon. Arthur Meighen. Mr. Arthur St. Laurent, M.E.I.C., assistant deputy minister of the Public Works Department was vice-chairman. Mr. St. Laurent became president of the Institute in 1932.

The members of the board consisted almost entirely of members of the Institute, such as W. J. Stewart, C. N. Monsarrat, John Murphy, H. G. Acres, O. Higman, B. F. Haanel and J. B. Challies who then was chief engineer of the Dominion Water Power Branch.

In the light of the recent awarding of honorary memberships to A. J. Grant and A. L. Killaly, it is interesting to read in this report of the Ottawa Branch about the opening of the Trent Canal. The date was Monday, June the 3rd, the King's Birthday. The report goes on to say—"in addition to Mr. A. J. Grant and his chief assistant engineer, Mr. A. L. Killaly, who have had direct charge of the work, the minister was accompanied by a large party of departmental engineers including, W. A. Bowden, L. Shearwood, A. T. Phillips and C. M. Monsarrat".

The article describes the canal

being "a six foot waterway from e southerly outlet to Lake Ontario waters at Trenton to Lake mcoe via Peterborough". The cost as stated as being $6,000,000.

Apparently those were stirring mes in government circles at ttawa. The report goes on to peak about the establishment of ie Dominion Peat Board. Here too iembers of the Institute take a rominent part. Of the four members, two were members of the nstitute, namely, R. A. Ross and 3. F. Haanel.

Included in the few personals of hat issue are the names of several nembers who are still with us, such is W. F. M. Bryce, who at that ime was commissioner of works for he city of Ottawa and who accordng to the notice had just been granted a commission in the Canadian Engineers. Another member was D. W. McLachlan, who at that time was engineer in charge of construction at Port Nelson Terminal.

Council Meeting

In the report of the Council meeting held on May 21, there is the first reference to the preparation of an emblem for the Institute. A committee was established and it was expected that a report would be made at the next meeting.

The same meeting of Council heard a report from the Library Committee. This suggests the great changes in the library since those days. The Library Committee "submitted a report the result of two meetings, recommending that the books in the library be indexed and classified in accordance with the engineering classification of the American Society of Civil Engineers". It goes on to state that two of the librarians at McGill have agreed to do the indexing for the sum of $100.00. It would take several thousand dollars to do it today, but of course the good work started then has been continued, so that no such overhaul job is required now.

Money for McGill

It is interesting to see that under the heading "Mortgage", there is a statement to the effect that the secretary has arranged with McGill University for a renewal of the mortgage on the Headquarters' property for two years at six and a half per cent. Although this report does not give the information it is known that at the time premises at 2050 Mansfield were purchased a sum of money was borrowed from McGill University to help finance the transaction. The history of that event records that this loan at such a substantial rate did not run for any great period of time.

Trade Union

The Institute had taken a strong stand against a trade union organization that was attempting to establish itself in British Columbia known as the B.C. Technical and Engineering Institute. The officers of the Engineering Institute fought this matter before the members of Parliament in Victoria and finally the organization was refused a charter. The minutes of the Council meeting state "The amount of the statement of legal expenses incurred in combatting legislation sought by the B.C. Technical and Engineering Institute, was approved". That is one of the earliest indications of the Institute's willingness to spend time and money to fight those things which are not good for the profession.

Montreal Branch

In the report of the Montreal Branch there is an account of meetings of several committees, but the important thing to note is that even in those days the Montreal Branch had technical divisions. These were civil, mechanical, electrical and manufacturing. The chairmen of the various divisions were—civil, J. deM. Duchastel and H. M. Lamb; mechanical, J. A. Burnett and John T. Farmer; electrical, J. A. Shaw and A. Frigon; manufacturing, S. F. Rutherford, H. G. Hunter.

Registration

All through these early issues there are references to registration. For instance, in the report of the Calgary Branch we see this "A resolution was passed endorsing the proposal of the Calgary Branch regarding the obtaining of legislation to define the status of an engineer".

In the news of the Saskatchewan Branch we find a similar reference —"The June meeting of our branch will be devoted to a discussion of legislation and professional affairs".

The Toronto Branch news indicates that they had a committee with an unusual title. It was known as the Committee on Prestige. They submitted a long report at the meeting on April 25 which was adopted unanimously. Here we see too the same interest in registration. The first clause of the report reads, "That the Ottawa Branch be invited to co-operate with the Toronto Branch in the drafting of a bill for the restriction of the employment of engineers upon Public Works such as federal, provincial and municipal works, to those who have conformed to the requirements which shall be defined therein; and such draft after being approved by the respective Branches, to be submitted to the Council of the Institute for prompt consideration and action."

There is the announcement of the creation of the Leonard Medal. Lieutenant-Colonel R. W. Leonard, M.E.I.C., deposited with the Institute a Victory Bond for $500.00, to establish the medal. This medal incidentally is the only one of its kind in Canada, in that it may be won either by a member of the Engineering Institute or of the Canadian Institute of Mining and Metallurgy.

Personals

The *Journal* also contains the announcement of the appointment of A. W. Haddow, M.E.I.C., to the position of city engineer of Edmonton, Alberta. Previously he had been acting city engineer. Mr. Haddow has held that position ever since, and has been an extremely active and valuable member of the branch.

There is an interesting news item which shows the engineers acting in rather an unusual capacity. The article starts this way—"The settlement of the differences existing between the City of Montreal and the Cook Construction Company over the contract for the second enlargement of the Montreal Water Works' aqueduct is proceeding daily before a board of arbitration composed of W. F. Tye, M.E.I.C.; J. M. R. Fairbairn, M.E.I.C. (who at that time was vice-president of the Institute); and Mr. Aime Geoffrion, who even then was a distinguished member of the bar in Montreal.

Visitors to Headquarters will be interested in the reference to the bronze tablet which is now on the walls at Headquarters in memory of Prof. C. H. McLeod, who as the tablet states "was for twenty-five years secretary of this Society". The accompanying announcement reads this way "In accordance with the resolution passed at the annual meeting, a bronze tablet has been prepared under the direction of Council and is now placed in position on the wall in the main hall at Headquarters where it remains a silent tribute to one to whom the engineering profession in Canada owes so much".

Under the Personals column we find this—"Major T. R. Loudon, 1st Canadian Railway Battalion

arrived in Canada recently and is now at his home in Toronto. He was invalided in January and has the distinction of having been mentioned in despatches".

Another person well known to the members today is referred to this way—"M. V. Sauer who has for several years been connected with the Greater Winnipeg Water District has been appointed chief hydraulic engineer of design for the Hydro Electric Power Commission of Ontario with headquarters at Toronto".

There is an interesting letter from Lt. Edward W. Francis, S.E.I.C., son of Walter Francis, in which he tells of the sinking of his ship in the Mediterranean. It is a most cheerful letter, but behind it all was a great tragedy. Lt. Francis was successful in reaching shore in spite of a swim of "a few miles". The general news announcement of that time indicated that many people lost their lives, but Lt. Francis' off-hand comment on the whole thing is this, "in future swims my name will not be entered as starting from scratch".

Also, there is reference to an organization meeting in Hamilton the outcome of which was the application for a charter in that city. There were many prominent engineers of the day at the meeting including J. A. Weller, who was credited with the design of the Welland Canal, City Engineer Gray, R. K. Palmer of the Hamilton Bridge Company, E. H. Darling, A. C. D. Blanchard, W. D. Black, and John H. Jackson.

In the Edmonton Branch news there is reference to a lecture delivered by George Porter on the Quebec Bridge. The meeting was held in the City Council chamber which proved too small for the audience. When Mr. Porter spoke on this same subject before the Calgary Branch they had to take a public hall but even then the capacity of 250 was inadequate and the report suggests that as many people were turned away as were admitted.

In the King's Birthday Honours List are included Lt.-Col. George Eric McCuaig, A.M.E.I.C., who was made a Companion of St. Michael and St. George, and Lt.-Col. Ibbotson Leonard, A.M.E.I.C., who was awarded the Distinguished Service Order. The note goes on to point out that "both are McGill graduates". (This comment is due, doubtless, to the fact that the secretary at that time himself was a McGill graduate.)

Employment

The employment page is not very impressive. Only nine openings are advertised. However there is a short editorial comment previous to the list of situations vacant which is interesting in the light of today's conditions. It says—"The near future should see a decided increase in the salaries paid to junior technical men in particular and to all engineers working for salaries in general. An indication of this is shown by the experience of a 1918 graduate from one of our universities. He wrote in to the Institute stating that he would be shortly open for a position, and that he was incapacited for military service. An offer was made to him of a position at $100.00 a month, but before he accepted this another offer was received at $125.00." This story is told as an indication of the rapidly increasing rate of remuneratio

Positions vacant include tw superintendents for a manufacturi plant; a chemist for making anal sis of coal, rock, iron, etc., for manufacturing company; a juni for a railway drafting office; junior to go on surveys with a larg mining corporation in London, On tario; a mining chemist; a transit man for a power company nea Montreal; and a woods enginee "one capable of taking off accurat quantities from mechanical equip ment from engineers' drawings an who has a fair idea of the cost o various machine shop operations pattern-making and the installatio of steam lines, shafting and genera mill equipment. This position offer $130.00 to $150.00 per month t start and promise of a good openin later". It doesn't sound very attrac tive in the light of today's rates.

Review of Technical Personnel Records

as reported by

Technical Personnel Section, Economics & Research Branch, Department of Labour, Ottawa.

The current review of individual records of architects, engineers and scientists in Canada, begun in 1951, is now sufficiently advanced to permit additional useful analyses of the results to be made. The task of bringing up to date those records accumulated before 1950 is nearing completion. In the case of the younger professional persons, members of graduating classes are asked to complete new questionnaire forms three years after graduation. By that time it is assumed they will have become established in a specialized line of work. Members of the 1950 graduating class will be asked to bring their records up-to-date later this year.

During the past two years, questionnaires have been mailed to approximately 48,000 persons, over 37,000 of whom have completed and returned them. Efforts are still being made to secure completed questionnaires from those who have so far failed to reply. Valuable assistance is being given by the various professional organizations concerned with architects, engineers and scientists. The publications of these organizations, as well as clippings from newspapers, are used to keep abreast of changes which should be recorded on individual questionnaires.

The information received from the questionnaires is coded on I.B.M. punch cards for ease of tabulation and sorting. Punch cards have been made to date for the following numbers in each of the groups listed below:

Civil Engineering	4,425
Chemistry and Chemical Engineering	4,319
Mechanical Engineering	4,273
Electrical Engineering	3,941
Agriculture	2,462
Mining and Metallurgy	2,052
Forestry	1,015
Biology	970
Physics	925
Architecture	782
Geology	651
Aeronautical Engineering	270
Mathematics	208
Geography	53
Total	26,346

While individual questionnaires are treated as confidential, the salient characteristics of the various professional groups as a whole can be determined from tabulations made from the punch cards. The remainder of this Bulletin will deal with some selected characteristics of the practising electrical and mechanical engineers for whom punch cards have been made up to March, 1953.

The individuals listed as living outside Canada are Canadian citizens. Among the others there are a few citizens of other countries who are residing in Canada. It is interesting to note that 80.5 per cent of the electrical engineering group and 78.7 per cent of the mechanical engineering group are working in

ıtario and Quebec. Although the and total for mechanical engineers greater, the number of electrical gineers exceeds mechanicals in E.I., New Brunswick and Mani-ba. In British Columbia mechan-al engineers outnumber electri-ls by nearly three to two, although ıe numbers are reasonably close the other provinces.

The breakdown for civil engineers Bulletin, April-June 1952) showed pproximately 79 per cent as holders f a bachelor's degree only and that 0.3 per cent never attended a niversity. There is no significant ifference in the numbers who eceived master's standing or a loctorate in the three professions.

It should be remembered that the graduating classes of 1950, 1951 and 952 are not included in these igures. This explains the small numbers shown in the 21-25 age group. There were 1,650 electrical and 1,725 mechanical engineering graduates in these three years, and most of them would be under 25 years of age. Those listed as being over 65 years are persons who are employed. There are many addi-tional registrants over 65 who are not employed.

The number of mechanical engi-neers over 55 years old is slightly greater, on a percentage basis, than the number of electricals. It is not likely, however, that the replace-ment demand due to retirements and deaths will be as great as the demand due to the growth of the Canadian economy. In the case of civil engineers it was estimated in June 1952 that the replacement demand due to retirements and deaths would be about 10 per cent in the next five years. At that time, out of 4,040, there were 355 over 65 years old and 463 in the 61-65 age group.

In completing the questionnaire, each person is requested to classify himself according to his special qualifications and then to state the function which he is carrying out in his special field. If two or more special qualifications are listed, the individual is coded on the punch cards in accordance with the one in which he states he is most compe-tent.

Opposite each function in the foregoing table is shown the number who state that they are best fitted to carry out that particular type of work. For example, in the electrical group, 103 are shown under research while in the mechanical group there are 99.

There are proportionally more mechanical engineers than electrical

Table I—Geographic Distribution of Electrical and Mechanical Engineers

	Electrical		Mechanical	
	Number	Per Cent	Number	Per Cent
Newfoundland	8	.2	12	.3
Prince Edward Island	5	.1	—	—
Nova Scotia	90	2.3	104	2.5
New Brunswick	63	1.6	50	1.2
Quebec	940	23.8	1,092	25.5
Ontario	2,221	56.7	2,268	53.2
Manitoba	114	2.8	105	2.5
Saskatchewan	47	1.2	56	1.3
Alberta	123	3.1	144	3.2
British Columbia	221	5.5	308	7.3
Yukon and N.W. Territories	2	—	1	—
Outside Canada	107	2.7	133	3.0
Totals	3,941	100.0	4,273	100.0

Table II—Level of Academic Training of Electrical and Mechanical Engineers

Training Level	Electrical		Mechanical	
	Number	Per Cent	Number	Per Cent
Never attended university	343	8.7	439	10.2
Attended university, degree not received	72	1.8	100	2.3
Bachelor's degree	3,310	84.0	3,500	82.0
Master's degree	192	4.9	218	5.1
Doctor's degree	24	.6	16	.4
Totals	3,941	100.0	4,273	100.0

Table III—Age Distribution of Electrical and Mechanical Engineers

Age	Electrical		Mechanical	
	Number	Per Cent	Number	Per Cent
Over 65	115	2.9	155	3.6
61-65	149	3.8	201	4.7
56-60	194	4.8	208	4.8
51-55	384	9.8	322	7.6
46-50	402	10.2	368	8.6
41-45	426	10.8	545	12.8
36-40	557	14.2	634	14.8
31-35	838	21.2	980	23.0
26-30	856	21.9	843	19.7
21-25	18	.4	16	.4
Not recorded	2	—	1	—
Totals	3,941	100.0	4,273	100.0

Table IV—Distribution by Function of Electrical and Mechanical Engineers

Function	Electrical	Mechanical
Supervision and management	735	811
Designing, draughting	603	737
Sales and service	392	545
Administrative and executive	300	390
Maintenance	198	301
Development	314	296
Production	83	237
Consulting	96	186
Operation	234	144
Layout and location	221	122
Installation, erection	169	107
Research	103	99
Testing, inspection, laboratory services	209	93
Teaching, instructing, extension work, writing	84	79
Construction	107	52
Personnel, safety and efficiency	46	32
Accounting	7	9
Other—various	40	33
Total	3,941	4,273

engaged in design, production, maintenance, sales and service and consulting. The reverse applies in the case of testing, inspection and laboratory services, installation and erection, operation (where there is more need for professionally trained individuals than in mechanical) construction and layout and location.

Information on other professional groups similar to that presented above will be included from time to time in future issues of the Technical Personnel Quarterly Bulletin.

Correspondence

Dear Mr. Editor:

I as a past president ("extinct volcano" is what we call ourselves) of the South Wales Institute of Engineers enjoy reading your monthly *Journal* that we exchange with ours, in our library. Yours is remarkably well produced and the contents are of interest to us in Britain.

This letter is also to say that for the use of your members, and of course your good self, who may be visiting Britain, I am posting you separately, some booklets that may interest. They are:—

1. Pictorial Guide to the City of Cardiff. Cardiff Castle was given to the City by the present young Marquis of Bute. It was the pride of his great grandfather with decorations by famous experts. The old man nearly ruined himself in starting Cardiff's prosperity in building its first dock. The castle site was a Roman fort on which the Normans built the castle. Caerphilly Castle ruins, the largest in Britain and Castell Coch, a lovely little place, restored by the same old man are within five miles of Cardiff. Another old place is St. Fagan's Castle, given by the present young Earl of Plymouth to the Museum of Wales who are making it into a Folk Museum that will rival the one in Stockholm, being visited by many thousands. It also is three miles from Cardiff.

Altogether, there are over 100 castle ruins between Gloucester City in the east and St. David's Cathedral 150 miles west, including those near Cardiff, as Chepstow, Raglan, etc.; St. Donat's that Randolph Hearst the American bought and spent a lot of money on; others west such as Coity, Oystermouth, Penard, Laugharne, Carew, Pembroke, Manorbier and St. David's Cathedral. One other, Castell Cerrig Cennen away in the lonely hill next the Black Mountains always reminds me of the fairy tale of the Sleeping Princess.

If friends want to see these places, ask them to let me know.

2. P.R.H.A. (Peoples Refreshment House Association) handbook of their Inns and small hotels in rural parts that motoring people can stay at. One can't expect every modern fitment, but they are comfortable as I know. The booklet describes them and illustrates many, with separate lists of those near golf and fishing. The foreword gives the reason for the foundation of P.R.-H.A. in 1896 and it has lived up to it.

If anyone would like copies, they should write to the general manager, P.R.H.A., 20 Victoria Street, Westminster, London, S.W.1.

3. "Guide to Trust Houses" of Trust Houses Ltd., Tourist and Enquiry Office, 81 Piccadilly, London, W.1. As the foreword shows, it was started in 1903 by pub spirited men to improve the small hotels and has done so; the man gers have to give comfort more th to sell drink. By the way, the wo Trust has not the same meanin as in U.S.A.

The idea of this letter is tha London is overcrowded and hote full, and at hotels in the larg towns also there may be a dif culty of finding a garage. It better to put up at one of the smaller outlying places and get i to the bigger towns and London b train or bus, for the streets there ar jammed full of traffic and parkin places the same.

Note also, the tariffs may now b a little higher since the booklet were printed.

Am sorry for this long screed, bu thought it may interest you an your members. So with good wishes

Yours truly,

C. T. Allan,
2, The Parade, Whitchurch, Cardiff

Elections and Transfers

At the meeting of Council held in Halifax, N.S., on May 19th, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

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G. P. F. Anthoulis, *Copper Cliff.*
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F. A. Benger, *Montreal.*
L. Dufresne, *Montreal.*
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A. J. Nechi, *Montreal.*
J. C. Nelson, *Toronto.*
S. O. Newhall, *Calgary.*
W. Rutherford, *Montreal.*
E. K. Skead, *Concord, Calif.*
K. Sproule, *Copper Cliff.*
S. B. Thomas, *Montreal.*
L. B. Walker, *Fort William.*
L. J. Whalen, *Fredericton.*

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A. M. Garlicki, *Galt.*
L. T. Gaunt, *Brownsburg.*
J. B. Genge, *Kingston.*
J. P. Harris, *Montreal.*
G. A .Kravetz, *Montreal.*
A. Marshall, *Montreal.*
E. P. McCormack, *La Tuque.*
D. McCorquodale, *Montreal.*
P. J. Provias, *Brantford.*
V. E. Slocum, *Peterboro.*
E. O. Stenerson, *Falconbridge.*
E. H. Wilson, *Niagara Falls.*

Transferred from the class of Junior to that of Member:

M. F. K. Leighton, *Moncton.*
J. A. Peebles, *Winnipeg.*
H. L. Smith, *Vancouver.*
D. Veitch, *Ottawa.*
D. A. Whelen, *Burnaby.*
C. D. Worby, *Winnipeg.*

Transferred from the class of Student to that of Junior:

W. A. Johnson, *Virden, Man.*
W. J. Roman, *Calgary.*

The following Students were admitted

L. L. Atkinson, *N.S.T.C.*
J. G. Boone, *N.S.T.C.*
G. W. Butler, *N.S.T.C.*
R. G. Curry, *Univ. of Ireland.*
J. A. R. Delisle, *N.S.T.C.*
M. S. Dubas, *Alberta.*
H. Fedorak, *Alberta.*
J. E. Houghton, *N.S.T.C.*
A. P. Kilroy, *Univ. of Ireland.*
B. J. Kirk, *N.S.T.C.*
J. H. J. Merritt, *N.S.T.C.*
J. B. Moriarty, *N.S.T.C.*
J. R. Raymond, *Toronto.*
T. E. Savoy, *N.S.T.C.*
O. K. Simmons, *Alberta.*
R. Walkey, *Toronto.*

Applications through Associations:

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

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J. Bathurst — J. S. C. Dunn

Junior to Member:

D. E. Doxsee — W. M. Price

Saskatchewan

Students:

A. F. George — J. D. Ross
S. G. Horton — J. R. Sutherland
J. B. Lintz — L. J. Thielen
M. Luciuk — Z. E. Wasarab

Nova Scotia

Members:

K. L. Robertson — W. D. Hagen

New Brunswick

Junior to Member:

R. M. Wickwire

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Institute Awards

At the banquet which concluded the ixty-seventh annual general and profes- ional meeting of the Institute, the award f honorary memberships to five dis- inguished engineers was announced. The ecipients of these memberships were Alexander Joseph Grant, formerly engi- neer in charge, Welland Ship Canal Office, Department of Railways and Canals, Welland, now of Montreal, Que.; Albert Lawrence Killaly, formerly superintending engineer, Trent Canal, Department of Transport, Peterborough, Ont.; Frederick Perry Shearwood, formerly chief engineer, now consulting engineer, Dominion Bridge Company, Montreal, Que.; Arthur Surveyer, D.Eng., D.Sc., senior partner, Surveyer, Nenniger and Chenevert, consulting engineers, Montreal, Que.; Stewart Young, B.A.Sc., formerly director of community planning, Province of Saskatchewan, Regina, Sask.

Their biographies and those of all winners of Institute awards are presented in the following pages. Presentations were made to those honorary members and award winners who were present on this occasion, and appropriate occasions will be sought later for the other presentations.

Honorary Memberships

Alexander Joseph Grant, Hon.M.E.I.C.

Alexander Joseph Grant was born in Scotland on May 10th, 1863, at Dufftown, Banffshire, and came to Canada in 1872. He was educated at the University of Ottawa and St. Mary's College, Montreal.

A. J. Grant, Hon.M.E.I.C.

His professional career began in 1880 on a survey party under H. D. Lumsden, for the Canadian Pacific Railway, west of Winnipeg. In 1883 he worked on the Baie des Chaleurs Railway, and in July 1886 he entered the outside service of the Department of Railways and Canals by joining the engineering staff of the Cape Breton Railway, under Hiram Donkin, M.E.I.C., where he was assistant engineer on the construction of the railway from 1887 to 1891. In the latter year he was transferred to the engineering staff of the Soulanges Canal under Thomas Munro, remaining as an assistant engineer until the completion of the canal in January 1903, when he was appointed to the position of engineer in charge of the Port Colborne improvements. Here he remained until April 1906, when he was promoted by the department to the position of superintending engineer of the Trent Canal.

During his tenure of this appointment, the construction of the Ontario-Rice Lake Division of the waterways was carried out, and the surveys and plans made for the Severn River Division of the canal. The works for improving the navigation of the Severn River were begun under his supervision, but, owing to war conditions, were suspended in 1916-17.

From January 1, 1919, to his retirement in April, 1934, Mr. Grant was engineer in charge of the construction of the Welland Ship Canal.

Mr. Grant joined the Institute before its change of name, having been elected an Associate Member on October 8th, 1891, and a Member on November 21st, 1901. Throughout his connection with the Institute he has been an unfailing supporter of its work and aims, and he took an active part in the formation of the Niagara Peninsula Branch in 1919. He served on Council as vice-president in 1928-1929, and was elected president in 1930, a year which was particularly appropriate, since it saw the official opening to traffic of the important waterway whose construction he had directed for more than ten years.

This great work, with its terminal harbours and flight locks, is an outstanding engineering achievement, and its sound design and substantial construction forms an enduring evidence of Mr. Grant's professional capacity, ripe experience, and ability as an engineer and administrator.

Today, Mr. Grant, or "chief", as he is affectionately referred to, is one of the few remaining links between the early days of the engineering pioneers and the modern miracle workers. He attains his ninetieth birthday in May of this year. He was made a Life Member of the Institute in 1947.

Albert Lawrence Killaly, M.B.E., M.E.I.C.

Albert Lawrence Killaly is the fourth generation in a long line of engineers going back for about two hundred years, famous for their work on canals. His great-great-grandfather was associated with John Brindley, remembered as the father of English canals. His great grandfather was the chief engineer for the Grand Canal Company of Dublin where he achieved considerable recognition and fame. His grandfather and uncle came to Canada in 1834, and became famous here for their work on canals and other government interests. Hamilton Hartley Killaly became the first engineer to hold cabinet rank in Canada and was the first president of the first organized body of engineers in Canada. As a member of the parliament of Upper Canada for London, Ontario, he was made Chief Commissioner of Public Works. His father who was one of the first Members of the Canadian Society of Civil Engineers, the progenitor of the Engineering Institute, was in charge of the enlargement of the Lachine, Cornwall and Rapide Plat Canals.

Albert Lawrence Killaly was born in Prescott, Ontario, in 1875. He joined the engineering staff of the Rapide Plat Canal in 1892, and later was transferred to Galops Rapids Channel where he did some unique and difficult work in currents up to fifteen miles per hour. Later he was employed on the staffs of the North Channel, the Gut Dam and river works from Prescott to Lake St. Francis. From 1908 to 1914 he was assistant to the superintending engineer of the St. Lawrence Canals and subsequently he was (1914-1930) the superintendent of the Trent Canal. From 1930-1945 he was superintending engineer of the Trent and Murray Canals.

Mr. Killaly became a Student of the Institute in 1900, Associate Member in 1910 and Member in 1940.

On the formation of the Peterborough Branch in 1919 Mr. Killaly was a member of the first executive and served until 1938 with the exception of the years 1927-28. He was vice-chairman in 1924-25, and chairman 1925-26. He became a Life Member in 1947.

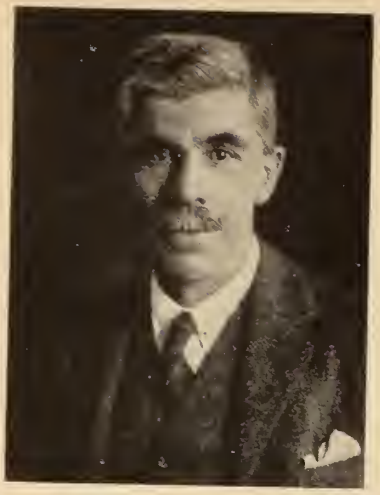
Frederick Perry Shearwood, Hon.M.E.I.C.

Frederick Perry Shearwood was born in London, England, in 1866 and received his education by private tuition. In 1884 he went to Brazil on railway work and after three years there came to Canada and joined the engineering department of the Dominion Bridge Company at Lachine, being appointed chief engineer in 1921 and consulting engineer in 1937.

Mr. Shearwood is widely known in engineering circles for his association with the design and erection of many of the important bridges and other structures in Canada.

An enthusiastic yachtsman and yacht designer, Mr. Shearwood was for 10 years associated with G. H. Duggan, in building and racing the boats which brought the Seawanhaka cup to Canada, and for a long period during the nineties successfully defended that trophy. Many other designs of successful yachts came off the

The *Journal* regretfully goes to press without a picture of Mr. Killaly. We hope to have in the July issue a photograph of Mr. Killaly taken at Halifax.



F. P. Shearwood, Hon.M.E.I.C.

Arthur Surveyer, Hon.M.E.I.C.

Stewart Young, Hon.M.E.I.C.

boards of Mr. Shearwood, adding to his skill in this field as in the field of structural design and erection.

Throughout his career he has been an active member of the Institute, joining the Canadian Society of Civil Engineers as an Associate Member in 1892, transferring to Member in 1904. He was elected to Council in 1909 and again in 1921-23, and was a vice-president from 1923 to 1925 and chairman of the Finance Committee at the same time. In 1926 he became treasurer of the Institute and retired from that office in 1930. Mr. Shearwood was elected president of the Institute in 1934.

He was also interested in other engineering organizations, being a Member of the American Society of Civil Engineers; Associate Member of the American Railway Engineering Association; and Member of the Corporation of Professional Engineers of Quebec. He also has served on various committees of the Canadian Standards Association.

Dr. Arthur Surveyer, Hon.M.E.I.C.

Arthur Surveyer was born in Montreal in 1878 and received his early education at Ste. Marie College, Montreal. He graduated from Laval University with the degree of B.A. in 1898 and received his civil engineering degree from Ecole Polytechnique, Montreal, in 1902. The following year he spent taking a post-graduate course at the Ecole Speciale d'Industrie et des Mines du Hinaut, at Mons, Belgium. He received the honorary degree of Doctor of Engineering from Rensselaer Polytechnic Institute in 1924, and in 1943 the honorary degree of Doctor of Science was conferred upon him by the University of Montreal.

Commencing his professional career with the Public Works Department of Canada in 1904, he remained with the Department until 1911 when he entered private practice as Arthur Surveyer & Company in Montreal, specializing in technical and financial investigations and engineering design and supervision. In 1947 the firm's name was changed to Surveyer, Nenniger & Chenevert. The many projects which Dr. Surveyer and his company have designed and supervised and reports and investigations made are too numerous to list, but among many are the preparation of plans and specifications for a portland cement factory for the St. Lawrence Cement Company; preparation of drawings for structures and mechanical equipment for a 700-ton per hour mill of Canadian Johns-Manville Company, at Asbestos, Que.; design of the electric smelter at Sorel, Que., for Quebec Iron and Titanium Corporation, and design of railway bridge foundations for the company; construction plans for all buildings of a 300-ton bleach sulphate pulp plant at Terrace Bay, Ont., for LongLac Pulp and Paper Company; preparation of construction plans for Canadian International Paper Company and its subsidiaries in connection with a bleach plant and a large water filtration plant at Gatineau, Que., a research laboratory and pilot plant at Hawkesbury, Ont., and other projects; design and preparation of construction plans for various projects of the Aluminum Company of Canada and its subsidiaries, such as a sand foundry at Etobicoke, Ont., an aluminum rolling mill at Sao Paulo, Brazil; preparation for the Chromium Mining & Smelting Corporation of a report on the establishment of a smelter in the Province of Quebec to produce ferro-silicon and ferro-chrome.

In 1948 Dr. Surveyer was appointed a member of the board to review the plans for better transportation at the Straits of Canso. He was a member of the National Research Council from 1942-1948. From 1949 to 1951 he was a member of the Royal Commission on the National Development in the Arts, Letters and Sciences (Massey Commission). He is a director of the Shawinigan Water and Power Company, of the Canadian International Investment Trust, the Confederation Development Corporation, Chromium Mining and Smelting Corporation, and Credit Foncier Franco-Canadien.

Dr. Surveyer joined the Institute (then the Canadian Society of Civil Engineers) as a Student in 1899, became an Associate Member in 1907, a Member in 1912, and a Life Member in 1947. He was elected to Council in 1915 and served until the end of 1921. He was then elected vice-president and filled that office until 1924 when he became president on the death of W. J. Francis.

Besides taking a great interest in the Institute, Dr. Surveyer is a member of the Corporation of Professional Engineers of Quebec; an honorary member of the American Society of Civil Engineers; a member of the American Management Association, and the American Society of Mechanical Engineers.

Stewart Young, Hon.M.E.I.C.

Stewart Young was born in Owen Sound, Ontario, in 1884, and was educated at the public and high school there and entered the University of Toronto from which he received the degree of B.A.Sc. (Civil) in 1912. Later he obtained the titles of D.L.S. and S.L.S.

He began his engineering career in 1910 as an inspector and junior engineer on sewer and waterworks installation, Cobalt, Ontario, and then went to Western Canada on survey and railroad construction.

Joining the Department of Public Works of Saskatchewan in 1913, he became district surveyor and engineer, Department of Highways in 1916, and director of community planning in 1924, which position he held until his retirement in 1949.

Since November, 1952, he has been engaged on a special survey for a high school building program.

Mr. Young became an Associate Member of the Institute in 1917 and Member in 1935. He was a councillor in 1935-36 and served as chairman of the Saskatchewan Branch in 1938 and secretary-treasurer in 1939-43. In 1936-37 he was councillor of the Professional Engineers of Saskatchewan, registrar from 1940-45, and president in 1948. He was also active in the Saskatchewan Land Surveyors Association, being president in 1945 and 1946.

Mr. Young was made a Life Member of the Institute in 1953.

Sir John Kennedy Medal

James A. Vance, M.E.I.C.

James A. Vance, of Woodstock, Ontario, was awarded the Sir John Kennedy Medal "As a recognition of outstanding merit in the profession and noteworthy contribution to the science of engineering and to the Institute".

The *Journal* was able to include in the April issue an editorial about Mr. Vance.

Julian C. Smith Medals

Julian C. Smith Medals, which are awarded for achievement in the development of Canada, were presented to John Edwin Armstrong, M.E.I.C., formerly chief engineer, Canadian Pacific Railway Company, Montreal, Que., and Marvin Wilbur Maxwell, M.E.I.C., formerly chief of developments, Canadian National Railways, Montreal, Que.

John Edwin Armstrong, M.E.I.C.

John E. Armstrong was born in Peoria, Ill. He graduated from Bradley Polytechnic Institute in 1905 and from Cornell University in 1908 with the degree of civil engineer.

From the beginning he has been associated with railways, starting at an early age in 1901. His earliest experience was

J. E. Armstrong, M.E.I.C.

M. W. Maxwell, M.E.I.C.

ith the Toledo, Peoria and Western ailway but subsequently he moved to the ennsylvania Lines west of Pittsburgh.

In 1912 he came to Canada with the anadian Pacific Railway at Montreal as ssistant engineer and became a Canadian itizen in 1921. In 1928 he was appointed ssistant chief engineer and in 1939 ecame chief engineer, a position he held ntil he retired in 1951.

In spite of the heavy duties of his professional position, Mr. Armstrong found time to assist in the activities of various societies. Three organizations to which he made special contributions are the American Railway Engineering Association, the Canadian Standards Association and the Engineering Institute of Canada. In the A.R.E.A. he has been a director, chairman of standing and special committees, vice-president and president and was made an honorary member in 1950. In the C.S.A. he was appointed to the main committee in 1941 and to the executive committee in 1945. In 1940 he was president of the Canadian Railway Club.

His most noteworthy work for the Institute was the chairmanship of the special committee on the Engineering Features of Civil Defence in 1942, working closely with Professor Fred Webster, Great Britain's expert on the effects of bombing. The proceedings were subsequently published and constituted Canada's text book on that subject.

Mr. Armstrong joined the Institute as a member in 1917. He was on the Finance Committee from 1939 to 1947, became vice-president in 1945 and president in 1949.

Marvin Wilbur Maxwell, M.E.I.C.

Marvin Wilbur Maxwell was born in Upper St. David, New Brunswick. He received the degree of B.Sc. in civil engineering from the University of New Brunswick in 1912, and did post-graduate work at the Massachusetts Institute of Technology.

On graduation Mr. Maxwell entered the employ of the Canadian Northern Railway, Mount Royal Tunnel and Terminal, as draughtsman. In 1913 he was appointed assistant engineer and remained in this position until 1915 when he took up work with the Forest Products Laboratories for six months prior to joining the Canadian Engineers, First Tunnelling Company, as a lieutenant. He was promoted to the rank of major and awarded the Military Cross before the conclusion of the war and he returned to Montreal to the Forest Products Laboratories as engineer in charge of timber tests.

Since 1923 Mr. Maxwell has been with the Canadian National Railways, first as assistant engineer in the bureau of economics, then special representative, and from 1925 to 1939 as industrial development officer in the United States with Headquarters at New York. In 1939 Mr. Maxwell was appointed chief commissioner of development and natural resources for the whole system with Headquarters in Montreal. In 1943 when the Department of Research and Development was divided into two branches, Mr. Maxwell was appointed chief of the development branch which position he still holds.

Mr. Maxwell joined the Institute in 1919 upon his return from overseas.

Gzowski Medal

Presented each year for the best paper on a civil engineering subject.

G. V. Eckenfelder, M.E.I.C.

G. V. Eckenfelder of Montreal, was awarded the Gzowski Medal of the Institute for his paper "Spray Hydro-Electric Power Development". This paper was published in the April 1952 issue of the *Journal*.

Mr. Eckenfelder is in the civil engineering department of Montreal Engineering Company.

He graduated from University of Alberta in 1933. He was employed by the Dominion Government Hydrographic Service that year, and was with the Department of National Defence from 1933 to 1936. He entered the service of Calgary Power Ltd., as a junior engineer, and spent four years in surveys, hydrometric work, maintenance and construction of structures, and power studies. He joined the Canadian Army Active Force in 1940, served in the Royal Canadian Signals in Great Britain, North Africa, and North West Europe. As a brigade signals officer with the 7th Canadian Infantry Brigade he landed, with his formation, during the assault on the Normandy Coast on June 6, 1944. Returning to Canada he was discharged in October, 1945, and re-entered the employ of Calgary Power Ltd., as resident engineer on the construction of the Barrier Power Development. Following this, he was transferred to Montreal Engineering Company, and was in charge of construction of the Snare River Hydro Development, which was built for the North West Territories Power Commission in the Yellowknife District in 1947-1948. He went from there to the Spray Development and on completion of this project, came to Montreal.

Mr. Eckenfelder joined the Institute in 1932 as a Student, transferring to Junior in 1937 and to Member in 1947.

Duggan Medal and Prize

Awarded for papers dealing with the use of metals for structural or mechanical purposes.

E. A. Allcut, M.E.I.C.

E. A. Allcut, of Toronto, has been awarded the Duggan Medal and Prize for his paper "Possibilities of the Heat Pump in Canada". This paper was published in the June, 1952, issue of the *Journal*.

Mr. Allcut is professor of mechanica engineering and head of the mechanical engineering department of the University of Toronto. He joined the staff of the University in 1921 as associate professor, being appointed professor in 1931.

He graduated with honours from the University of Birmingham in 1908 with the degree of B.Sc. He received the degree of M.Sc. in engineering in 1909, and was the Heslop Gold Medallist. He was a Bowen Research Scholar in the 1908 and 1909 university years.

He obtained engineering experience as assistant engineer for the Humphrey Pump Company; as manager of the engineering and testing machine department, W. & T. Avery Ltd.; and as chief inspector of materials for Austin Motor Company.

Professor Allcut's memberships in professional associations and a review of the

G. V. Eckenfelder, M.E.I.C.

E. A. Allcut, M.E.I.C.

work he has done for them can be summarized as follows: fellow of the Royal Aeronautical Society, 1939; president, Affiliated Engineering Societies of Ontario, 1946; member and past chairman of the Ontario Section of the American Society of Mechanical Engineers; chairman of the Canadian Advisory Committee of the Institution of Mechanical Engineers; member of the Association of Professional Engineers of Ontario; chairman of the American Society of Mechanical Engineers Power Test Codes Committee No. 16 on Gas Producers.

He has served as a member of the Committee on Substitute Fuels of the National Research Council, and as chairman of the Sub-committee on Producer Gas (War Research). He was the joint author with R. H. Patten of the two reports of this Committee—N.R.C. Nos. 1220 and 1293—"Gas Producers for Motor Vehicles". He was on the committee appointed by the Government of the Province of Ontario to investigate an accident at the Paymaster Mine and to suggest changes in the mining regulations of the Province for the purpose of ensuring greater safety for mining personnel. He is also chairman of the Smoke Abatement Advisory Board of the City of Toronto and of the Committee on Atmospheric Pollution in Canada, established in 1950.

His work has been recognized on previous occasions—when he was the recipient of the Herbert Akroyd Stuart Prize of the Institution of Mechanical Engineers, 1930; the Plummer Medal of the Engineering Institute, 1943; and the Gzowski Medal of the Engineering Institute, 1947.

Professor Allcut is the author of the following books: Materials and Their Application to Engineering Design; Engineering Inspection; An Introduction to Heat Engines; Principles of Industrial Management; and many technical articles and papers.

Ross Medals

Awarded for papers on electrical engineering subjects.

F. L. Lawton and J. S. Kendrick have been awarded Ross Medals of the Institute for their jointly-authored paper "Nechako-Kemano-Kitimat Hydro Electric Power Development and Aluminum Reduction Plant". This paper appeared in the September, 1952, issue of the *Journal*.

F. L. Lawton, M.E.I.C.

F. L. Lawton, of Montreal, a newly-elected councillor of the Institute, is a well-known Canadian hydro-electric engineer.

F. L. Lawton, M.E.I.C.

Graduating from the University of Toronto in 1923, he was for a short while with Canadian Westinghouse Company Limited at Hamilton, following which he joined the General Electric Company at Schenectady on their well-known test course. On completion of this, he was placed in charge of extensive large-scale tests designed to develop the theory underlying the steady-state and transient stability of long-distance power transmission systems.

In 1925, Mr. Lawton joined the Quebec Development Company, then completing the construction of the Isle Maligne hydro-electric power development, as an electrical engineer. In 1927 he became associated with the Duke-Price Power Company, Limited, as assistant to the superintendent of operation, and in 1937 was appointed chief engineer of the successor Saguenay Power Company, Limited.

He soon assumed broader responsibilities in the Canadian aluminum industry, first as assistant chief engineer, Aluminum Company of Canada, Limited, in 1941, and then as chief engineer, power department, Aluminium Laboratories Limited in 1948.

He was intimately associated with the design and construction of the 1,200,000 hp. Shipshaw power development and the related Lake Manouan and Passe Dangercuse storage reservoirs, as well as the mercury-arc power-conversion facilities and associated power supply arrangements at Arvida.

He was closely associated with the initial investigations for the British Columbia power project and has been acting in a consulting capacity on a number of major engineering problems, such as the pressure conduits, underground powerhouse, transmission facilities and system planning.

He has investigated numerous hydro-electric projects in many parts of the world, and has written a number of papers on hydro-electric and related subjects.

As a past chairman of the Saguenay and Montreal Branches of the Engineering Institute of Canada, a fellow and past vice-president of the American Institute of Electrical Engineers, and a member of the American Society of Civil Engineers and of the Corporation of Professional Engineers of Quebec, he has taken a very active part in professional activities. He is president of the Canadian Electrical Association.

J. S. Kendrick, M.E.I.C.

J. S. Kendrick, also of Montreal, is assistant project manager for the Aluminum Company of Canada, Limited, on the British Columbia project.

He was born in Vancouver and graduated from the University of British Columbia in 1938. He worked with the Water Rights Branch of the British Columbia Government until 1948 with the exception of four years in the Naval Service during the war. In 1949 he joined the Aluminum Company of Canada as resident engineer in Vancouver and has been working on the British Columbia project ever since, latterly as assistant project manager.

Prior to moving to Montreal in the summer of 1952, he had been a member of the board of examiners and a member of the Council of the British Columbia Association of Professional Engineers. He is also an Associate Member of the American Society of Civil Engineers.

Mr. Kendrick joined the Engineering Institute in 1951 as a Member.

J. S. Kendrick, M.E.I.C.

Leonard Medal

Awarded for papers on mining subjects.

F. E. Patton

F. E. Patton, of Noranda, Que., won the Leonard Medal for his paper on "Backfilling at Noranda". This paper was published in the April 1952 issue of the *Canadian Mining and Metallurgical Bulletin*.

F. E. Patton

Mr. Patton, who is mine captain at Noranda Mines Ltd., is from Anyox, B.C. He received his early education there and at Portland, Oregon. He came to Quebec in 1934, working for a year at Beattie Mines.

He went to the Michigan School of Mines, and graduated in 1937 with the degree of B.Sc. in mining.

He was associated first with Noranda Mines Ltd., as a surveyor from 1938 to 1943; and as a mine research and ventilation engineer from 1943 to 1945. He worked with K. V. Gamble, Toronto, as a field engineer for a year, before going to Consolidated Beattie as shift boss and chief engineer (Donchester) in 1946 and 1947. Returning to Noranda Mines Ltd., he was appointed chief mine engineer in 1947. He became mine captain in 1952.

The Canadian Lumbermen's Association Prize

Awarded for the best paper on the use and treatment of lumber.

Carson F. Morrison, M.E.I.C.

Professor Carson F. Morrison, M.E.I.C., of the University of Toronto, was awarded the Canadian Lumbermen's Association

C. F. Morrison, M.E.I.C.

'rize for his paper "Glued Laminated Timber", which appeared in the April 1952 issue of the *Journal*.

Professor Morrison was born in Saskatchewan and attended the University of Saskatchewan and McGill University. He taught civil engineering and mathematics at the University of Alberta before joining the staff of the University of Toronto where he is now professor of civil engineering. He is co-author with Dr. C. R. Young of a textbook "Structural Problems", and author of the chapter of Timber Construction in the "Civil Engineering Reference Book" edited by Probst and Comrie, recently published in London, England.

He has done research work on modern methods in timber construction at the University of Toronto and at the Forest Products Laboratory, Ottawa.

He has been actively engaged since 1940 in the practice of consulting engineering, and since 1946 as a member of the partnership Morrison, Hershfield, Millman and Huggins, Consulting Engineers, Toronto.

Professor Morrison is a member of the C.S.A. Sectional Committee on Timber Standards and its Committee on Structural Timber. He is on the Forest Products Laboratory Advisory Committee and is chairman of its sub-committee on timber engineering. He is a member of the Technical Committee on Design, Panel on Wood, Associate Committee on the National Building Code.

Active in the work of the Engineering Institute, Professor Morrison is a past chairman of the Toronto Branch, and a past councillor.

The prize-winning paper, "Glued Laminated Timber", was a condensation of a paper entitled "Research on the Structural Use of Glued Laminated Timber" which was presented at the Building Research Congress, 1951, in London, England.

Students and Junior Prizes

Awarded for the best papers presented by Students and Juniors of the Institute in the vice-presidential zones.

John Galbraith Prize

N. E. Hudak, Jr.E.I.C.

N. E. Hudak, of Hamilton, Ont., was awarded the John Galbraith Prize for his paper "Location of Faults in Power Cables by Fault Generated Surges".

Mr. Hudak is a design engineer for Canadian Westinghouse Company, Hamilton, in the metalclad switchgear department.

He graduated in 1948 from the University of British Columbia with the degree of B.A.Sc. in electrical engincering. He was awarded the British Columbia Telephone Company Limited scholarship, and in 1948 returned to the University of British Columbia for post-graduate studies,

N. E. Hudak, Jr.E.I.C.

and was also an instructor in electrical engineering. He received the degree of M.A.Sc. in the spring of 1951.

During vacations in 1948, 1949 and 1950, Mr. Hudak was employed by the B.C. Eleetric Railway Co. Ltd., on substation design. In June 1951 he went to Canadian Westinghouse Co. Ltd., in Hamilton, on a graduate engineer training course, and after a year on the course joined the metalclad switchgear department.

He has, during 1952 and 1953, given a course at Canadian Westinghouse for Nova Scotia Technical College Graduate Studies Department on the subject "Symmetrical Components". He has been in the Reserve Army since 1948, at present a lieutenant with the 5th Technical Regiment of the R.C.E.M.E. in Hamilton, Ontario.

Mr. Hudak joined the Institute as a Student in 1946 and transferred to Junior in 1950.

Ernest Marceau Prize

Leon Tougas, S.E.I.C.

Leon Tougas, S.E.I.C., has been awarded the Ernest Marceau Prize for his paper entitled "Structure de bois pour une tour de télévision située sur le Mont-Royal".

Leon Tougas, S.E.I.C.

Mr. Tougas has been an engineer in Marine Industries Limited, design and estimating department, since 1952.

He is from Iberville, Que., where he received his early education. He attended high school at College St. Jean in Montreal, and went on to Ecole Polytechnique, where he graduated in 1952 with the degree of B.A.Sc. in civil engineering. He received the silver medal of the Association of Graduates of Ecole Polytechnique.

Mr. Tougas' summer work for two years was with the Royal Canadian Electrical and Mechanical Engineers. He spent one summer surveying for the Hydro-Quebec Commission and one as an assistant job engineer for Pentagon Construction Limited.

He was awarded the Marine Industries Limited scholarship of $5,000.00 offered in 1952 for the young engineer chosen from among the 1952 graduates employed by the Company after one year's work.

Mr. Tougas will be sent this year by Marine Industries Limited to Massachusetts Institute of Technology, to study for a master's degree in naval architecture and marine engineering.

Phelps Johnson Prize

Paul Thibault, S.E.I.C.

Paul Thibault, S.E.I.C., has been awarded the Phelps Johnson Prize for his paper entitled, "Operation of an Earth to Air Heat Pump".

Mr. Thibault was born at Levis, Quebec, January, 1923. He attended Montreal Technical School and graduated with honours, receiving the Lieutenant Governor's Medal, the Bausch & Lamb Medal and the Montreal Technical School Medal. He graduated in 1952 from McGill University with the degree of bachelor of engineering in mechanical engineering, with honours, and with the British Association Medal.

Paul Thibault, S.E.I.C.

Mr. Thibault served for 5½ years with the engine room division of the Royal Canadian Navy, in the capacity of chief engine room artificer. He worked during the summer of 1951 at the National Research Council on the heat pump project. During the academic year 1952-1953, he was assistant to Dr. C. A. Robb in power plant design at McGill University, while still engaged in consulting and design work. He joined the consulting firm of Wiggs, Walford, Frost & Lindsay, in Montreal in May, 1952, as a design engineer.

Personals

News of the Personal Activities of Members of the Institute

R. E. Jamieson, O.B.E., M.E.I.C., dean of the engineering faculty of McGill University, has recently been elected president of the Canadian Standards Association.

Dean Jamieson graduated from McGill University in 1914. After serving overseas with the rank of lieutenant during the First World War, he returned to McGill for post-graduate study, receiving his M.Sc. degree in 1920. That same year he joined the staff of the engineering faculty as lecturer in mathematics and civil engineering. Twelve years later he was appointed professor of civil engineering and chairman of the department. Last year he was named dean of the engineering faculty.

R. E. Jamieson, M.E.I.C.

During the Second World War Dean Jamieson served as director general of the Army Engineering Design Branch of the Department of Munitions and Supply in Ottawa. After his resignation from this position in 1945 he remained a member of the Army Technical Development Board.

Dean Jamieson is a past-president of the Corporation of Professional Engineers of Quebec. He has served on many committees of the Engineering Institute. Previous to his recent appointment as president he was vice-chairman of the executive committee of the Canadian Standards Association.

Arthur Duperron, M.E.I.C., chairman of the Montreal Transportation Commission, has been appointed treasurer of the Engineering Institute of Canada for the year 1953-54.

Mr. Duperron was born at Nicolet, Que. He received his early education at Mount St. Louis College. After obtaining his B.Sc. degree in civil engineering from Ecole Polytechnique in 1911 he was engaged in hydro-electric surveys in Quebec during 1911 and 1912, after which he served with the Canadian Pacific Railway Company until 1915.

A. Duperron, M.E.I.C.

From that time until 1927 he was associated with the Quebec Streams Commission and was named assistant chief engineer in 1925.

Two years later he was appointed chief engineer of the Montreal Tramways Commission, and in 1937, chief engineer of the Montreal Tramways Company. In 1942 he became assistant general manager and in 1949, general manager of the Company. The following year he was named chairman of the Montreal Transportation Commission.

McNeely DuBose, M.E.I.C., was elected president of Saguenay Power Company, Ltd. at the recent annual meeting of the Company's board of directors.

Mr. DuBose is vice-president of Aluminum Company of Canada, Ltd.; director and vice-president of the Aluminum Power Company; president and director of Saguenay Transmission Company, Ltd.; and vice-president and director of The Alma & Jonquieres Railway Company.

He has been active in the management of Saguenay Power Compan Ltd. for nearly 30 years and is inte nationally known for his contributio to the design and operation of hydr electric power developments in mar parts of the world. He is responsib for the major share of the planning ar execution of the Aluminum Compan of Canada, Ltd.'s development in Bri ish Columbia.

Mr. DuBose received his B.E. degre from the University of South Carolin and his E.E. degree from North Car lina State College of Engineering.

He is a past vice-president of th Engineering Institute of Canada, and past-president of the Canadian Electr cal Association. He is a member of th Corporation of Professional Engineer of Quebec and a Fellow of the American Institute of Electrical engineers.

McNeely DuBose, M.E.I.C.

Dr. C. J. Mackenzie, C.M.G., M.E.I.C., chairman of Canada's Atomic Energy Control Board and past-president of the National Research Council, was awarded the doctorate of science by the University of Montreal at its recent convocation on June 3.

Dr. Mackenzie, a past-president of the Engineering Institute, has been similarly recognized for his outstanding contributions to engineering and science by the Universities of Dalhousie, Queen's, Western Ontario, Algiers, Saskatchewan, McGill, Laval, Cambridge,

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British Columbia, Princeton, Toronto and the Nova Scotia Technical College.

Robert F. Legget, M.E.I.C., became the first engineer to be admitted as an Honorary Fellow to the Royal Architectural Institute of Canada at its annual convocation on April 25, bringing to fifteen the number to receive this honour.

He was presented his certificate of membership at the R.A.I.C. annual dinner by His Excellency the Governor-General of Canada who is also an Honorary Fellow of the Institute.

In recent years Mr. Legget has addressed the Institute on the work of the National Research Council's Division of Building Research of which he is director, and which serves both the engineering and architectural professions in its service to building in Canada.

In addition to speaking and writing about the relations between the two professions in Canada, Mr. Legget conducted in 1943 a survey of some aspects of architectural training in Canada for the R.A.I.C.

Stewart Young, M.E.I.C., former direc of Community Planning for the Pr ince of Saskatchewan, has been elec an Honorary Member of the To Planning Institute of Canada in rec nation of his distinguished contri tions in the field of town planning.

Mr. Young was also among the f engineers to receive honorary memb ship in the Engineering Institute Canada at its sixty-seventh ann meeting banquet in Halifax on M 22, 1953.

Arthur R. Hannaford, M.E.I.C., who h retired as city building commissior in Hamilton, Ont., has opened a priva practice as consulting engineer in B lington, Ont. He is specializing in vestigations and reports.

Mr. Hannaford was born in Dert England, and came to Canada in 19 He joined the engineering staff of t Grand Trunk Railway and continu his connection with the railway un 1921 when he accepted the position office and designing engineer with t city engineer's department at Hamilto In 1944 he was appointed city buildi commissioner.

He joined the Institute as an Ass ciate Member in 1920 and became Member in 1940. On January 1 of th year he was granted Life Membe ship.

Mr. Hannaford is a past chairma and secretary of the Hamilton Branc and served on the Branch executive.

John Melville Wilson, M.E.I.C., has r tired as Toronto district engineer aft nearly 40 years' service with the D partment of Public Works. He is no a partner in Wilson & Partridge, marin engineering consultants.

Mr. Wilson obtained his B.A.Sc. de gree in civil engineering from the Uni versity of Toronto in 1908, and hi law degree from Osgoode in 1923. Fo a number of years he was employed i municipal work both in Toronto an Moose Jaw, Sask. He was appointe district engineer in Toronto for th Federal Department of Public Work in 1914.

In June, 1922 he received the degre of C.E. from the University of Toronto

Mr. Wilson joined the Institute in 1907, transferring to Associate Membe in 1909 and to Member in 1918.

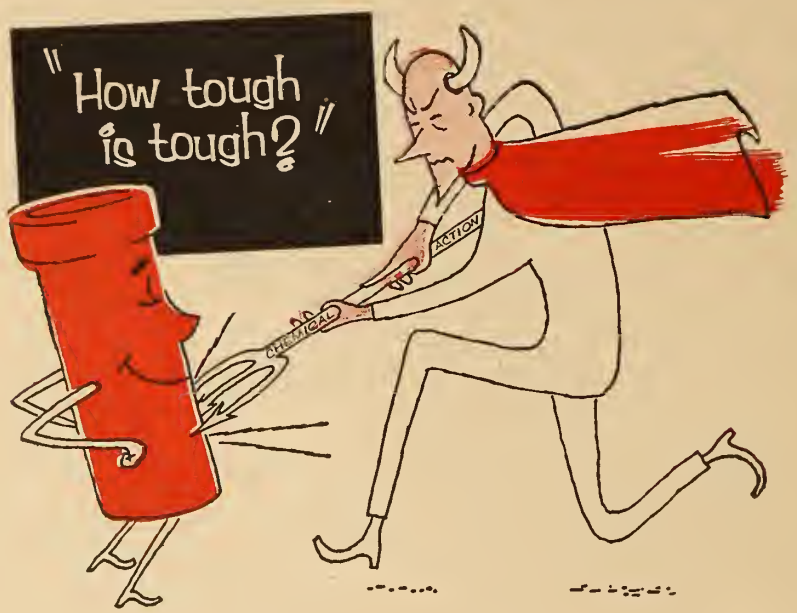
T. R. McLagan, O.B.E., M.E.I.C., has recently been appointed to the board of directors of The Foundation Company of Canada Limited. He is president and general manager of Canada Steamship Lines, president of Canadian Shipbuilding and Ship Repairing Association, and president of the Canadian Industrial Preparedness Association. He is also a governor of McGill University.

Other directorates held by Mr. McLagan are Algoma Steel Corporation Limited; Canadair Limited; General Dynamics Corporation of New York; Commercial Alcohols; and Abitibi Power and Paper Company, Limited.

J. K. Jamieson, M.E.I.C., has been appointed a vice-president of Imperial Oil Limited during the recent annual meeting of the board of directors.

Mr. Jamieson has been associated with the oil industry since 1932.

He attended the University of Alberta and the Massachusetts Institute of Technology, graduating from the latter in 1931.



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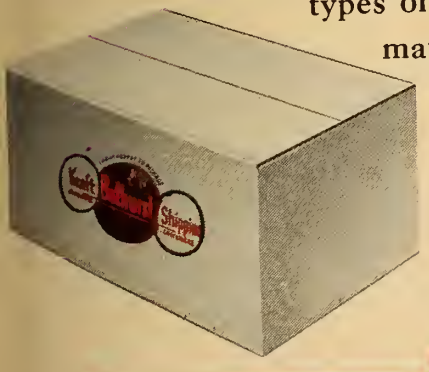

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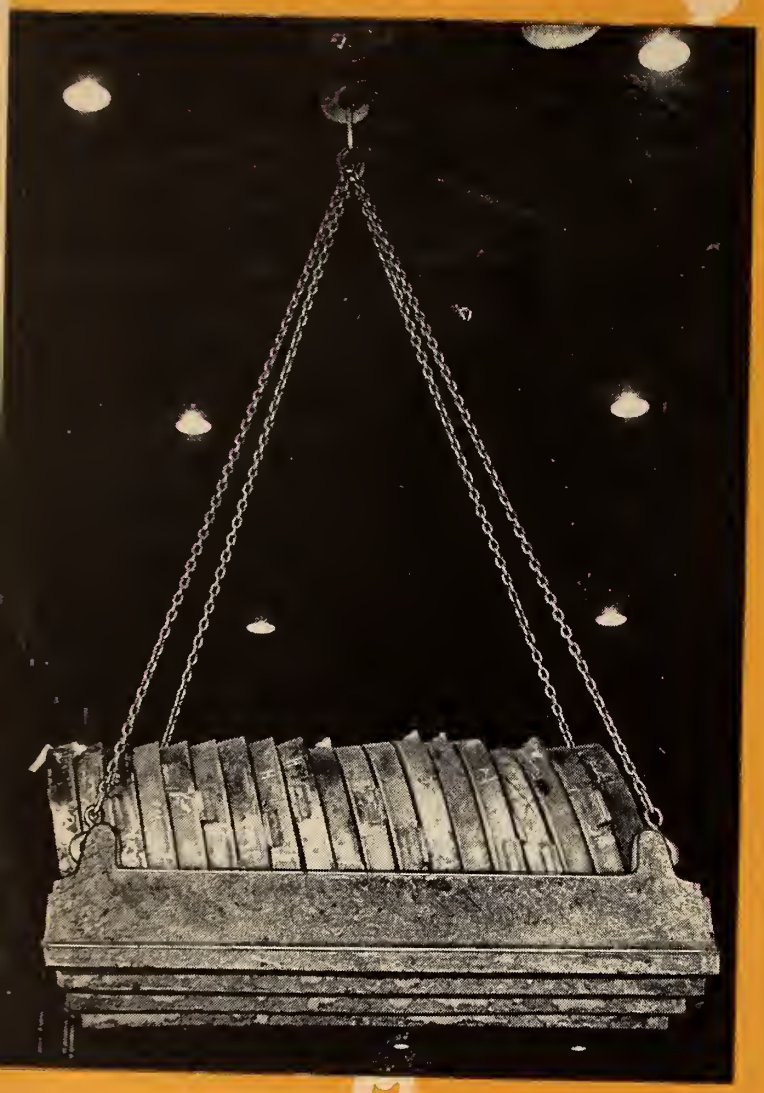

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on R. Tasse, M.E.I.C., of Tasse, Sarault Associates, consulting engineers in uebec City and in Montreal, has been ected president of the Quebec Board Trade.

Yvon R. Tasse, M.E.I.C.

Mr. Tasse was born in St. Gabriel de Brandon and received his education at St. Mary's College and at Ecole Polytechnique where he received his civil engineering degree in 1935.

After graduation he undertook the two-year engineering training course provided by the Canadian General Electric Company. In 1938 he entered the Company's Montreal office as engineer in the industrial appliances department. The following year he was transferred to Quebec City where he was in charge of the same department until 1948.

At this time he opened consulting engineering offices with Mr. Gilles Sarault under the firm name of Tasse, Sarault and Associates.

Mr. Tasse is a past-president of the Canadian General Electric Test Alumni Association, and since 1951 he has been a director of the Ecole Polytechnique Graduate Society.

W. R. Godfrey, M.E.I.C., former director of works for the City of Saint John, N.B., has joined James F. MacLaren Associates, consulting engineers, as manager of the Company's Saint John office which was opened on May 1.

W. R. Godfrey, M.E.I.C.

A native of Chatham, N.B., Mr. Godfrey graduated in electrical engineering in 1935 from the University of New Brunswick. He then served as cost accountant and assistant to the provincial district highway engineer of New Brunswick district No. 2. In 1940 he joined the Department of Transport as instrumentman, and two years later he became water supply engineer of the Department for airports in eastern Canada and Newfoundland. He was appointed to the position of director of works for Saint John in 1946.

Mr. Godfrey served as chairman of the Saint John Branch of the Engineering Institute in 1951.

Fred L. Allen, M.E.I.C., former vice-president and manager of manufacturing for the Canadian International Paper Company, has been named vice-president and general manager.

Mr. Allen has been connected with the pulp and paper industry for nearly 30 years. He joined the Canadian International Paper Company in 1928 and was appointed its chief engineer in 1936, becoming manager of manufacturing in the Newsprint Division in 1944. Three years later he was named vice-president and director, and in 1948 he became manager of manufacturing.

Mr. Allen received his B.S. and M.E. degrees in mechanical engineering in 1914 from the Clarkson College of Technology.

E. L. Hartley, M.B.E., E.D., M.E.I.C., contract engineer with Western Bridge and Steel Fabricators Limited in Vancouver, B.C., has been named chairman of the Vancouver Branch of the Engineering Institute.

Mr. Hartley was born in Liverpool, England. After graduating from the Liverpool Institute School in 1930, he entered Queen's University in Kingston,

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Ont., graduating in civil engineering in 1933.

His first job after graduation was on the supervisory staff of the Unemployment Relief Camps in Barriefield, Ont. In 1934, he entered the properties department of Jas. Richardson & Sons, Ltd. in Winnipeg, Man. Two years later he joined W. G. Swan Engineering Co., Ltd. in Vancouver. In 1937 he was appointed engineer in charge of construction of the Canada Packers Ltd. Vancouver plant, and he also served as assistant estimating engineer for the Western Bridge Company during this period. In 1938 he was associated with B.C. Appraisal Co. Ltd. and also with the Dominion Bridge Co., Ltd., during the construction of the Lions Gate Bridge.

E. L. Hartley, M.E.I.C.

At the beginning of World War II, Mr. Hartley joined the Royal Canadian Engineers as works officer in the Vancouver Area. In 1940 he was field engineer at Second Canadian Division headquarters. He was promoted to the rank of captain in 1941 and served with the First Canadian Army overseas until the end of the war. He was mentioned in despatches, named a Member of the British Empire, and awarded the E.D. for distinguished service. He was also named an officer of the Order of Orange Nassau by the Netherlands Government.

In 1945 he entered the Western Bridge and Steel Fabricators Limited in Vancouver as designing engineer, and in 1947 he was appointed to his present position.

Clifford N. Murray, M.E.I.C., has been appointed general superintendent of Dominion Steel and Coal Corp., Ltd. in Sydney, N.S.

Mr. Murray is a graduate of the Sydney Academy, Acadia University, and the Nova Scotia Technical College from which he received his B.Sc. degree in mechanical engineering in 1935.

He entered the Dominion Steel and Coal Corporation in January, 1936 as a blast furnace helper and earned several promotions leading to his appointment as assistant superintendent of the blast furnace department in 1942. The following year he was appointed superintendent of that department, a position he filled until his promotion to assistant to the general superintendent of the Sydney Steel plant in June, 1950.

Clifford N. Murray, M.E.I.C.

Mr. Murray is a councillor of the Engineering Institute, and a past-chairman of the Cape Breton Branch. He is a member of the Eastern United States Blast Furnace and Coke Ovens Association, the Mining Society of Nova Scotia, and the Professional Engineer's Industrial Relations Committee.

John J. Denovan, M.E.I.C., vice-president of Denovan Limited in Montreal, has received an award presented by The Royal Commission on Awards to Inventors for his work on an engineer tank. His original work led to an official requirement for the Assault Vehicle Royal Engineers.

Mr. Denovan was born in Dalkeith, Ont. After receiving his elementary and high school education at Asbestos, Que. and Cornwall, Ont., he entered Queen's University, graduating in mechanical engineering in 1940.

That same year he was commissioned in the Royal Canadian Engineers and proceeded overseas. In 1942 he was attached to the Department of Tank Design of the British Ministry of Supply as liaison officer and it was during this period that the design of the engineer tank was made.

Mr. Denovan returned to Canada at the end of the war in Europe and served for a time with the Director of Engineer Development in Ottawa, and as liaison officer on supply-dropping with the Canadian Army's expedit Musk-Ox. He retired from the Ar in 1946 with the rank of major.

He was employed for 18 months machine designer at Dominion En neering Company after which he joi Sumac Limited as chief engineer a manager. Three years ago he and father, R. A. Denovan, M.E.I.C., form their own consulting company to des asbestos milling machines and asbes mills.

J. J. Denovan, M.E.I.C.

J. J. Hanna, M.E.I.C.

J. J. Hanna, M.E.I.C., superintendent the Calgary Refinery of Imperial O Limited, has been appointed presider of the Association of Professional Eng neers of Alberta.

Mr. Hanna received his B.A.Sc. de gree from the University of Toronto i 1914. After overseas service with th rank of captain during the First Worl War, he returned to the City of Cal gary Engineering Department where h had worked previously, and was engage for two years in reinforced concrete an bridge construction. In 1921 he wa employed as resident engineer on th Old Man River crossing for the Leth bridge Northern Irrigation District.

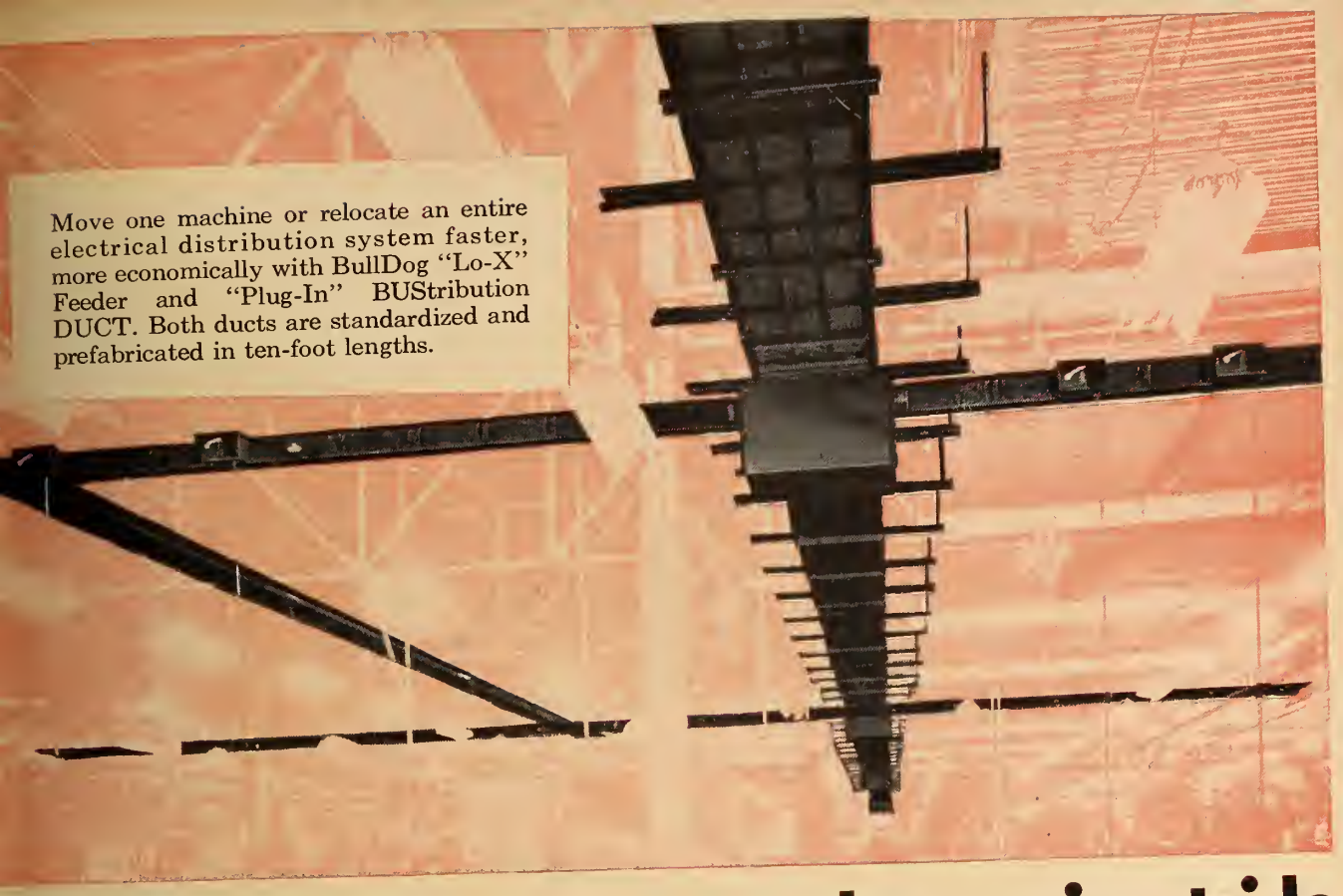
He joined Imperial Oil Limited at th Calgary Refinery in 1922 and has re mained with the Company, working a construction engineer, refinery engineer assistant superintendent, and since 1948 as superintendent.

Mr. Hanna served as a Councillor in the Association of Professional Engineers of Alberta in 1950-1952.

H. J. Williamson, M.E.I.C., district controller of air services for the Department of Transport at Moncton, N.B., has been appointed chairman of the Moncton executive of the Professional Institute of the Public Service of Canada.

A 1930 graduate in electrical engineering from the University of New Brunswick, Mr. Williamson joined the Government service in 1931, serving first with the Defence Department, and then in 1937 with the Transport Department in western Canada where he took part in the early development of a trans-continental airway.

In 1941 he was placed in charge of developing radio communications for the northwest staging route and the Alaska highway. He undertook a National Defence College course at Kingston, Ont., in 1949, and a year later was appointed to his present position.



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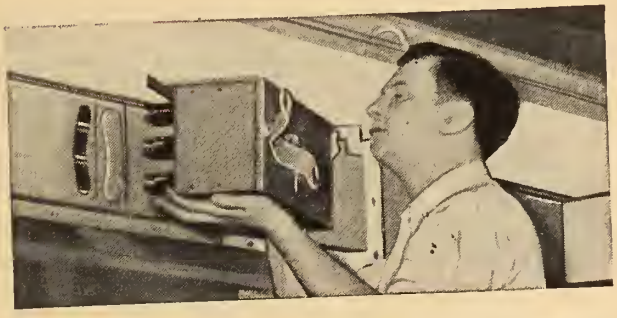

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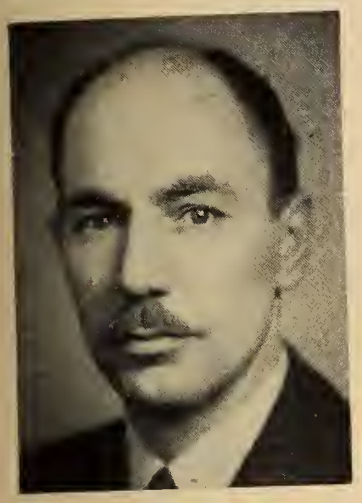
BOX 10, MONTREAL

Suppliers of plastic raw materials.

J. D. Duncan, M.B.E., M.E.I.C., has been appointed manager of Administrative Service for the Canadian General Electric Company, Limited.

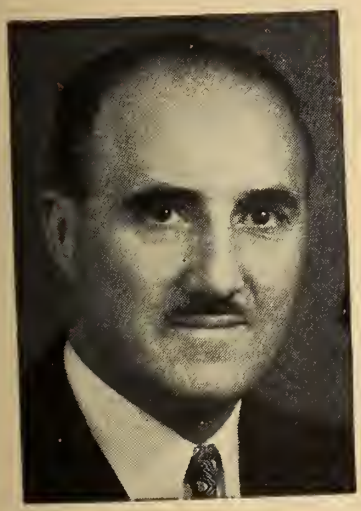


J. D. Duncan, M.E.I.C.

Mr. Duncan undertook the Company's test training after graduation in 1928 from the University of British Columbia. He has held a number of appointments in the Company's apparatus organization.

During the war he rose to the rank of major in overseas services with the Royal Canadian Signal Corps and was named a Member of the Order of the British Empire in 1945.

J. W. Greenlaw, M.E.I.C., has been appointed manager of the air conditioning department of the Industrial Products Division of the Canadian General Electric Company.



J. W. Greenlaw, M.E.I.C.

A graduate in electrical engineering from the University of Manitoba in 1929, Mr. Greenlaw has wide experience in the Canadian electrical industry. Before joining the Canadian General Electric Company in his present capacity, he was a partner in Lighting Materials Limited, a Winnipeg electrical manufacturing firm.

Mr. Greenlaw is a member of the Association of Professional Engineers of Manitoba.

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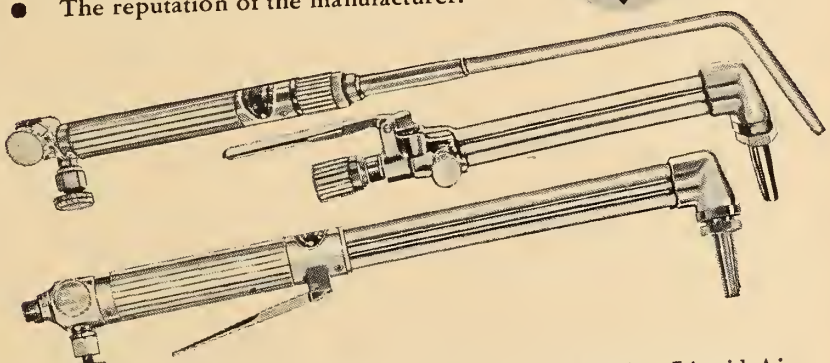

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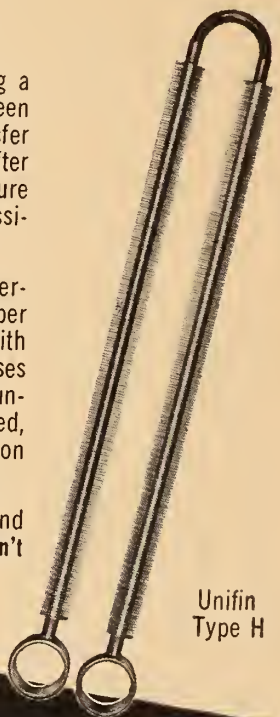

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J. A. Beveridge, M.E.I.C.

J. A. Beveridge, M.E.I.C., has recently been appointed city commissioner of Red Deer, Alta., as manager of all departments including public works, power distribution and civil defence.

After obtaining his B.Sc. degree from the University of British Columbia in 1947, Mr. Beveridge joined Canadian Industries Limited as maintenance engineer at the James Island explosives plant. He then obtained his master's degree in engineering from the John Hopkins University in 1950, after which he entered the service of the Government of Alberta as acting provincial sanitary engineer. During his two years in this position he was a member of the Provincial Board of Health, a director of the Western Canada Water and Sewage Conference, and a lecturer at the University of Alberta.

More recently he has served as a member of the Legislative Committee of the Union of Alberta Municipalities; as a member of an Associate Committee working on the National Building Code; and as district representative of the Community Planning Association of Canada.

J. L. Miller, M.E.I.C.

J. L. Miller, M.E.I.C., has established a consulting engineering practice in Vancouver, B.C. His office will specialize in the design and supervision of industrial plants and in harbour and marine structures.

Mr. Miller was formerly senior engi-

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neer with Canadian Bechtel Limited in Vancouver, and from 1947 to 1952 he was supervisor of civil engineering for the B.C. Electric Company in Vancouver.

He is a graduate in civil engineering from the University of Saskatchewan, class of 1941.

J. W. Hughes, M.E.I.C.

J. W. Hughes, M.E.I.C., retired recently as general electrical engineer of the Canadian Pacific Railway Company.

Mr. Hughes' association with the Canadian Pacific Railway Company dates back to 1907 when he began as an engineer in the electrical department at Angus Shops, Montreal. He directed installation of modern electric equipment on the Company's bascule bridge at Sault Ste. Marie in 1914, and supervised the building of machinery for the diesel-electric tug and coal car in operation between Prescott and Ogdensburg.

He has been electrical engineer for the eastern lines for 38 years.

Mr. Hughes is a past-president of both the Canadian Railway Club of Montreal and the Toronto Railway Club.

Hugh C. Nourse, M.E.I.C., staff engineer of the automotive equipment department of the Bell Telephone Company of Canada in Montreal, has recently been appointed by the Council of the Engineering Institute as one of the three trustees for the Harry F. Bennett Education Fund.

H. C. Nourse, M.E.I.C.

Mr. Nourse graduated from Queen's University in mechanical engineering in 1914. He joined the Canadian Ingersoll Rand Company in Sherbrooke, Que., in 1915 and continued with this Company until 1924 when he entered the Bell Telephone Company in Montreal as construction apparatus engineer and later as vehicles engineer.

He joined the Engineering Institute as an Associate Member in 1919, transferring to Member in 1940. He has been on the Student Guidance Committee of the Montreal Branch since 1947, serving as chairman of that committee in 1950 and 1951.

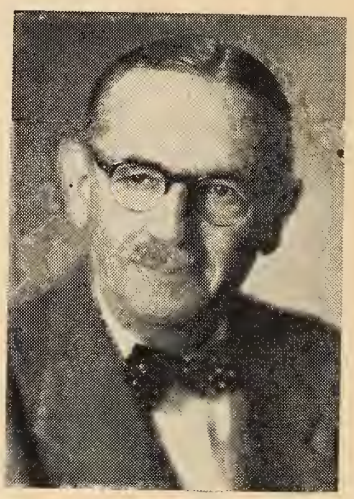
Mr. Nourse is a member of the Corporation of Professional Engineers of Quebec, the Society of Automotive Engineers, and the Canadian Standards Association.

Chipman H. Drury, O.B.E., M.E.I.C., has been appointed a director of the Provincial Transport Company at a recent meeting of that Company's board of directors. He is a vice-president of Canadian Car and Foundry Co. Ltd. in Montreal.

Mr. Drury is a graduate of Lower Canada College and the Royal Military College. He received his B.Sc. degree in chemical engineering from McGill University in 1939. After war-service overseas with the rank of colonel, he entered the Harvard Graduate School of Business Administration, graduating with an M.B.A. degree in 1947. That same year he entered Canadian Car and Foundry Co. Ltd.

W. Sefton, M.E.I.C., has been appointed senior engineer of the C. D. Howe Company in Montreal. He was formerly deputy to the project engineer.

Mr. Sefton graduated in civil engineering in 1938 from the University of London.



F. J. McHugh, M.E.I.C.

F. J. McHugh, M.E.I.C., was elected president of the Canadian Institute of Steel Construction Inc. in Toronto following a recent annual meeting of the Institute.

Mr. McHugh brings to his new position nearly a half-century of engineering experience. Since 1905 he has been on the engineering staff of the Dominion Bridge Company. For many years he was chief draughtsman and is now engaged on special assignments.

John Grieve, M.E.I.C., has been appointed general manager and executive secretary of the Canadian Institute of Steel Construction Inc. in Toronto.

John Grieve, M.E.I.C.

A native of Scotland, Mr. Grieve was employed in Canada by the Dominion Bridge Company in Montreal, and later in the United States by the Detroit Graphite Company as vice-president in charge of the New York office. Returning to Canada, he became general industrial manager of Brandram-Henderson Limited, and later, sales promotion manager of Imperial Varnish and Colour Company.

Mr. Grieve is a Life Member of the Engineering Institute, a member of the Association of Professional Engineers of Quebec, and an associate member of the American Society of Civil Engineers.

Nicholas Shisko, M.E.I.C., is assistant chief engineer with Abitibi Power and Paper Company Limited in Toronto.

He was formerly construction engineer with Thunder Bay Paper Co. Ltd., a Company subsidiary in Port Arthur Ont.

Mr. Shisko is a 1940 mechanical engineering graduate of Queen's University.

James G. Boultbee, M.E.I.C., is in Calgary, Alta., employed as estimator with Mannix Limited.

Before joining the Company in 1951 he was associated with the Rayner Construction Company in Thessalon, Ont.

Mr. Boultbee is a 1941 graduate in civil engineering, and a 1947 graduate in forestry from the University of Toronto.

John P. Collier, M.E.I.C., has been transferred by British American Oil Company Limited from Edmonton, Alta. to Toronto, Ont.

Mr. Collier is a graduate in chemical engineering from the University of Alberta, class of 1934.

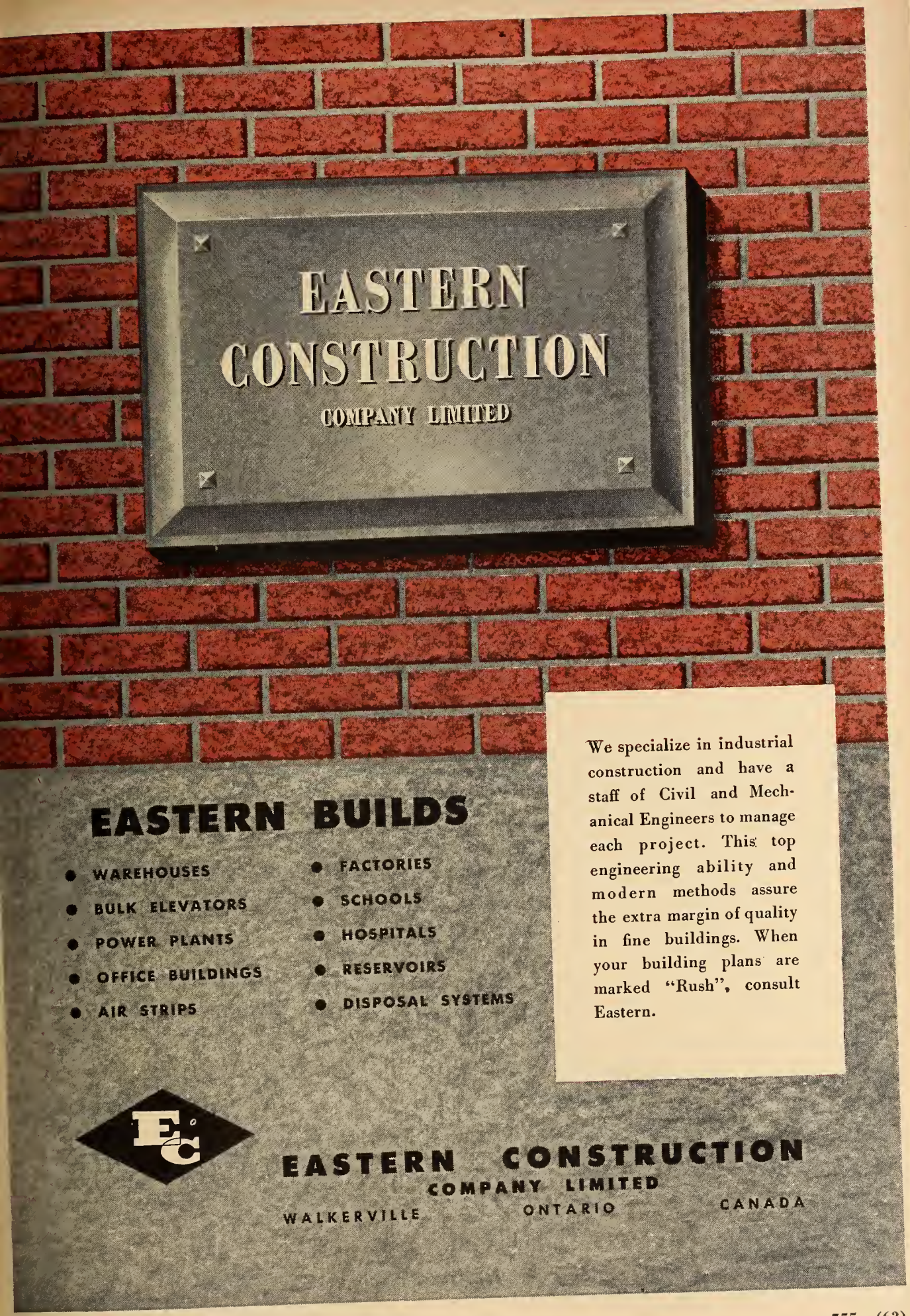
G. A. Kotzer, M.E.I.C., has been transferred to the Ottawa office of the Engineering and Architectural Division of the Department of Resources and Development. He was formerly in Banff, Alta.

Mr. Kotzer is a graduate in civil engineering from the University of Saskatchewan, class of 1949.

R. Rodaru, M.E.I.C., is managing director of the Cardinal Engineering and Machinery Company in Montreal.

He was formerly manager of the Industrial Division of Volcano Limited in Montreal and Ste. Hyacinthe, Que.

Mr. Rodaru is a graduate of Berlin-Charlottenburg Technical High School in mining engineering, class of 1926.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R. T. P. Houlihan, M.E.I.C.

M. C. Edwards, M.E.I.C.

R. C. Mitchell, M.E.I.C.

R. T. P. Houlihan, M.E.I.C., Vancouver district sales manager of the Canadian Westinghouse Company, has been transferred to Hamilton, Ont., where he will take over the position of sales manager of the Niagara district in the Company's District Apparatus Division.

Mr. Houlihan joined the Company following graduation from the University of Alberta in 1941. Upon completion of the two-year graduate training course he entered the correspondence department.

During the war he saw service with the Royal Canadian Navy and in 1946 he entered the apparatus sales department of the Company's Winnipeg office.

In 1950 he was appointed manager of the Western District and the following year became Vancouver District sales manager.

M. C. Edwards, M.E.I.C., has been appointed manager of control engineering of the Industrial Products Division of the Canadian Westinghouse Company.

After receiving his B.Sc. degree in electrical engineering from the University of Alberta, Mr. Edwards entered the Company's graduate training course in 1937.

He was transferred to the Vancouver apparatus sales office where he was employed for some time before joining the Royal Canadian Air Force.

After his wartime service he entered the Company's engineering department in Hamilton, and since 1945 has been engaged in switchgear engineering.

R. C. Mitchell, M.E.I.C., has been appointed manager of power generating apparatus sales in the Power Products Division of the Canadian Westinghouse Company.

A graduate of the University of Toronto, Mr. Mitchell joined the Company in 1934, spending two years in the graduate training course.

He was later associated with the Burlington Steel Company and with a consulting engineering firm before returning to the Canadian Westinghouse Company in 1948 as supervisor of frequency conversion. He was later appointed manager of the distribution apparatus section of the marketing department.

Leonard E. Salkeld, M.E.I.C., is associated with the irrigation engineering and construction department of the Department of Agriculture in Gleichen, Alta.

Mr. Salkeld graduated in 1950 from the University of Saskatchewan in civil engineering.

William F. Lever, M.E.I.C., is now associated with Macco Corporation, engineers and constructors in Paramount, Calif.

He was previously employed as construction superintendent with Manwell Construction Co. Ltd. in Vancouver.

V. S. B. Corbet, M.E.I.C., has joined the staff of Canadian Cottons Limited in Montreal.

He was previously with J. D. Woods and Gordon in Toronto.

Mr. Corbet is a graduate in mechanical engineering from McGill University, class of 1944.

M. Kamen-Kaye, M.E.I.C., is a consulting petroleum geologist in Regina, Sask.

He received his B.Sc. degree in oil technology from the Royal School of Mines in 1929.

Wing Commander W. M. Diggle, R.C. A.F., M.E.I.C., has been promoted from the rank of squadron leader and has been transferred from Aylmer, Ont., to Air Force headquarters in Ottawa.

He is a graduate in civil engineering from the University of Saskatchewan, class of 1940.

L. L'Allier, M.E.I.C., is assistant director of Public Works for the City of Montreal, Que.

He is a graduate of McGill University in electrical engineering, class of 1935.

James R. Rettie, M.E.I.C., has been projects engineer with the Manitoba Hydro Electric Board in Winnipeg, Man., since 1950.

Previous to that time he was with Fraser-Brace Co. Ltd. in La Tuque, Que.

Mr. Rettie graduated in 1935 from the University of Manitoba in civil engineering.

W. J. Nichols, M.E.I.C., has joined Stevenson & Kellogg Limited in Toronto, Ont.

He was previously with J. D. Woods and Gordon Limited, management consultants in Montreal.

Mr. Nichols is a graduate in mining engineering from the University of Toronto, class of 1939.

E. A. Thompson, M.E.I.C., is now on the staff of Terminal Construction Company Limited in Montreal.

He was formerly with Mount Enterprise Limited in Morin Heights, Que. He had previously served as town manager of Sackville, N.B., and a town engineer of Bridgewater, N.S.

J. F. Semple, M.E.I.C., formerly on the staff of S. B. Russell & Sons Ltd. in Aberdeen ,Scotland, has joined the staff of C. D. Howe Company Limited in Montreal.

Mr. Semple graduated in mechanical engineering from the University of Aberdeen in 1944, and in civil engineering from the same university in 1948.

J. G. Dowie, M.E.I.C., is now associated with Canadian Bechtel Limited in Toronto.

He was formerly in the rapid transit department of the Toronto Transportation Commission in that City.

Mr. Dowie is a graduate in civil engineering from the University of Edinburgh, class of 1927.

Oswald A. Schmidt, M.E.I.C., has been appointed production co-ordinator of the P.S.C. Applied Research Limited in Toronto, Ont.

He was formerly assistant to the general manager of Elora Industries Ltd. in Elora, Ont.

Mr. Schmidt is a graduate in mechanical engineering from the University of Berlin, class of 1932.

E. A. Mahr, Jr.E.I.C., is now associated with Warren Bituminous Paving Co. Ltd. in Toronto, Ont.

He was formerly with Central Mortgage and Housing Corporation in Shilo, Man.

Mr. Mahr graduated in civil engineering in 1951 from the University of Manitoba.

Bruce E. Wilson, Jr.E.I.C., former field engineer on the Peribonka Power Projects of the Aluminum Company of Canada, Limited, has joined the firm of Spencer, White & Prentis of Canada, Limited, Toronto, engineers and contractors.

Mr. Wilson graduated in civil engineering in 1951 from Queen's University.

J. Kurelek, Jr.E.I.C., has joined the staff of Northern Engineering and Supply Co. Ltd. in Fort William, Ont.

Mr. Kurelek is a graduate in mechanical engineering from the University of Manitoba, class of 1951.

BABCOCK
BOILER FEED PUMP DELIVERS

60 GALLONS/MIN. AT 230° FAHRENHEIT

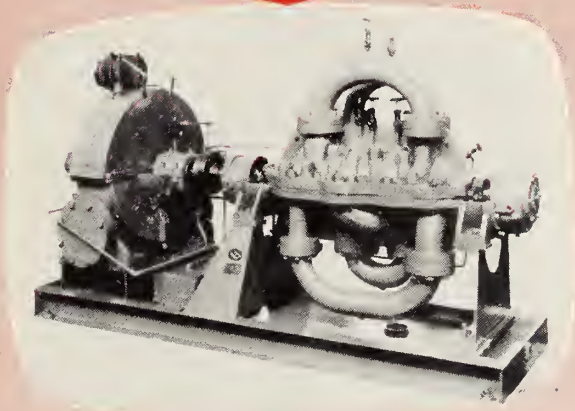
THE OGILVIE FLOUR MILLS CO., LIMITED installs BABCOCK FEED PUMPS

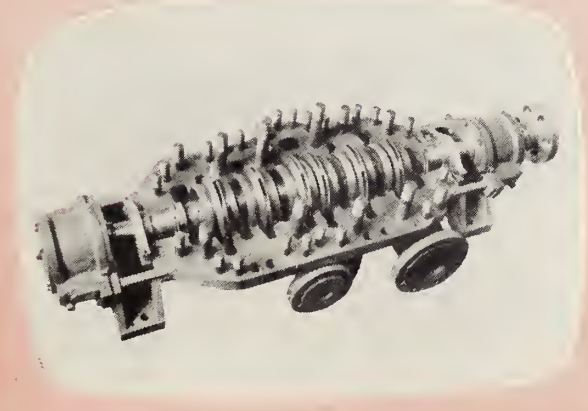
3 Babcock Six-stage Centrifugal Boiler Feed Pumps supply the feed water far Babcack bailers installed at the Montreal Plant of the Ogilvie Flour Mills. Each pump is designed ta deliver 60 imperial gallans per min., handling water at 230°F., against a total head of 1,382 feet when running at 3,500 R.P.M. Two units are motor driven and the other by a Babcack turbine, as shown in centre illustration.

Centre illustratian—shows centrifugal pump and Babcock turbine maunted as one unit.

Battom illustratian—shaws rotating element—easily accessible far inspection by remaval af top casing.

Consulting Engineers:
The Rankin Company Limited, Montreal





BABCOCK
SIX-STAGE BOILER FEED PUMPS

B.A. 2.

BABCOCK-WILCOX AND GOLDIE-McCULLOCH LIMITED, GALT, ONTARIO. MONTREAL - TORONTO - CALGARY - VANCOUVER

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- **VINYL, PLASTIC BACKING**—unaffected by acids, oils, greases, alkalis, water, salts and common commercial solvents.
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SALES OFFICES: HALIFAX MONTREAL TORONTO WINNIPEG VANCOUVER
Resident Salesmen: Saint John Quebec City Ottawa Hamilton Windsor Saskatoon Regina Calgary Edmonton

E. W. Hill, Jr.E.I.C.

E. W. Hill, Jr.E.I.C., has been appointed manager of switchgear sales in the Power Products Division of the Canadian Westinghouse Company.

A 1948 graduate of the University of Toronto, Mr. Hill undertook the two-year training course and has since been engaged in design work on switchboards and relays in the switchgear engineering department.

Hugh Coleopy, Jr.E.I.C., is on the staff of Vancouver Engineering Works as design draughtsman.

He was formerly with Vivian Diesels and Munitions Ltd. in Vancouver.

Mr. Coleopy graduated in mechanical engineering in 1951 from the University of British Columbia.

Howard R. Lumsden, Jr.E.I.C., is now associated with Fraser-Brace Terminal Constructors.

He was formerly with the Aluminum Company of Canada, Limited in Arvida, Que.

Mr. Lumsden graduated in civil engineering from McGill University in 1949.

Theodore Sakellarious, Jr.E.I.C., is now on the staff of the Canadian Pacific Railway Company.

He was previously with Canadian Westinghouse Company Limited in Hamilton, Ont.

Mr. Sakellarious graduated in mechanical engineering from the University of Athens in 1944, and in electrical engineering from the same university in 1946. After post-graduate study in power engineering at Ecole Central in Paris, he entered McGill University and received his M.Sc. degree in electrical engineering in 1950.

Cecil E. Jay, Jr.E.I.C., is now a district field representative in communications with General Electric Company Limited in Syracuse, N.Y.

Mr. Jay is a graduate of Dalhousie University and of the Nova Scotia Technical College where he received his electrical engineering degree in 1951.

H. G. Saville, Jr.E.I.C., is associated with Ferranti Electric Limited in Toronto, Ont.

He was formerly with Defence Research Medical Laboratories in Toronto.

Mr. Saville is a graduate in engineering physics from the University of Alberta, class of 1949.

David Townsend, Jr.E.I.C., is one of the ten Canadian engineers in industry to receive the Athlone Fellowship this year.

He is presently employed in research work at McGill University for the Defence Research Board.

Mr. Townsend was previously employed by the Ontario Paper Company at Heron Bay, Ont., and by the Eastern Rockies Forest Conservation Board at Calgary, Alta.

He is a civil engineering graduate of McGill University, class of 1948.

Fred A. Delory, Jr.E.I.C., is among the ten Canadian engineers in industry to win the Athlone Fellowship this year.

He was born in Georgetown, P.E.I. In 1948 he received his B.Sc. degree in civil engineering from McGill University, and in 1951 he obtained his M.A.Sc. degree from the University of Toronto.

After graduation from McGill University he joined Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C., and in 1951 he entered the Aluminum Company of Canada Limited in Montreal. He was transferred by the Company a year ago to Vancouver, B.C., and is presently employed at Kitimat, B.C.

Leonard W. Stock, Jr.E.I.C., is assistant planning engineer for the Township of Etobicoke in Toronto, Ont.

He was formerly assistant secretary on township planning for North York at Willowdale, Ont., and earlier, with F. A. Bell, consulting engineer and county engineer at St. Thomas, Ont.

Mr. Stock obtained his B.A.Sc. degree from the University of Toronto in 1949.

Victor K. Jameson, Jr.E.I., is assistant works manager with Dominion Tar and Chemical Company in Trenton, Ont. He was previously with the Company in Edmonton, and Calgary, Alta.

Mr. Jamieson is a 1950 mechanical engineering graduate of the University of Saskatchewan.

A. L. Adams, Jr.E.I.C., is now associated with the C. D. Howe Company in Montreal.

He was formerly electrician and assistant electrical engineer in the newsprint mill of James Maclaren Company at Masson, Que.

Mr. Adams graduated in electrical engineering from McGill University in 1951.

Bruce Earl Wilson, Jr.E.I.C., has joined Spencer, White & Prentis of Canada Ltd. in Toronto, Ont.

He was previously field engineer with Hydro-Electric Power Developments at Isle Maligne, Que.

Mr. Wilson graduated in civil engineering from Queen's University in 1951.

Thomas Fell, Jr.E.I.C., has joined the Department of Public Works of Canada in Port Arthur, Ont.

He was formerly associate civil engineer with United Engineers and Constructors, Inc. in Detroit, Mich.

Mr. Fell graduated in civil engineering from Queen's University in 1950.

Masao Saito, Jr.E.I.C., has been transferred by the Canadian Hydrographic Service from Ottawa, Ont. to Kemano, B.C.

He is a 1950 civil engineering graduate of the University of Manitoba.

J. R. Goff, Jr.E.I.C., is associated with B.C. International Engineering Company in Kemano, B.C.

He was previously with Hydrographic Surveys in Victoria, B.C.

Mr. Goff graduated in electrical engineering from the Nova Scotia Technical College in 1951.

R. A. Pollard, Jr.E.I.C., has joined the Pacific Oceanographic Group of the Fisheries Research Board of Canada in Nanaimo, B.C.

He was formerly with the Northern Construction Company at Bridal Falls, B.C.

Mr. Pollard is a 1949 civil engineering graduate of the University of British Columbia.

R. J. Miller, Jr.E.I.C., is associated with B. J. Miller's Motor Service in Herbert, Sask.

He was formerly with the Department of National Defence in Ottawa.

Mr. Miller is a 1950 graduate in mechanical engineering from the University of Saskatchewan.

E. O. Butts, Jr.F.I.C., has been appointed town engineer of Picton, Ont.

He was previously site engineer with Central Mortgage & Housing Corp. in Picton, Ont.

Mr. Butts is a civil engineering graduate of Loughborough College, class of 1949.

Chas. Donald Muir, Jr.E.I.C., is intermediate engineer with Canadian Aviation Electronics in Cartierville, Que.

He was formerly in the Telephone Division of the Northern Electric Company in Montreal.

Mr. Muir is a McGill University electrical engineering graduate, class of 1950.

Roger Houle, Jr.E.I.C., is technical representative in the Polythene Division of Canadian Industries Limited in Montreal.

Mr. Houle is a 1951 civil engineering graduate of Ecole Polytechnique.

Irwin R. Robinson, Jr.E.I.C., is now associated with B.C. International Engineering Company Limited in Vancouver, B.C.

He was formerly employed by Central Mortgage and Housing Corporation in Vancouver.

Mr. Robinson graduated in civil engineering from the University of British Columbia in 1950.

S. Oancia, Jr.E.I.C., is now associated with the Quebec North Shore Paper Company in Baie Comeau, Que.

Mr. Oancia graduated in civil engineering from the University of Alberta in 1950.

Walter F. Light, Jr.E.I.C., is supervising engineer with the Bell Telephone Company of Canada in Montreal.

He joined the Company in 1950 as engineer's assistant in Toronto.

Mr. Light graduated in 1949 from Queen's University in electrical engineering.

G. W. Rosebrugh, Jr.E.I.C., is now senior methods analyst with the Canadian Westinghouse Company in Hamilton, Ont.

Before joining the Company, Mr. Rosebrugh was associated with General Steel Wares in London, Ont.

He is a graduate of Queen's University in mechanical engineering, class of 1950.

Norman F. Stewart, Jr.E.I.C., has joined County Construction Company Limited of Charlottetown, P.E.I., as building construction engineer and estimator.

Mr. Stewart graduated in civil engineering in 1951 from the Nova Scotia Technical College.

R. S. White, Jr.E.I.C., is president of Sunset Construction Company Limited in Edmonton, Alta.

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Industrial Mechanical
Contractors to the Pulp
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Howard Smith Paper Mills, Cornwall, Ontario, housing Canada's largest fine paper machine, installed by Provincial Engineering Ltd.

Years of continued service to the pulp and paper industry provide a background of accumulated experience unsurpassed in the mechanical construction and installation of pulp and paper mills.

A staff of over 2000 skilled mechanics is available to carry out expansion programmes for all industries, with an integrated construction service under one channel of direction and one operating overhead.

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PROVINCIAL

PROVINCIAL ENGINEERING LTD.
CONSTRUCTION DIVISION
NIAGARA FALLS, ONTARIO

HAMILTON, ONT. EDMONTON, ALTA. MONTREAL, P.Q.

He was formerly survey party chief with the Manitoba Highways Branch of the Department of Public Works.

Mr. White graduated in 1950 in civil engineering from the University of Manitoba.

George A. Coslett, JR.E.I.C., has joined the engineering sales department of John Spotton Co. Ltd. in Toronto.

He was formerly with A. V. Roe Canada Limited in Toronto.

Mr. Coslett is a mechanical engineering graduate of McGill University, class of 1951.

Benjamin Smolensky, JR.E.I.C., is now manager of the Riverside Plumbing and Heating Company in Calgary, Alta.

He was formerly assistant manager of Riverside Hardware.

Mr. Smolensky received his electrical engineering degree from the University of Saskatchewan in 1948.

Haddon S. Wilson, JR.E.I.C., has been transferred from Canadian General Electric Co. Ltd. in Toronto to Radio Corporation of America in Camden, N.J., where he is employed as systems project engineer in microwave communication.

Mr. Wilson graduated in electrical engineering from Queen's University in 1950.

George Wood, JR.E.I.C., has joined the Canada Cement Co. Ltd. in Toronto.

Mr. Wood graduated in civil engineering from the University of Saskatchewan in 1950.

William Yukish, JR.E.I.C., is now with the general engineering department of the International Petroleum Company in Talara, Peru.

He was previously junior engineer with McKay & Cocker Construction Ltd. in London, Ont.

Mr. Yukish graduated in 1950 in civil engineering from the University of Toronto.

A. R. Sandall, JR.E.I.C., is materials inspector in the mechanical department of the Ontario Northland Railway in North Bay, Ont.

Mr. Sandall graduated in 1950 from the Nova Scotia Technical College.

James A. Crowe, JR.E.I.C., is presently employed by the Petroleum and Natural Gas Conservation Board as assistant field engineer in the Stettler area, Alberta.

Mr. Crowe graduated in chemical engineering from McGill University in 1950.

James P. Collins, JR.E.I.C., has joined the Hydro-Electric Power Commission of Ontario in Toronto.

He was formerly with the Department of Public Works in Ottawa.

Mr. Collins graduated in civil engineering from the Nova Scotia Technical College in 1950.

Harry F. Denham, JR.E.I.C., is industrial sales representative for Imperial Oil Limited in Hamilton, Ont.

He was previously with the Company in Leaside, Ont.

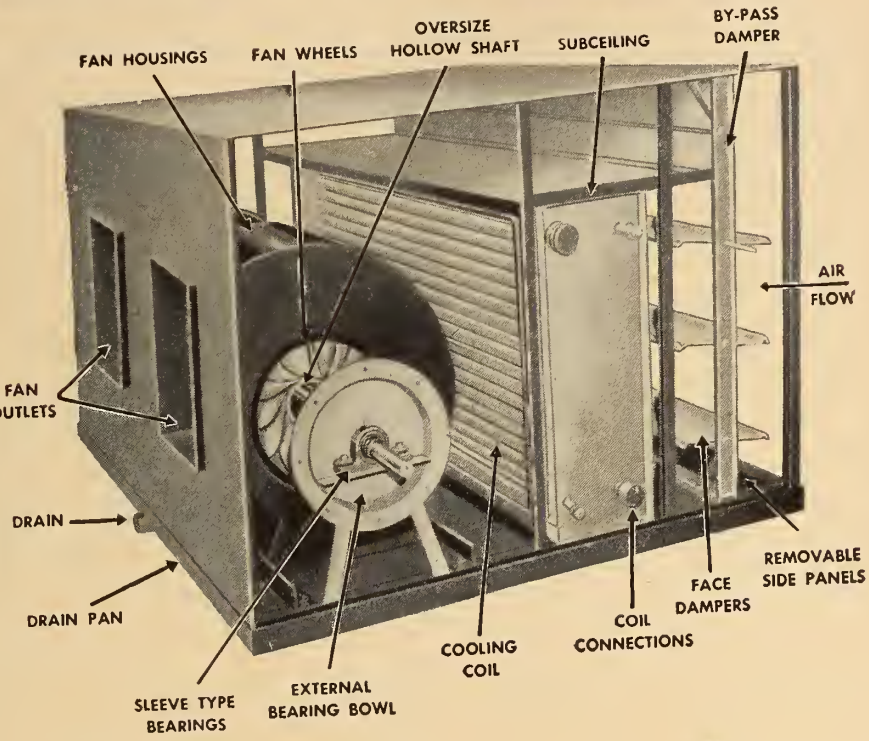
Mr. Denham is a graduate in mechanical engineering from the University of Toronto, class of 1946.

Ralph W. Curtis. JR.E.I.C., is sound maintenance engineer with the National Film Board of Canada in Ottawa, Ont.

He was formerly a lecturer in electrical engineering at the University of Manitoba.

Mr. Curtis is an electrical engineering

AIR ... AS YOU LIKE IT



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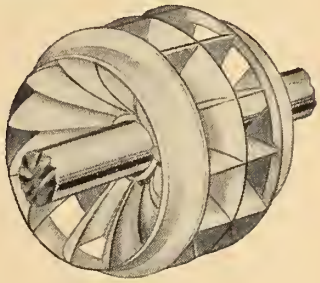
MODEL "G" AIR CONDITIONING CABINETS

Here, at last, is an air conditioning unit whose blower head incorporates a new, more efficient and quiet wheel designed to remain stable over a wide range of capacities and pressures.

This compact, economical unit gives you *complete* control of your air. Available in combinations suitable for simple cooling or complete air conditioning with any, or all, of the functions listed at the right, automatically controlled if desired. May be furnished with air washing section where required.

Write for bulletin #3703 and get all the facts on this efficient new long-life unit.



★ COOL
★ HEAT
★ HUMIDIFY
★ DEHUMIDIFY
★ CLEAN

"Canadian Buffalo"

CANADIAN BLOWER & FORGE
COMPANY LIMITED
HEAD OFFICE: KITCHENER, ONTARIO

ENGINEERING SALES OFFICES:
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Soint John • Winnipeg • Regino
Colgary • Edmonton • Voncouver

graduate of the University of Manitoba, class of 1945.

J. F. Harris, JR.E.I.C., has been appointed assistant to the vice-president of Don Mills Developments Limited in Toronto.

He was previously with Stevenson & Kellogg Co. Ltd. in Montreal, and with Canadian Breweries Limited in Toronto.

Mr. Harris is a graduate in mechanical engineering from McGill University, class of 1949.

F. A. Grant, S.E.I.C., is now employed by Babcock-Wilcox and Goldie-McCulloch in Galt, Ont.

Mr. Grant is a graduate in mechanical engineering from the University of Manitoba, class of 1952.

Wilfred Pegush, S.E.I.C., has joined the staff of Swan, Rhodes and Wooster, consulting engineers in Vancouver, B.C.

Mr. Pegush graduated in 1952 in civil engineering from the University of British Columbia.

T. R. Marien, S.E.I.C., has been transferred by the Pentagon Construction Company Limited from St. Joseph d'Alma, Que. to Asbestos, Que.

Mr. Marien joined the Company in 1951 after graduating in civil engineering from McGill University in 1950.

Lawrence A. Neil, S.E.I.C., has been transferred by the National Research Council from Vancouver, B.C. to Toronto, Ont.

While in Vancouver he was junior research officer employed on the Fraser River Model at the University of British Columbia. In Toronto he will be employed in hydraulic research.

Mr. Neil graduated in mechanical engineering in 1952 from the University of Toronto.

A. Perry Foster, S.E.I.C., is now associated with the Bridge Branch of the Department of Highways of Alberta in Edmonton.

He was previously on the staff of Associated Engineering Services, consulting engineers in Edmonton.

Mr. Foster is a graduate in civil engineering from the University of Saskatchewan, class of 1952.

Michael S. Magas, S.E.I.C., has joined the Department of Highways of Alberta as resident highway engineer in Edmonton.

He was previously with the Department of Transport at Cold Lake, Alberta.

Mr. Magas is a 1952 University of Alberta graduate in civil engineering.

Marcel Tremblay, S.E.I.C., has joined the Department of Resources and Development in Montreal.

He is a 1953 Laval University civil engineering graduate.

Jean-Claude Careau, S.E.I.C., has joined the Department of Public Works as a civil engineer in the preparation of bridge projects.

Mr. Careau is a graduate in civil engineering from Laval University, class of 1953.

C. R. Elliott, S.E.I.C., is now with the Willett Engineering and Surveying Company at Port aux Basques, Nfld.

C. Clarke Robinson, S.E.I.C., has joined the mechanical department of the Sarnia Refinery of Imperial Oil Limited.

Mr. Robinson is a graduate in mechanical engineering from the University of Manitoba, class of 1952.

Gordon R. Pangborn, S.E.I.C., is a manufacturing trainee with the American Can Company in Simcoe, Ont.

Mr. Pangborn graduated in 1952 in mechanical engineering from the University of Toronto.

Ronald G. Harding, S.E.I.C., has joined the Department of Public Works in Winnipeg, Man.

Mr. Harding is a 1952 graduate in civil engineering from the University of Manitoba.

R. Tardif, S.E.I.C., is now associated with the Saguenay Electric Company in Chicoutimi, Que.

Mr. Tardiff graduated in 1952 in electrical engineering from McGill University.

R. B. Turner, S.E.I.C., has been employed since June, 1952, as junior research officer in the nuclear engineering branch of Atomic Energy of Canada Limited in Deep River, Ont.

Mr. Turner graduated in 1952 in mechanical engineering from the Nova Scotia Technical College.

Cyril Burgoyne, S.E.I.C., is construction and maintenance assistant in the marketing department of Imperial Oil Limited in Winnipeg, Man.

Mr. Burgoyne is a 1952 civil engineering graduate of the University of Manitoba.

Jean-Yves Perron, S.E.I.C., has joined the development department of Northern Electric Co. Ltd. in Montreal.

John E. Umiker, S.E.I.C., is assistant test engineer with the Massey-Harris Company in Toronto, Ont.

Mr. Umiker is a 1952 mechanical engineering graduate from the University of British Columbia.

P. A. Berube, S.E.I.C., has joined Canadian General Electric Co. Ltd. in Peterborough, Ont.

He graduated in electrical engineering from the Nova Scotia Technical College in 1952.

Raymond H. Vezina, S.E.I.C., is now with the Department of Public Works in Westmount, Que. He was previously with the Department in Rimouski, Que.

Mr. Vezina is a graduate of the University of New Brunswick in civil engineering, class of 1952.

Jacques M. Cleroux, S.E.I.C., is in the design department of Surveyor, Nenniger and Chenevert in Montreal.

Mr. Cleroux is a graduate in civil engineering from Ecole Polytechnique, class of 1952.

J. M. McCoy, S.E.I.C., has joined the staff of the Inspection Services of the Department of National Defence.

F. K. Burgar, S.E.I.C., is general manager of the Watson Construction Company in Marmora, Ont. He was previously with Defence Construction Limited in Barriefield, Ont.

H. F. Lawson, S.E.I.C., has accepted employment with the Township of London, Ont.

He was formerly associated with the Department of Transport.

Mr. Lawson graduated in civil engineering from the University of Toronto in 1952.

J. W. Thompson, S.E.I.C., is assistant engineer with Canadian Fairbanks-Morse Company Limited in Saint John, N.B.

He is a 1952 civil engineering graduate of the University of New Brunswick.

George Banz, S.E.I.C., is structural designer witht Ramseyer & Miller Inc. consulting engineers in New York City.

He was previously with North American Cynamid Co. in New York and earlier, with Chemical Construction (Inter-American) Ltd. in Toronto.

Mr. Banz received his M.Sc. degree from Oklahoma A. & M. College in 1952.

Steven Cymbaluk, S.E.I.C., is presently employed by the Biscayne Engineering Company, civil engineers in Miami Florida. He is a 1952 graduate in civil engineering from the University of Manitoba.

J. Papanicolas, S.E.I.C., has joined the Dominion Bridge Company Limited in Lachine, Que., as electrical engineer.

Mr. Papanicolas is a graduate in engineering from Ecole Speciale des Travaux Publics, class of 1951.

W. J. Grandall, S.E.I.C., has joined the staff of Imperial Oil Limited in Devon Alta.

Mr. Grandall is a graduate of the University of Manitoba in mechanical engineering, class of 1952.

H. G. Pinder, S.E.I.C., has joined the staff of the Filling Division of Canadian Arsenals Limited in Montreal.

Mr. Pinder is a 1952 physics graduate of Queen's University.

S. Butts, S.E.I.C., has joined the staff of the Aluminum Company of Canada Limited in Kemano, B.C.

R. J. D. Gardner, S.E.I.C., has joined the staff of Lethbridge Iron Works Co. Ltd. in Lethbridge, Alta.

Mr. Gardner is a graduate in mechanical engineering from the University of British Columbia, class of 1952.

G. S. Laing, S.E.I.C., has joined the staff of Canadian Westinghouse Company Limited in Hamilton, Ont., as methods engineer.

Mr. Laing is an electrical engineering graduate of the University of New Brunswick, class of 1952.

Visitors to Headquarters

F. C. Mechin, M.E.I.C., Toronto, Ontario, May 4, 1953.

T. O. Orr, Birmingham, England, May 4, 1953.

R. Pollard, JR.E.I.C., Nelson, British Columbia, May 13, 1953.

J. F. Petree, London, England, May 13, 1953.

Armand Mayer, Paris, France, May 14, 1953.

J. B. Lambert, M.E.I.C., Vancouver, British Columbia, May 19, 1953.

H. J. Little, Perth West, Australia, May 25, 1953.

Dr. A. A. Meyerhof, London, England, May 25, 1953.

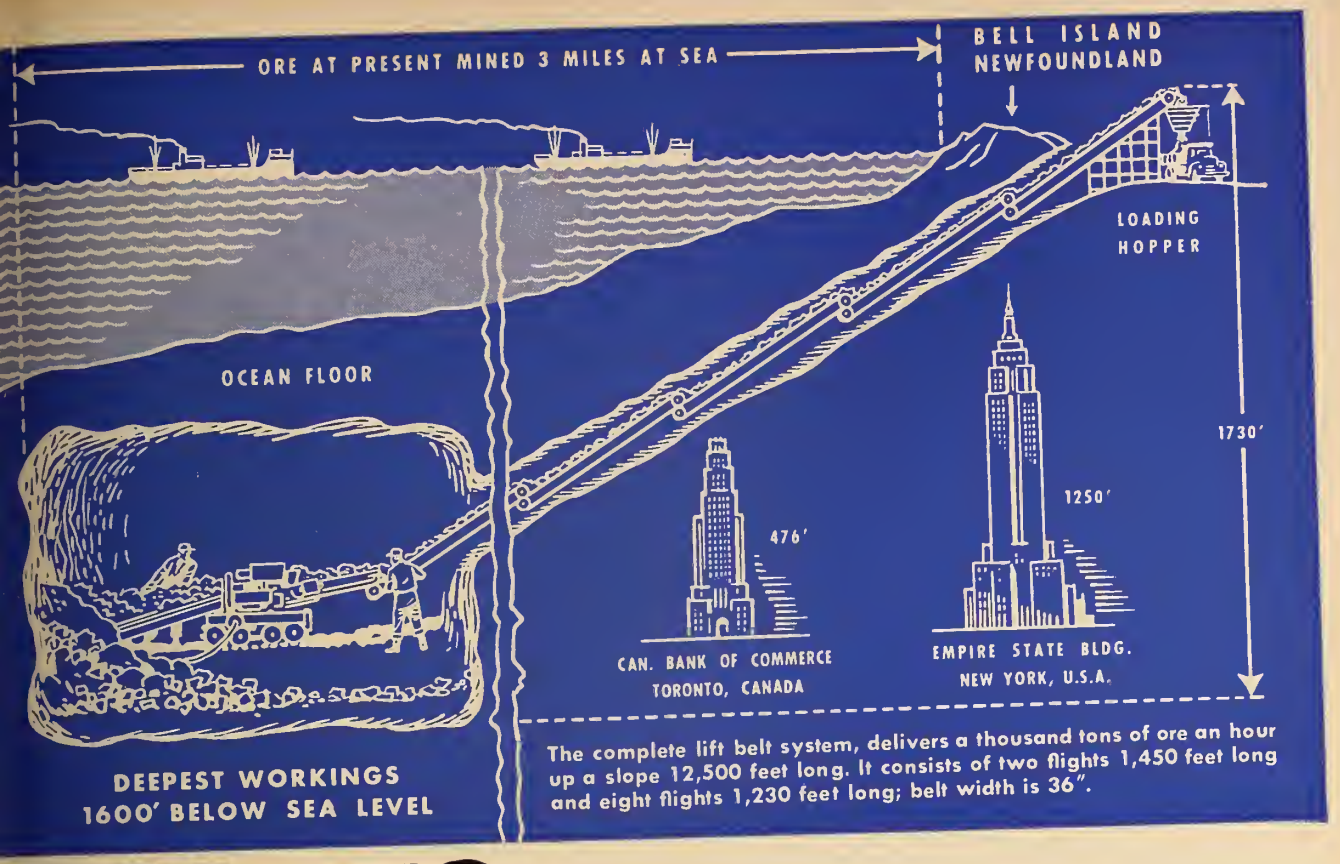
G. H. Loane, M.E.I.C., Fredericton, New Brunswick, June 1, 1953.

J. F. MacLaren, M.E.I.C., Toronto, Ontario, June 3, 1953.

Charles E. Garnett, M.E.I.C., Edmonton, Alberta, June 5, 1953.

Paul E. Buss, M.E.I.C., Thorold, Ontario, June 8, 1953.

Lt.-Col. J. H. Edgar, M.E.I.C., Winnipeg, Manitoba, June 9, 1953.



3 MILES UNDER THE SEA

...5-Mile Belt System Lifts Iron Ore 1730 FEET at 1000 tons an hour...

The world's most unusual mine is probably the Wabana Iron Mine in Newfoundland, owned and operated by The Dominion Steel and Coal Corporation of Sydney, N.S. One of the world's richest iron mines, its underground operations extend three miles out from shore, 1,600 feet below sea level. For years this important source of ore was worked by slow, intermittent loading. Later, mechanical equipment and track transport were used in an effort to bring the iron ore to the surface more rapidly.

High present and future ore demands from the Wabana Mine necessitated a more efficient means of handling the output. To raise the daily tonnage to a new high, Goodyear was selected to design and build belts for a conveyor system that would treble production. Five miles of 36" wide Goodyear belting were required to complete the system.

Specifying its world-famous Compass Cord Belts, Goodyear belted this slope conveyor system of ten "flights"—to lift the ore a thumping 1,730 feet to dwarf every known lift—setting a *world's record for vertical climb.* This system of ten belts—each bodied with rope cords in the load-carrying section—will haul a thousand tons of ore each hour up the slope.

Goodyear has built "rubber railroads" that have set tonnage records the world over. Of the fifteen highest slope lifts in the world, thirteen, including the top three, are equipped with Goodyear belts. The world's longest single flight conveyor—installed in one unit—just over two miles, centre to centre, is Goodyear built.

If you have any unusual conveyor or drive problems let Goodyear help you solve them. Write or call your nearest Goodyear Branch—Saint John, N.B., Quebec City, Montreal, Toronto, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver.

GOODYEAR

INDUSTRIAL RUBBER PRODUCTS ENGINEERED FOR THE JOB

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

The Honourable Frederic Erskine Bronson, M.E.I.C., member of Her Majesty's Canadian Privy Council, and for 15 years chairman of the Federal District Commission in Ottawa, died suddenly on April 13, 1953 while holidaying in Atlantic City.

Mr. Bronson was born in Ottawa on December 4, 1886. He received his early education at the Ottawa public schools and at the Ottawa Collegiate Institute. During the summer of 1904 he was employed as an assistant on a geological survey party in Nicola Valley, B.C., and during the following summer he served in a similar capacity in Charlotte County, N.B.

He entered McGill University in 1905 and graduated with a B.Sc. degree in civil engineering in 1909.

Immediately after graduation he returned to Ottawa to assist his father, the late Hon. Erskine H. Bronson, in the direction of the family pulpwood and water power business known as the Bronson Company, and to take charge of plant maintenance and operation of the Ottawa Light, Heat and Power Company Limited. In 1915 he was appointed president and managing director of the Bronson Company, and in 1924 he became vice-president of the Ottawa Light, Heat and Power Company Limited, as well as vice-president of the Ottawa Electric and Ottawa Gas Companies. He was appointed president of these three companies by their directors in 1938.

In 1936 he was named chairman of the Federal District Commission by the federal government under the late Prime Minister, Rt. Hon. W. L. Mackenzie King. At the time of the appointment, Mr. King said that "in Mr. Bronson the government feels it has an admirable successor (to W. E. Matthews, retiring chairman), an able businessman, a very public-spirited citizen and a man with an able grasp of the Commission's business."

During the 15 years which followed, Mr. Bronson bore out the prediction. The nation had launched a vigorous program through the Federal District Commission to beautify the nation's capital, and this was a challenge to Mr. Bronson's ability and resourcefulness.

In the war years the National Capital Plan was not accelerated as much as in normal times, but by 1945 the government turned its attention to its development. From that date until he retired as chairman in 1951, Mr. Bronson devoted practically all of his time to the business of the Federal District Commission, at the same time capably handling his duties as an official of the Ottawa Light, Heat and Power Company Limited. When this Company was succeeded by the Interprovincial Utilities Limited on March 30, 1951, Mr. Bronson was named a director of the new organization.

In recognition of his pride and interest in the planning of the nation's capital, Mr. Bronson was made a member of Her Majesty's Canadian Privy Council in the fall of 1951, shortly after his retirement.

Mr. Bronson joined the Engineering Institute of Canada as a Student in 1908, transferring to Associate Member in 1913 and to Member in 1925. He was granted Life Membership in the Institute on January 1, 1948.

George Edward Bell, M.E.I.C., former delegate director of Deloro Stellite Limited in Birmingham, England, died in Montreal in February, 1953.

Mr. Bell was born in St. Thomas, Ont. on September 27, 1883. After graduating from the Collegiate Institute in St. Thomas in 1899, he entered the draughting office of Dominion Bridge Company Limited in Lachine, Que. in January, 1901. He enrolled in the civil engineering course at McGill University in September, 1902 and returned to the Company during the summer months of 1903.

From May until December of 1904 he served as field draughtman on location with the Canadian Pacific Railway's Toronto-Sudbury branch, and from January until August of 1905 he was employed as draughtsman with the Dominion Coal Company Limited in Glace Bay, N.S. During the summer of 1906 he was inspector with Messrs. Coffin & Thorpe of Boston, Me. on the construction of a filtration plant at Bar Harbor, Me.

In 1907 Mr. Bell received his B.Sc degree with honours from McGill University. He then entered the Montreal office of Dominion Bridge Company Limited as designing and estimating engineer. He was placed in charge of that office in 1911. Within six months he was appointed western manager of the Company in Winnipeg, Man., where he was responsible for the shop and engineering office.

During World War I he served with the rank of captain with the Canadian Engineers. At the end of hostilities he was appointed assistant to the president of Dominion Engineering Works in Montreal, Que.

In 1935 he joined M. J. O'Brien Limited in Ottawa as assistant to the managing director.

He entered Deloro Smelting and Refining Company Limited as manager in London, England in 1932, becaming delegate director of the Company in Birmingham in 1942.

Mr. Bell joined the Engineering Institute as a Student in 1901, transferring to Associate Member in 1908 and to Member in 1914. In January, 1947 he was granted Life Membership in the Institute.

Jean-Marie Alphonse Bleau, M.E.I.C. former mining engineer with the Department of Mines of the Province of Quebec, died suddenly on April 28, 1953 in Quebec City.

Mr. Bleau was born in Montreal, Que. on February 20, 1897. He received his early education at Collège de Montréal and Collège Ste. Marie, graduating with a B.A. degree in 1918.

Upon graduation he joined the Royal Flying Corps and at the end of hostilities entered McGill University where he obtained his B.Sc. degree in metallurgical engineering in 1923.

He was then employed as a chemist with R. W. Hunt Company Limited in Montreal; as a field engineer with the Montreal Electrical Commission; as a builder on his own; and as a field engineer with the Montreal Water Board.

In 1927 he was appointed professor of chemistry, minerology and geology by the Royal Military College in Kingston, Ont. While serving in this capacity he obtained his M.Sc. degree in metallurgical engineering from Queen's University in 1932.

He relinquished his position at the Royal Military College in 1940 to become mining engineer with the Quebec Provincial Department of Mines. Two years later he joined the Royal Canadian Engineers with which he served for three years.

At the war's end he returned to his position with the provincial government.

Mr. Bleau was a past-president of the Quebec branch of the Queen's Alumni Association. He was a member of the Corporation of Professional Engineers of the Province of Quebec.

He joined the Engineering Institute of Canada as a Member on January 12, 1946.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEERING GRADUATES required by power and paper company located in Toronto. Applicants should have up to 5 years experience and be interested in research. File No. 4579-V.

CHEMICAL ENGINEER WITH experience in chemical plants, capable of designing process services, plant layout, and supervising erection and installation of process equipment. File No. 4589-V.

CHEMICAL ENGINEER required by a company in Montreal for the industrial division which embraces the brewing, paper and oil industries. Applicant must have sales ability and be able to meet company officials. When applying please enclose recent photo. File No. 4590-V.

CIVIL

CITY IN ONTARIO invites applications for the position of city engineer. The applicant must be a registered professional engineer of Ontario, and shall state age and education, and professional experience especially in municipal work. File No. 4573-V.

PLANNING ENGINEER required by rapidly growing municipality in Ontario, to act as chief physical planner and manager of industrial commission. Applicant should have town planning experience and be able to co-ordinate all planning and development activities. Salary according to qualifications. File No. 4580-V.

BUILDING COMMISSIONER and zoning administrator required by rapidly growing municipality in Ontario to be in charge of the operation of the building and zoning by-laws. Applicant must be able to check construction and have administrative experience of some kind. File No. 4580-V.

REGISTERED ENGINEER with municipal experience in the operation and superintendence of sewer systems. Rapidly growing municipality in Ontario. Estimated population of 100,000 within seven years. Age thirties or early forties. Salary according to experience. File No. 4580-V.

TOWN IN ALBERTA is seeking applicants for the position of Town Engineer. Duties include supervision of the public works program, direction of the town crews, administration of building inspection and zoning control, and development detail of the general plan for the town as circumstances require. Special consideration will be given to applicants with executive training and to those with some experience or training in town planning. Population now 3,000 every prospect of growing into a small city within the near future. Salary depending upon qualifications. File No. 4581-V.

ASSISTANT CHIEF DRAUGHTSMAN structural steel industry Niagara District. All replies confidential. File No. 4585-V.

CIVIL ENGINEER WITH drawing office experience, for layout, design, and development work. To prepare plans and estimates for small industrial buildings in timber, steelwork, plain and re-inforced concrete, roads and drainage. Should possess several years practical experience in building construction work carried out by contract and direct labour. File No. 4589-V.

SENIOR DRAUGHTSMAN for structural design in timber, steelwork, plain and re-inforced concrete for small industrial buildings. File No. 4589-V.

GRADUATE CIVIL ENGINEER with from two to five years experience in hydro-electric work or water resources study. This work would be in connection with the large power project in the Yukon Territory and Northern British Columbia. File No. 4591-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER graduate with 1 or 2 years field experience, good appearance and high sales ability by the leading manufacturing company in their line. Duties consist of calling on architects and engineers and assisting in preparing specifications and technical data in connection with low tension signaling equipment. Experience in dealing with electrical contractors will be helpful. Territory to be served is Montreal, Province of Quebec and the Maritimes after a short specialized training program at our plant. This is a salaried position with an excellent future also participation in full group sick and accident insurance and pension plans. Applicants to give full details including age, marital status and experience first letter. Personal interview will be given selected applicants. File No. 4569-V.

LIGHTING SALES ENGINEER required by leading manufacturer of lighting and switchgear. Actual sales experience in commercial and industrial lighting in Ontario, contacts with architects, consulting engineers and contractors would be an asset. Unusual opportunity with better than average earnings to right man. Good salary and commission. New car supplied plus car allowance and expenses. File No. 4577-V.

CHIEF ENGINEER required in West Toronto. The man we seek is now a chief engineer or an assistant ready to step into this key position. Through a promotion in our organization we can offer this highly desirable position to a man with an E.E. degree, conversant with television; home and auto, radio circuits. Should have strong experience in successfully administering a small flexible engineering group. Excellent opportunity for right man to take a big part in a fast growing aggressive organization and earn an excellent salary. Free medical services and company profit sharing plan. Please send complete resume to File No. 4576-V.

MECHANICAL

MECHANICAL ENGINEER for Montreal Brewery, recent graduate with practical leaning for on-the-floor training and imminent supervision of installation and maintenance of bottling, pasturizing and conveyor equipment. Administrative and production control future. File No. 4568-V.

SALES ENGINEER preferably mechanical interested in the sale of air handling equipment such as fans, heating coils, air conditioning units, etc. Present location Toronto. File No. 4572-V.

MECHANICAL ENGINEER, university graduate with two or three years experience in mechanical or metallurgical fields and above average literary ability. Permanent employment in Ottawa with well-known industrial association. Pension plan. File No. 4578-V.

A PROGRESSIVE AND expanding container manufacturing company has an opening at its Toronto plant for an industrial engineer. A young man who has just graduated from university or who has had 1 or 2 years work experience in Canada will be preferred. This opening offers an opportunity to train in a standard cost system as the follow-up man for the plant industrial engineer. Address replies stating age, education and qualifications. File No. 4584-V.

THE SERVICES OF A design engineer, mechanical preferred, are required by large organization in Montreal, Canada. Must be thoroughly familiar with portable and permanent crushing plants, asphalt plants, ready mix concrete plants and all types of road building equipment with eight to ten years experience in this field and with engineering degree or equivalent. Permanent position if applicant is qualified. Please give age, experience and references and state salary expected. All replies will be treated in strictest confidence. File No. 4586-V.

MECHANICAL ENGINEER with two to three years experience in design of air conditioning and heating required by

Montreal Contractor and manufacturer. State age, training, experience and salary expected. File No. 4587-V.

MECHANICAL ENGINEER for plant located in Southern Ontario. Candidates should be recent graduates with preferably some manufacturing experience and knowledge of rubber. Initiative and mature judgment are of course requisites. Duties would include co-ordination and supervision of engineering details in connection with an expanding program. File No. 4588-V.

MECHANICAL ENGINEER with industrial experience in the design, layout, and installation of equipment for heating, hot water, ventilation, factory mains comprising compressed air, steam and water, and general mechanical equipment. File No. 4589-V.

MECHANICAL DRAUGHTSMAN for preparation of plant layouts, equipment and installation drawings. File No. 4589-V.

MECHANICAL ENGINEER for the mechanical engineer's division of the Chief Architect's Branch of the Department of Public Works at Ottawa, Ontario. Duties: to take charge of the mechanical engineering section of the chief architect's Branch of the department of Public Works and will be responsible for the design of power plants, heating systems, ventilation systems, plumbing installations, air conditioning systems, sprinkler systems, refrigeration and for the installation of such equipment in public bldgs., laboratories and hospitals. The desirable qualifications include university graduate from a university of recognized standing, member of the Engineering Inst. of Canada or in a Provincial Assoc. of Prof. Engineers. Applications received until September 1, 1953. Salary up to $7,200.00. File No. 4593-V.

MISCELLANEOUS

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources $273-$348 per month, a variable cost of living bonus presently $6.40 is paid in addition to above stated basic salary. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metallic or industrial minerals of the province. Good pension plan and conditions of employment. File No. 4564-V.

METALLURGICAL CHEMIST required. A graduate with 2 years experience for analysis of metals and slugs required for a firm located in Guelph. Good prospects for advancement. File No. 4567-V.

METALLURGIST REQUIRED with a background in foundry practice for large organization with headquarters in Montreal. Applicant should be in the age range of 22 to 35 years. File No. 4571-V.

REQUIRE QUALIFIED engineer with good all round experience in general machinery and machine construction to solicit main and sub-contract work for a large new machine plant. Able to discuss at top management level throughout Canada. Salary according to qualifications. Writing first instance giving fullest details to File No. 4575-V all applications treated in strictest confidence.

POSITION OPEN AS assistant to the plant superintendent. Duties in connection with the operation and maintenance of a low head hydro plant consisting of 5 Francis type units with a total capacity of 167,000 K.W. Location about 125 miles from Rio de Janeiro in a healthy climate. Preferably single between 30 and 40 with at least 5 years experience in hydro plants. File No. 4583-V.

CHIEF SUPERINTENDING ENGINEER ($7,000.00-$8,500.00) for the post office department at Ottawa. Details and application forms at your nearest Civil Service Commission Office, National Employment Office or Post Office. File No. 4592-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEERING, recent graduate required by water treatment company for sales and service. Location Eastern Canada. Applicants must be free to travel. File No. 4550-V.

CHEMICAL ENGINEER required for modern plant in medium sized town in central Ontario. Must have at least three years production and supervisory experience. Knowledge of machine maintenance desirable. Good opportunity with a growing industry. Reply giving complete details of education and experience and salary expected to File No. 4560-V.

CIVIL

CITY IN WESTERN CANADA has a permanent position open for civil engineer for valuation and assessment work in the assessment department. Several years practical experience in commercial building estimating and construction essential. Salary according to qualifications. Excellent opportunity for advancement. General Pension plan. File No. 4529-V.

EXPERIENCED STRUCTURAL DESIGN engineer. Must be Canadian citizen, graduate in engineering from a university of recognized standing and with a number of years of experience in the design and construction of engineering structures in both reinforced concrete and steel. Applicants should state age and qualifications and give full particulars of experience. Salary open depending on experience. File No. 4536-V.

TWO CIVIL ENGINEERS for structural design by large organization in Ontario. Graduates should have minimum of three years experience. Applicants should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

CIVIL ENGINEER, for permanent position with experience in the design and construction of sewers and other municipal works. Salary range $400.00 to $480.00 per month, plus cost of living bonus of approximately $30.00 per month. Apply giving full particulars of education and experience. File No. 4554-V.

INSPECTIONS ENGINEER required by City in Western Canada to administer the Inspections Department and to co-ordinate varied civic inspections for public safety programs and to supervise subordinate technicians and inspectors engaged in construction and trade inspections and related tasks. University graduates in Civil Engineering, supplemented by extensive related experience in building construction engineering. Preference will be given to applicants of mature years who have had municipal engineering positions of an administrative nature. File No. 4563-V.

PROJECTS ENGINEER required by City in Western Canada to work under general administrative direction to supervise design and construction of varied municipal works and to interpret plans and specifications to employees and contractors; to make technical studies and maintain related cost and other records. University graduation in civil engineering, supplemented by some related experience in design and in projects supervising. File No. 4563-V.

ELECTRICAL

ELECTRONIC DEVELOPMENT ENGINEERS, Test Engineers, installation engineers, required by organization located in the Maritimes. Salaries commensurate with ability. Five-day week, group insurance. File No. 4515-V.

LIGHTING ENGINEER required by manufacturing company in Toronto. Applicant should be experienced in both sales and layout of interior lighting schemes in hot/cold cathode lighting. Some experience in street and flood lighting an advantage. File No. 4516-V.

COMPONENTS ENGINEER with at least 5 years experience in general electronics devices such as radar, radio and television etc. Will probably have a design background with sound knowledge of procurement problem and supply resources on components. Familiar with military and industrial specifications. Location Ontario. File No. 4518-V.

ELECTRONICS ENGINEER required by national research council to carry out research on electronic telecommunications equipment; to design and develop specialized electronic equipment as required; to carry out technical liaison duties. Honours degree in physics engineering or electrical engineering with specialized training in electronics required. Must have interest and ability in circuit design; must have interest in or experience with electronic computers. Research experience in circuit wo would be useful. File No. 4591-V.

ELECTRICAL ENGINEER with electr utility experience to assume post general superintendent or to work in this position. The vacancy is with hydro-electric utility having 40,000 cu tomers and comprises high voltag transmission, substations, undergrou and overhead distribution. Location I Baz, Bolivia, population 410,000. Salar open depending on experience an qualifications. File No. 4521-V.

SERVO MECHANISMS engineer require to carry out research and developmer on guided missiles. Experience wit electrical and electro hydraulic serv system and with navigation equipmer desirable. File No. 4522-V.

ELECTRONIC INSTRUMENTATION engi neer to carry out instrumentation wor on guided missiles, telemetering an range instrumentation experience de sirable. The applicant must be capabl of planning and directing the work o junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER required b pulp mill located in P.Q. Applican would be primarily in charge of a mill electrical maintenance and electri cal repair installations. Prepared to con sider applicants who have had a few years experience, or those with man years experience in this type of work Salary open. Good opportunity for ad vancement. File No. 4535-V.

ELECTRICAL ENGINEER, experience necessary, capable of laying out powe stations and all electrical work for the construction of a pulp mill at Sain John, N.B. Permanent employment t qualified person. Salary is open depend ing upon experience and qualifications File No. 4548-V.

ELECTRICAL ENGINEER for electrical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience and should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

RECENT ELECTRICAL engineering graduate required by Montreal firm for sales and engineering work in Montreal and district. Good opportunity for advancement. File No. 4557-V.

ELECTRICAL ENGINEER required by city in Western Canada to perform a variety of technical tasks in surveying system facilities, developing standards of electrical utility distribution, preparing reports concerning wholesale power supply to consumers, maintaining technical records, assisting in layout and design and related engineering tasks as assigned. University graduate in Electrical Engineering, supplemented by some related experience, preferably in an electrical distributing system. File No. 4563-V.

MECHANICAL

MECHANICAL DRAUGHTSMAN, wanted for piping and equipment layouts for small steam plant, factory buildings, and town water supply and sewage disposal to work in our Montreal Head office. Apply in writing giving full details of experience, qualifications, age and references. File No. 4512-V.

MANUFACTURING ENGINEER required with 2-10 years experience in manufacturing design methods and tooling. Should be mechanical engineer with considerable electrical experience. Location Ontario. File No. 4518-V.

MECHANICAL ENGINEER required for old established concern in S.E. Ontario within 70 miles of Toronto. Applicants must be interested in design work as applied to materials handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance, profit sharing and pension plan available. Apply stating experience and remuneration. File No. 4418-V.

MECHANICAL ENGINEERS with six to 10 years experience to carry out design and development on armament systems. The applicants must have experience in planning and directing the work of junior scientists. File No. 4522-V.

MECHANICAL ENGINEER required to act as sales engineer for company specializing in the solution of manufacturing problems involving materials handling, dust and fume disposal, and the processing of materials. Man required must be maintaining active personal contact

CIVIL SERVICE
(Federal)
CHIEF SUPERINTENDING ENGINEER
$7,000 - $8,500
for the Post Office Department at Ottawa.
Details and application forms at your nearest Civil Service Commission Office, National Employment Office or Post Office.

with industry. He should be preferably mechanical engineer with a knowledge of plant layout, and the application of materials handling equipment. Duties would be to follow up inquiries contact prospective customers. This work could be undertaken in conjunction with present activities. File No. 4523-V.

MANUFACTURER OF STELLITE AND PRECISION CASTINGS requires a production works manager who has proven managerial capabilities. Preference will be given to a mechanical or metallurgical graduate who has experience in machine and tool manufacturing and foundry operation. Familiarity with high temperature alloys an asset. Salary commensurate with qualifications and experience. Location Ontario. File No. 4525-V.

RECENT MECHANICAL ENGINEER with evidence of interest in mechanical or technical problems and with experience or aptitude for sales. He should be completely bilingual and able to deal with all levels of personnel and management. The work involves study of actual conditions related to the use and formulation of procedure and policies which must be sold at the level of top management. File No. 4527-V.

DESIGN ENGINEER a good opportunity with a sound future for a graduate mechanical engineer who has had practical experience in structural designing for commercial vehicle production. In reply state age, experience, references and salary expected. File No. 4533-V.

TWO OR THREE 1953 graduates, preferably mechanical required by large size, industry in Ontario. File No. 4551-V.

TWO MECHANICAL ENGINEERS required for mechanical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience. Applications should state complete particulars and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

RESEARCH MINDED YOUNG textile company in Granby, Quebec, wishes to add a mechanical engineer to its staff. Attractive opportunity for right man interested in production and development work. Recent graduate with some working experience preferred, but exact nature of work not important. All communications will be treated strictly confidential and interviews will be arranged with applicants having suitable qualifications. Address reply to File No. 4562-V and please include telephone number.

MISCELLANEOUS

DESIGN ENGINEER required with experience in radar VHF and UHF equipments, servo-mechanisms and general electronic devices for air borne radar projects. Location Ontario. File No. 4518-V.

TELECOMMUNICATIONS engineer required with 2-10 years experience in the design and development of small transformers. File No. 4518-V.

SENIOR PRODUCTION control planner with 3-10 years experience in either production control planning, factory supervision, methods or time study capable of supervising small staff. Location Ontario. File No. 4518-V.

COMMUNICATIONS ENGINEER required by national research council to study and report on new and existing communications systems and on development in ancillary equipment; to act as liaison officer on radio propagation matters. Honours degree in engineering physics or electrical engineering and knowledge of multiplex and telegraphic equipment required. Post graduate training or experience desirable. File No. 4519-V.

MECHANICAL OR FORESTRY ENGINEER required by Montreal branch of well known Eastern Canada manufacturer to handle sales and installation of specialized line of machinery for pulp and saw mills. Candidate should be bilingual, ready to travel and have at least 2 years experience in either of the above industries. File No. 4520-V.

ELECTRICAL ENGINEER or engineering physicist to direct electronic design and electronic systems production engineering for guided missile development. The applicant must have experience in electronic component testing and subminiaturization techniques, and must be capable of directing the work of junior scientists. File No. 4522-V.

MICROWAVE AND ELECTRONICS engineer or physicist with six to 10 years experience to carry out research and development on guided missiles. The applicant must have experience in planning and directing the work of junior scientists. File No. 4522-V.

ELECTRICAL ENGINEER or engineering physicist with experience in electronic computation to carry out development work on aircraft fire control computors. Basic knowledge of microwave and servo mechanisms desirable. File No. 4522-V.

ENGINEERING OR SCIENCE graduates for general training designed to equip suitable persons for future responsibility. Eventual job assignment, after completion of general training course, will depend upon personal aptitude. Preference given to single applicants not over 25 years of age. File No. 4524-V.

ASSISTANT OR ASSOCIATE professor mechanical engineering required in Halifax, N.S. Duties to instruct undergraduate students and develop post graduate work. Time and facilities for research. QUALIFICATIONS: university graduate preferably some post-graduate training. Several years practical experience which may include industrial graduate engineer training course. Classification of appointee will depend upon qualifications of successful applicant. File No. 4528-V.

ASSISTANT SUPERINTENDENT for open-pit mine and terminal operations on St. Lawrence north shore. Mechanical or electrical engineer preferred, with at least three years experience in maintenance work. Candidate should speak French. New 6-room house available. Salary open. File No. 4534-V.

A YOUNG ENGINEER with experience in gas properities, flows, pressure regulation and combustion plus a knowledge of mechanical design. Work will involve the design and development of gas equipment including customer promotional work. Salary will be commensurate with experience and qualifications. File No. 4543-V.

THREE DRAUGHTSMEN, required by automotive industry located in Toronto area. Applicants must be capable of making detailed drawings or sketches from designs made by either a mechanical or an electrical engineer, also required to initiate sketches or drawings of miscellaneous minor equipment in connection with plant maintenance. File No. 4547-V.

SALES ENGINEER 22-30 years of age. Woodworking, box making and pulp and paper making machinery and supplies. Locations eventually Western Canada. File No. 4556-V.

SALES ENGINEER or manufacturers agents required to sell American automatic boilers (package type) already in operation from coast to coast in Canada, as agents representatives for Quebec City and surroundings, further for Toronto, London, Hamilton, Windsor, North Bay, Abitibi District, etc. Mechanical or electrical engineers with experience in the combustion and heating line would be an asset. File No. 4558-V.

Situations Wanted

CIVIL ENGINEER AND LAND SURVEYOR, M.E.I.C., 26 years of varied experience abroad and in Canada, in: Railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey of layouts and location. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. File No. 489-W.

PLANT ENGINEER with civil and mechanical background, 1936 graduate, M.E.I.C., P.Eng. (Ont.), 17 years experience in design, construction, maintenance, supervision, purchasing and operations in leading Canadian paper mills desires change. Interested in engineering, purchasing, or engineering sales. Picture, details of experience, references on request. File 619-W.

GRADUATE MECHANICAL AND INDUSTRIAL Engineer, P.Eng., M.E.I.C., bilingual, knows how to get along with people, experienced in production control, machine manufacture, foundry operation, methods installation, first class references, desires responsible position. File No. 1730-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., McGill, age 32, married, bilingual, 9 years diversified experience—structural and municipal engineering, field supervision, estimating, preparation of specifications, project administration; presently employed with consulting firm. Seeks further opportunity as project engineer or equivalent administrative position. Location immaterial. Minimum salary $7500. File No. 2817-W.

MECHANICAL ENGINEER, 1947 graduate with 6 years industrial experience in design, maintenance and some production. Single. Also has Arts Degree. Ready to become sales engineer with Montreal firm. File No. 3208-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 28, B.Eng., 1948. Desires position with advancement possibilities, preference for pulp and paper industry. Experience: 2 summers with a pulp and paper industry, 2½ years as a project engineer of a hydro power development, 2½ years with large production firm on liaison work. File No. 3358-W.

CONSTRUCTION ENGINEER seeks an administrative position with a construction firm. P.Eng., M.E.I.C., B.Sc., in civil engineering from U.N.B. in 1949. Age 33, married. Six years experience in

Sperry Gyroscope Company of Canada, Limited
requires
ENGINEERS
For work on new types of electro-mechanical instruments for marine and aircraft use. University degree and two to eight years experience required. Preference given to men with manufacturing experience. All replies will be treated in confidence.
Please write full details of education and experience to:
PERSONNEL MANAGER
P.O. BOX 6121, MONTREAL

construction as labourer, tradesman, field engineer, office engineer, and cost engineer on large projects. Experienced in office procedures, estimating, scheduling, job control, material control, cost accounting, field layout and supervision of all trades on construction of industrial, housing and petro-chemical processing plants. File No. 3386-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 25, single. Experience includes 12 months sales and installation of equipment in propane gas and 6 months in building construction. Desire permanent position in sales covering Maritime Provinces. File No. 3903-W.

GRADUATED ELECTRICAL and mechanical engineer, Jr.E.I.C., Vienna technical university, 1½ years in Canada, fluent in English, and French, seeks responsible position in design, project or plant engineering with consulting or contracting firm, oil, chemical, paper or related industry. 4 years experience as: draftsman, checker, designer, estimator, field engineer and project engineer in: heating, air conditioning, drying, thermo electric power stations; piping, steel, instrumentation, etc. File No. 3945-W.

ELECTRICAL ENGINEER, 27 years of age, veteran, graduate of Manitoba 1950, completed Canadian Westinghouse Test Course. Desires job of technical aspect in Western Ontario or Western Canada. File No. 4021-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A.Sc., age 35, married with children. Seeks position as Regional or District sales manager with progressive company in some branch of electrical industry. Extensive experience in sales and distribution of electrical hardware and associated products to public utilities in Province of Ontario. Experience includes five years sales engineer, two years public utilities, two years own business, three years Army (Captain). Excellent record and have available for examination recent report from well known firm management consultants. Presently located in Southern Ontario. Available on one month's notice. File No. 4039-W.

CIVIL ENGINEER, B.A. (Honours in mathematics); B.Sc. (Civil Eng.). Has done post-graduate work at McGill University. Outstanding academic record; about one and a half year's experience in irrigation dam design and bridge work; working on soil problems at present. Available from November 1, 1953, anywhere in Canada. Best references. File No. 4108-W.

ELECTRICAL ENGINEER, English, A.M.I.E.E., P.Eng., age 29, married, no children. 7 years' experience in switchgear manufacturing, 4 years' experience in consultants on H.V. substations and steam power plants, 2 years' experience with large Canadian electrical manufacturer. Desires responsible position with consultant, manufacturer or utility. Available on short notice. File No. 4162-W.

CHEMICAL ENGINEER, Jr.E.I.C., age 32, veteran, 1949 graduate. Experience consisting of production supervision, process development and control work including supervision of engineering graduates in this work. Desires position providing experience in another manufacturing field. File No. 4166-W.

CIVIL ENGINEER, unmarried, 28, bachelor's degree Cornell University, master of science degree Cornell University in engineering materials and highway engineering. Interested in research or teaching position in soil mechanics, concrete, highway materials, highway engineering; or working with a well established engineering firm. Available July 1, 1953. File No. 4167-W.

CHEMICAL ENGINEER, P.Eng., Ont., Jr.E.I.C., 1949 graduate (Queens), age 25, single. One and a half years experience in production supervision in chemical extraction plant and two years experience in process development and production supervision in chemical plant producing cellulose and thermoplastic films. Interested in a position in supervision process development or technical service offering a good opportunity for advancement. Location, Ontario or Western Canada preferred. Presently employed but available on reasonable notice. File No. 4168-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in industrial planning of major expansions, and plant improvements including investigation, reports, estimates, and design (civil and some mechanical). During 4 years in pulp and paper industry, reaching supervisory capacity, have obtained broad field and office experience in diversified structural design and plant engineering. Spent 1 year structural design of power plants with consulting engineer. Seek responsible position with industrial organization. Locate anywhere in Canada. File No. 4171-W.

SHELL STRUCTURE SPECIALIST AVAILABLE. M.Sc., M.E.I.C., graduated 1947. File No. 4173-W.

MECHANICAL ENGINEER, married, with three years experience in production supervision quality improvement, cost reduction, and maintenance in a large basic industry. Worked as an undergraduate with the Dominion Government in charge of a field crew. Will consider a position with any organization that presents opportunity and challenge. Will work anywhere in Canada including the N.W.T. and will consider a foreign assignment. File No. 4174-W.

GRADUATE IN BOTH mechanical and electrical engineering (B.Sc., Queen's, Belfast, 1946), P.Eng., M.E.I.C., age 29, single. Experience comprises two years manufacture of marine and land diesel engines, diesel alterations, steam turbines, six months manufacture and repair of electrical machinery, eight months diesel drawing office work, and two years steam power station operations. Canadian experience—ten months electrical distribution, four months electrical protection. Seeks position in Alberta, British Columbia, or Western U.S.A. File No. 4175-W.

GRADUATE CHEMICAL ENGINEER, M.E.I.C., honours, family, multilingual, high invention record, imaginative, resourceful, 20 years diversified experience in heavy chemicals and management (pilot plant experiments, research, production, economic studies, estimation, plant design). Conversant with fluid — mechanics, thermodynamics, fluidization, heat exchange, drying, air conditioning. Extensively travelled. Presently employed but interested in more responsible position offering scope to introduce improvements, consultant or assistant to senior executive. Location preferably Montreal area, but would consider going elsewhere depending on nature of position offered. File No. 4176-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc. (mathematics and chemistry), B.E. from Nova Scotia Technical College 1952, desires a position offering more scope for learning and advancement. Presently employed in transmission and distribution department of utility. Interested in learning design. Age 25. File No. 4177-W.

STATISTICAL ENGINEER, graduate engineer Jr.E.I.C., qualified in mathematical statistics and quality control, desires position in the applied statistics, engineering research, or quality control fields. File No. 4178-W.

CIVIL ENGINEER and architect, graduated in Germany, Danzig and Munich Universities, seeks position anywhere in Canada. Polish immigrant, fluent in English and French, age 39, married, no children. 17 years varied experience in Europe and Near East, in design of residential, industrial and hospital buildings, supervising and directing construction (concrete), town planning (received 2nd place in the town planning competition for lower part of the town of Haifa), municipal work. Willing to start in junior position with the possibility of advancement. File No. 4182-W.

MECHANICAL - CHEMICAL ENGINEER (M.Eng., Dresden, Karlruhe), M.E.I.C., P.Eng. At present lecturer at McGill. 15 years experience as Plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. Available end of April. File No. 4183-W.

BRITISH ELECTRICAL ENGINEER, Whitworth Scholar, First class honours degree (1949), emigrating in September, wants job in computing, servo-mechanisms or process control. Four years apprenticeship in naval dockyard, one year test course in Metropolitan-Vickers, one year on design of electrical computers, eight months on liaison work with U.S.N. in Washington, D.C., one year on machinery control. File No. 4186-W.

1950 U. of A. E.E., P.Eng., M.E.I. veteran of R.C.N.V.R., married, quires employment, preferably in We ern Canada, commencing around July Experience includes heating, ventil ing and electrical design, limited w head production, equipment sales, a field supervision of construction power plant equipment and steam d tribution system. Desires employme on sales or construction supervision heavy machinery or power plant equ ment. File No. 4187-W.

METALLURGICAL ENGINEER, Jr.E.I. B.Eng., McGill 1951, age 31. Marri one child; two years experience as p ject engineer in steel industry and mi ing experience in mining industry. D sires responsible position which offe interesting and diversified work wi definite possibilities for advancement executive position. Willing to Trav Available on reasonable notice to pre ent employer. File No. 4189-W.

CIVIL ENGINEER, Jr.E.I.C., 4 years e perience, desires part time employme reinforced concrete or steel designi and detailing in Montreal. File N 4190-W.

CIVIL ENGINEER, Jr.E.I.C., P.En B.A.Sc. (honours), Toronto 1949. Pos graduate training and knowledge of pr stressed concrete. Age 25, single. Pre ently employed as design engineer mechanical field. Experience includ harbour work planning, design, mai tenance, and administration; structur steel and concrete, design, and co struction supervision. Seeking positi with either consulting civil engineer contractor where capabilities and trai ing will be used. Available on reaso able notice. File No. 4191-W.

GRADUATE ELECTRICAL ENGINEE age 28, single, presently employed electrical draughtsman in Montrea Seeks position as junior engineer pre ferably in Ontario. File No. 4192-W.

AVAILABLE OCTOBER 15, 1953, youn Dutch Civil Engineer, graduate Del Technological University, Holland. Ag 25, married, no children. In full com mand of the English language. Speci interests and some experience in con crete and prestressed concrete struc tures. Wanted: work in a first class con struction company, with possibilities fo advancement. Location anywhere i Canada with preference for Ontario o British Columbia. File No. 4193-W.

MECHANICAL ENGINEER, British A.M.I., Mech.E., A.M.I. Prod. E., seek executive position or position wit prospects. Wide experience in produc tion methods, production control, tool ing, etc., several years experience i development projects. Structural exper ience gained during service with H.M Forces. Age 37. File No. 4194-W.

COULD YOUR FIRM use a young civi engineer, P.Eng. (Ont.), B.Sc., Queen' 1950, Jr.E.I.C., age 24, single. Desires t change from present job to some thin new. Will make up in enthusiasm wha I lack in experience in your line o work. Type of work or location no governing. File No. 4203-W.

ELECTRICAL ENGINEER, P.Eng. M.E.I.C., B.Eng., 1952, age 32, married 3 children. Experience includes layout and supervision of all types of industrial electrical construction and installations, heat-treating, standards committees, specification writing and presently on management of small manufacturing concern. Located in Ontario at present but desires opportunity in Western Canada, preferably Alberta. Available on reasonable notice. File No 4205-W.

CIVIL ENGINEER, B.Sc., 1949, single, age 25, Jr.E.I.C., railway experience, consisting of location survey, construction, track work, design and supervision of frame and reinforced concrete structures, estimating and administration. Particularly interested in work in the north or foreign assignment. Available on short notice. File No. 4206-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., Ass. Mem. A.I.E.E., B.A.Sc., University of Toronto, 1951, age 28. Test Course graduate of a prominent electrical firm with experience in design and related production problems. Previous experience in maintenance of electronic equipment. Interested in servo mechanism. Desires position of increased responsibility with progressive organization. Married, one small child. File No. 4210-W.

SALES MANAGER

A Western Canadian manufacturer requires an experienced and capable sales manager to direct the sales of its products which include commercial semi-trailers and sheet metal and plate products for the petroleum and petro-chemical industry. The company wishes to enlarge its operation in the sheet metal, plate work and mechanical fields and requires an energetic and capable man with vision to assist in this development. Reply to File No. 4595-V.

MECHANICAL ENGINEER, graduated, over 20 years engineering experience in heating, plumbing, ventilating, air conditioning, refrigeration, waterwork and sewer installation, experience in process industries, steam power plant, boilers, pumps, valves, seeks adequate occupation. Experience includes design, construction, maintenance and planning. File No. 4211-W.

CIVIL ENGINEERING GRADUATE (B.Sc., St. Andrews University, Scotland), 1952, at present studying for honours, wishes post with structural engineering firm, preferably in West or Mid-West. Some experience of steelwork design and detailing, interested in reinforced concrete, age 25. File No. 4212-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., graduate of Alberta 1950, age 29, married, no children. Completed 2 years training course with internationally known electrical industry. Presently residing in Montreal—sales department for industrial apparatus. Interested in sales and construction industry. Previous experience city engineering department, Naval Petty Officer. File No. 4213-W.

MECHANICAL AND CHEMICAL ENGINEER, M.E.I.C., P.Eng., age 37—hold degree in Mechanical engineering, chem. Eng., also 1st. class stationery engineer's papers. Considerable experience in Plant Maintenance Engineering and personnel administration. No particular location preferred and willing for out of Canada position. Interested in plant maintenance, installations, technical sales and engineering administration. Presently employed but looking for position where opportunities and advancement are available to one with initiative. File No. 4215-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.Eng., McGill 1947. Will obtain Ph.D. from Princeton in fall 1953. Age 28, single, three years experience in production, tech. service to production, and development work (economic feasibility studies). Interested in process design or development, tech. service to production, or production. Available fall or winter of this year. File No. 4216-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill 1951, age 28, single. Presently completing 2 year graduate student training course offered by large electrical industry. Desires position with opportunity to demonstrate ability. Preferred location Montreal or Toronto area. Available in June. File No. 4217-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., 2 years heavy construtcion field work and supervision, desires work in Ontario or Western Canada. File No. 4218-W.

MANAGEMENT ENGINEER, age 38, family. Queen's 1936, B.Sc. Mechanical (honours), M.E.I.C., and volume sheet-metal industries. Thoroughly experienced all phases factory supervision, production and material control, industrial engineering, tool planning and manufacture, quality control, engineering design supervision and liaison, etc. Recent experience includes general management responsibilities in company organization, sales and contract administration, labour relations, and management control. Seeking position offering management career possibilities; Southern Ontario location preferred, but will consider others, including foreign. Available after May 1st. File No. 4219-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.Sc. 1942, M.Sc. 1946, P.Eng., age 30, married, with 7 years all round experience of physics applied to industry, desires position with laboratory (electrical or other industry. Previous work includes super-sonics, electronics, magnetic materials, high-voltage testing, radio-active materials. Would prefer small city, if possible up North. File No. 4229-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), 1949, graduate, age 37, married, no children. R.C.A.F. veteran (operational air navigator), 5 years teaching experience. 4 years varied experience in rural distribution including administration, consumer service, employee training, rate analysis, pole line construction and maintenance, tower line maintenance and some metering. Two summers surveying. Desires job with a definite opportunity for advancement and greater responsibility. Location of secondary importance if job suitable. Available on reasonable notice. File No. 4230-W.

FACTORY MANAGER available, M.E.I.C., P.Eng., graduate civil engineering 1935, 13 years experience as factory manager in rubber and plastics molding plant employing over 600 persons. Experience covers production, plant layout and expansion, engineering and maintenance, standards (time-study, estimating, and specifications), labour negotiations and personnel, etc. References will show career of unqualified success to date—with necessary knowledge, experience, ability, and personal qualities required in factory management. Age 39, married with family, and in good health. File No. 4231-W.

CHEMICAL ENGINEER, M.A.Sc. (U.B.C., 1951), Jr.E.I.C., age 25, single, with 1½ years experience desires a position in an industry offering opportunity for advancement. Presently employed and available on reasonable notice. Location in Ontario or Western Canada preferred. File No. 4232-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 1951 graduate, age 28, married, without children. Desires position in electrical design with a power company or consulting engineers in Montreal. Experience includes one year with a large firm of contractors in England on design of substations and transmission lines. At present with a large manufacturer of electronic equipment. Available on one month's notice to present employer. File No. 4233-W.

SANITARY ENGINEER, P.Eng., M.E.I.C., age 35, married, desires change in employment. Qualifications include a B.A.Sc. in Civil Engineering and a M.Sc.E. in Sanitary Engineering. Experience includes two years in hydraulics and hydrometrics and six years in public health and sanitary engineering. Desires job involving the planning, design or administration of water supply systems, sewage disposal systems or industrial waste treatment facilities. File No. 4234-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. 1949, aged 28, R.C.A.F. veteran, currently engaged in automatic controls and rolling mill electrics with a large firm in England, desires to return to Canada end of September 1953. Experience since graduation includes substation operation, development engineering, demonstrating at a Canadian university, lecturing at a British technical college, industrial control engineering, rolling mill engineering, commercial experience in estimating and tendering. File No. 4237-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. Queen's 1948, veteran, age 31, married, with five years experience on design, layouts and surveys related to steel and reinforced concrete structures, desires position as design engineer with construction company or consulting firm. Available on 30 days notice to present employer. Will locate anywhere in Canada if position suitable. File No. 4238-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A.Sc. (Electrical, 1951), U.B.C., P.Eng. Ont., graduate training course with large electrical manufacturer, also design and administrative experience in Canada and overseas, desirous of improving present position with wider scope of responsibility and opportunities of growth, preferably in the administrative field. File No. 4239-W.

APPLICATION ENGINEER returning to Canada from completed foreign assignment. Six years experience in the design, construction and placing in operation of air conditioning and refrigeration plants. Desires responsible position either in Canada or foreign. Willing to travel. B.A.Sc. and M.Sc. degrees. Registered professional engineer in Ontario. Working knowledge of Spanish. References and background resume upon request. File No. 4240-W.

CIVIL ENGINEER, member E.I.C., A.C.I., graduate Univ. of Pennsylvania, U.S.A., bilingual, married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice to present employer. File No. 4242-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc., Technological University of Delft, Netherlands, with 20 years executive experience as consultant-sales engineer on continent. Design experience in Canada, specialist in steam, air, instrument ration and internal transportation. Perfect English and fluent French, seeks position. File No. 4243-W.

1943 GRADUATE IN CIVIL Engineering, University Berlin, age 34, married, 2 children. Specialist in hydraulics, 7 years experience in design of navigable waterway, dams, locks and hydro power stations, hydraulic research and hydraulic laboratory work, and also river regulations and water supply. File No. 4244-W.

MECHANICAL ENGINEER, M.E.I.C., 31, married, family. Desires position in Ontario. Higher National Certificate (Gt. Britain), and endorsement in industrial administration, 10 years experience in medium and heavy special purpose machine design. At present employed in Montreal as mechanical engineer on machine design. File No. 4245-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., Ont., B.Sc., Sask. 1945, age 29, single. Last 5 years engaged in project design for two large petro-chemical plants. Plant engineering studies to improve and replace equipment for 3 years. Desires one of the following supervisory positions in a process industry, plant design and construction, production or works engineering in that order. Greater than average responsibility of a small industry or plant desirable. Available after middle of August. Location not a prime consideration. File No. 4248-W.

SENIOR CHEMIST, graduated in chemical engineering. Have held leading positions in Hungary, France and Brazil. Two years in Canada in Pulp and Paper Research Institute. Broad scientific knowledge and experience. Desires position in paper or related industry, mineral, oil laboratories or rubber tire manufacturer. Languages spoken: English, French and German. Excellent reference. Single, will accept work anywhere. Available immediately. File No. 4249-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age 30, 5 years varied construction experience including small homes, apartments, hospitals, heating plants, air force and industrial bldgs., where work entailed project supervision, estimating contracts, complete liaison with owners, architects, engineers and sub-contractors. Fully experienced in office routine, accounting, and purchasing, and knowledge of design of timber, concrete and steel construction. Desires position where experience and administrative ability may be best utilized. File No. 4254-W.

News of the Branches

Activities of the Forty-four Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. Lusk, Jr.E.I.C.,
Secretary-Treasurer

Annual Meeting, May 11

The Belleville Branch of the Institute held its regular annual meeting at the Masonic Temple in Belleville on May 11 with 65 members and guests present. Chairman G. A. Bradford presided at the meeting.

The Secretary-Treasurer read the minutes of the annual meeting held on April 28, 1952. It was moved by S. Sillitoe and seconded by C. R. Phillips that the minutes be adopted as read.

Mr. Bradford then briefly outlined the activities of the Branch under his chairmanship, making particular note of the Professional Development Course sponsored by the Junior Members and also the $25.00 prize which would be awarded to a high school student who intends to take an engineering course at a recognized university.

The Secretary-Treasurer presented a report on the Branch membership and also a financial statement as of April 30, 1952. It was moved by C. R. Whittemore and seconded by A. D. Janitsch that this report be adopted and approved as read.

Mr. Bradford asked if there was any new business. C. E. Richards read a letter from G. L. Schneider, director of the Hamilton Branch Professional Development Course, advising that a meeting would be held in Hamilton on May 16 to formulate a report and recommendations on such courses to be forwarded to Lt.-Col. L. F. Grant. Mr. Richards advised that he would attend this meeting and invited any other members who would care to accompany him.

As there was no further new business Mr. E. G. Gurnett, chairman of the Nominating Committee, presented the proposed slate of officers for the new year. Mr. Gurnett moved that this slate be accepted and this was seconded by W. H. Sweet. There were no further nominations and the new slate of officers was adopted unanimously.

The new executive is composed as follows: Chairman, C. R. Whittemore; Vice-chairman, A. O. Drysdale; Committee, J. C. R. Punchard, A. E. Argue, T. E. Flinn, E. L. Littlejohn, A. D. Janitsch, J. H. Legate; Ex-Officio, G. A. Bradford and S. Sillitoe.

The new officers were introduced to the Branch by Mr. Bradford.

C. R. Phillips introduced the speaker, T. Rodden of the Northern Electric Co. Ltd. in Montreal. Mr. Rodden gave a short talk outlining the background behind the film "Tooling for Work Simplification" produced by the Northern Electric Co. This film won second prize at the nation-wide United States-Canadian work simplification contest sponsored by the Industrial Management Society of America at Chicago in 1951. This film which illustrated four basic principles behind tooling for work simpliciation was well received by the members. A. E. Argue extended the appreciation of the Branch.

Cornwall

L. H. Snelgrove, Jr.E.I.C.,
Secretary-Treasurer

John E. Pescod, Jr.E.I.C.,
Branch News Editor

Ladies' Night

The Cornwall Branch of the Institute held its second annual Ladies Night at Cornwall Golf and Country Club on the evening of March 20. Approximately thirty couples enjoyed dancing to the music of a local orchestra. Spot dances were won by Mr. and Mrs. Howard Campbell and Mr. and Mrs. Jesse Humphries.

A buffet luncheon was served at the conclusion of the evening.

General Meeting, April 14

The April general meeting of the Cornwall Branch was held in the Assembly Room at Courtaulds. This was Branch Night, an annual event; the speaker was Mr. Lawrence Snelgrove, plant engineer of Courtaulds (Canada) Limited of Cornwall and secretary-treasurer of the local Branch.

Mr. Snelgrove, who spoke on "Plant Maintenance", has been associated with Courtaulds since his graduation as an electrical engineer from McGill University in 1946. He spent approximately two years with the parent company, Courtaulds of England, observing and training in plant maintenance work procedures in England, and is well acquainted with current American practice.

The speaker explained that the installation of modern labour saving devices and automatic controls has tended to increase the ratio of maintenance labou to that of labour for line productio Management is of course concerned wit the increasing cost of maintenance wit the result that many industries ar developing sound plant maintenanc schemes.

Mr. Snelgrove then outlined the prin ciples of such a scheme and some c the advantages to be gained.

Following a discussion period a film dealing with the history and manufac ture of dyes and pigments was shown.

Mr. Snelgrove was introduced by P Nasmyth and thanked by Mr. Rothwell Mr. John Hawkes was chairman of th meeting.

Eastern Townships

R. H. Blackmore, Jr.E.I.C.,
Secretary-Treasurer

Professional Development Course

G. M. Dick, chairman of the Eastern Townships branch of the Institute gave the final lecture to the local section of the engineers' professional development course on April 30, at the Ecole Technique, Sherbrooke. Mr. Dick used as his subject: "Obligations of the Engineer." He stressed the obligation of the engineer to help in community projects and associations. As a case in point he told of Mayor Levesque's request that the Eastern Townships branch of the E.I.C. undertake an investigation of the need of a filtration plant for the city of Sherbrooke.

The course, which began on November 14, 1952, and included 14 lectures, consisted of talks on various subjects, mainly of a non-technical nature. Professor Gray, of Bishop's University, opened the course with two lectures on public speaking. Following were talks on Labor Relations from three points of view: from Management's by C. M. McGaw, industrial relations manager, Canadian Johns-Manville Company, Limited; Labor by G. B. Nicol, director of Education Research, International Brotherhood of Pulp and Paper Workers; the public by Professor H. D. Wood, McGill University.

Two Sherbrooke lawyers talked on law: B. N. Holtham on labor law and H. Grundy on the civil code.

Modern business methods were explained by the following: G. H. Lynch, Industrial Engineering Department,

eneral Foods, explained "How our isiness System Operates." "Financial nalysis of Industrial Operations" was ven by T. P. Boyle of Canadian Johns-lanville Company, Limited; and Mr. oel, C.A., Montreal, lectured on cor-orate finance.

H. A. F. Gregory of the St. Lawrence orporation, East Angus, told "What ndustry Expects from the Engineer"; . J. McKenna outlined the organization f the Montreal Stock Exchange; and . A. Walton, economic adviser to the ank of Montreal, lectured on "The conomic Situation."

The course this year was well attended y engineers from Sherbrooke, East ngus, Windsor Mills and Asbestos, and t was decided that a similar course ould be offered next year.

Fredericton

R. E. Tweeddale, M.E.I.C.,
Secretary-Treasurer

R. S. Myles, M.E.I.C.,
Branch News Editor

Annual Smoker

On May 5 the Fredericton Branch of the Engineering Institute of Canada held their annual smoker in honour of the engineering graduates at the University of New Brunswick. The smoker was held at Colwell's Inn and a large turnout of members and students was on hand.

Guest speaker for the evening was Colonel Kropper, Corps of Engineers, U.S. Army, who expressed his regret that so many young men were leaving New Brunswick in the face of the promising industrial expansion brought about by the mining boom and hydro-electric development. He spoke of his pleasant associations with the people he had met in New Brunswick. Following Colonel Kropper's address the film, "Nechako Survey", was shown which depicts the Aluminum Company of Canada's huge project in British Columbia.

Chairman C. E. Weyman presided at the meeting.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

D. R. Graham, Jr.E.I.C.,
Assistant-Secretary

April Meeting

The April meeting of the Kingston Branch was held on Tuesday, April 21 at the Royal Military College. Commander H. S. Dennis P. Eng., assistant laison engineer for the Hydro-Electric Power Commission of Ontario was guest speaker. Commander Dennis' subject was "The Richard L. Hearn Generating Station, Canada's Largest Fuel Electric Plant".

The Richard L. Hearn Generating Station is located on the Toronto waterfront. This ideal site was selected because of three factors: proximity to load demands in the Southern Ontario System; availability of water supplies for condensing and cooling purposes, and fuel supplies at the lowest possible cost.

The station is named in honour of Ontario Hydro's general manager and chief engineer, Dr. Richard L. Hearn. Construction began in the fall of 1949, with the official opening taking place in October 1951.

This station and the J. Clark Keith Generating Station, Windsor, are Ontario Hydro's first major fuel-electric generating stations and the largest in Canada. The Richard L. Hearn G.S. and the J. Clark Keith G.S. have been constructed primarily to take care of system peak and low water conditions on hydraulic stations.

At the present time, Commander Dennis said, work on the Richard L. Hearn G.S. was proceeding rapidly on the installation of the plant's fourth and final unit. It is scheduled for service in June. Three units are now in operation—one at 60 cycles, and two at 25 cycles. The fourth will operate at 60 cycles. With four units at 60 cycles, this plant will have an installed capacity of 536,000 horsepower.

Coal is conveyed to the pulverizers from the 400,000-ton stock pile to the powerhouse on an 1,100-foot long conveyor rising to a height of 137 feet. The coal is pulverized to the fineness of talcum powder and forced into the steam generating units where it is burned in suspension. When operating at full capacity, each furnace will consume fifty tons of coal, or more than one carload of coal every hour. Smoke control equipment, incorporating the latest technological improvements, remove over 95 per cent of soot and fly-ash, thus more than satisfying Toronto's anti-smoke ordinance.

The steam-generating units, 120 feet in height or equivalent to a 10 storey building, will have 80,000 feet (over 15 miles) of seamless steel tubing. Each generator will be capable of producing 850,000 pounds of steam per hour at 875 pounds per square inch gauge pressure at a temperature of 900 degrees Fahrenheit.

At this high temperature and pressure, steam is fed to the turbine where it strikes in jets against the blades of the rotor forcing it to revolve 1,800 times per minute. The turbine rotor is coupled directly to the generator rotor. After the steam has expended its energy, it is drawn into a condenser, and discharged through a 78-inch diameter pipe to Lake Ontario.

The steam turbine-generators are the largest in Canada, and are exceeded in size by few in the world. Each weighs 590 tons and is over 80 feet in length.

After Commander Dennis' talk members were served refreshments in the Officers' Mess.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

Wm. J. Roy, Jr.E.I.C.,
Branch News Editor

Dinner Meeting April 18

Chairman J. C. Neufeld presided at the last regular meeting of the 1952-53 season. Forty-five members, affiliates and guests were present.

Dinner music was supplied by the Browns Orchestra and Bob Lawrence ably led in community singing. The guest soloist Bill Gordon and his accompanist Jack Stead favoured the meeting with two very enjoyable selections.

The guest speaker, E. A. Olafson, M.E.I.C. P. Eng. M.Sc., was introduced by Walt Thompson. In his paper on Drainage Investigation in Irrigation, Mr. Olafson outlined the reasons for and advantages of proper drainage of irrigated lands. As head of the Drainage Division of the P.F.R.A., Mr. Olafson has undertaken extensive field tests and has conducted experiments concerning various drainage methods and land levelling equipment. Highlights of the paper were illustrated with slides.

Irrigation covers only three percent of the arable land in Alberta but this irrigated land supplied ten percent of the agricultural revenue. As irrigation overcomes the hazards caused by moisture deficiencies, the irrigated area of Southern Alberta should become one of the most stable farming areas in Canada.

Proper irrigation required not merely ample water but water, soil and men all working together to increase productivity. The water requirements of crops must be known and wastage of water avoided as this unnecessarily raises the water table level causing drainage problems. Even with proper irrigation it is necessary to provide some subsurface drainage. Drainage investigation is carried out to determine if the soil will drain, and how much water must be drained off. At present drainage is an art rather than a science but investigations now being carried on should provide a scientific basis for future drainage.

Improperly drained land is very liable to become salty and unproductive. To prevent saturation which will bring salts to the surface it is necessary to undertake some land levelling. Land levelling costs in the Milk River Development in the U.S.A. have averaged about $50.00 per acre. With properly levelled land and adequate control equipment one man can irrigate as much as 50 acres per day.

Water table levels may be raised by leakage from irrigation canals; and studies of soil permeability and of canal losses are being made. A very satisfactory asphalt canal lining method has been developed. In this method the canal is over excavated to a depth of one to two feet, and the canal is then rolled to provide a smooth surface. Hot asphalt is sprayed on the canal surface to provide a continuous membrane about 3/16 inches thick. The canal is then lined with one to two feet of clay. Costs of this method have been about $1.25 per square yard but this cost may be reduced to about $1.00 per square yard as improved engineering is developed.

Linings of glacial clays and gravel have been constructed at a cost of 60 cents per square yard.

For subsurface drainage, special ditching machines have been developed which automatically place the pipe. This eliminates the danger and expense of cave-ins which are present in ordinary ditching and pipe laying methods.

Mr. Jim Campbell expressed the thanks of the branch to Mr. Olafson for his excellent paper.

London

R. S. Cuthbertson, M.E.I.C.
Secretary-Treasurer

R. S. Allison, Jr.E.I.C.
Branch News Editor

Tour of General Motors Diesel Limited Plant

General Motors Limited at London was host to the Branch on the occasion of the monthly meeting on March 19.

year of achievemen

Just one year ago, the Canadian plant of Brown Boveri went into production. Since then an ever increasing flow of power transformers, distribution transformers, air blast circuit breakers, and switchboards has been going forward to a growing list of customers.

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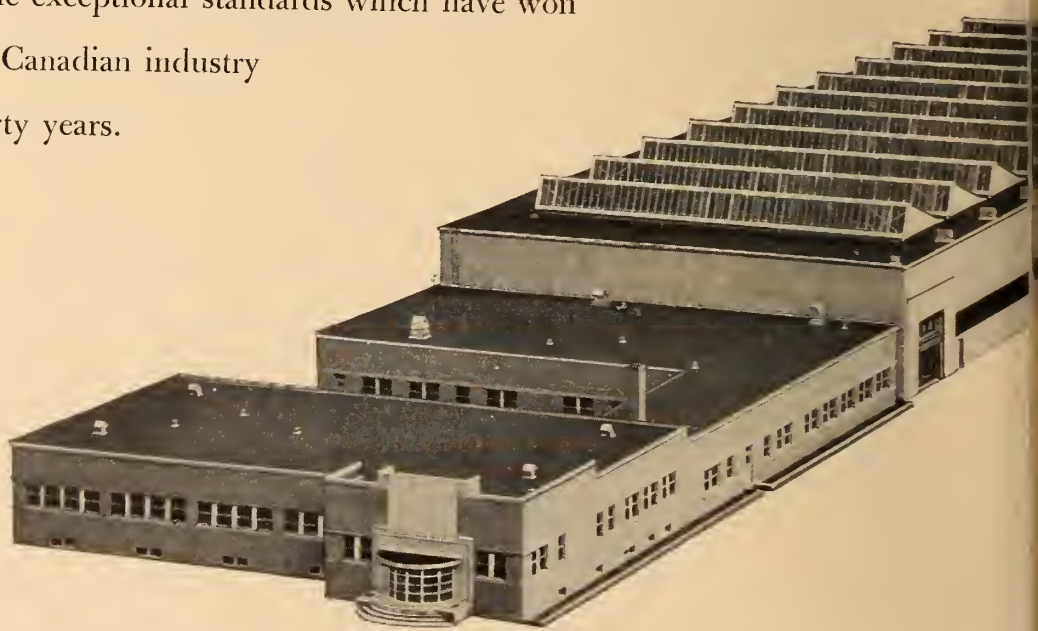

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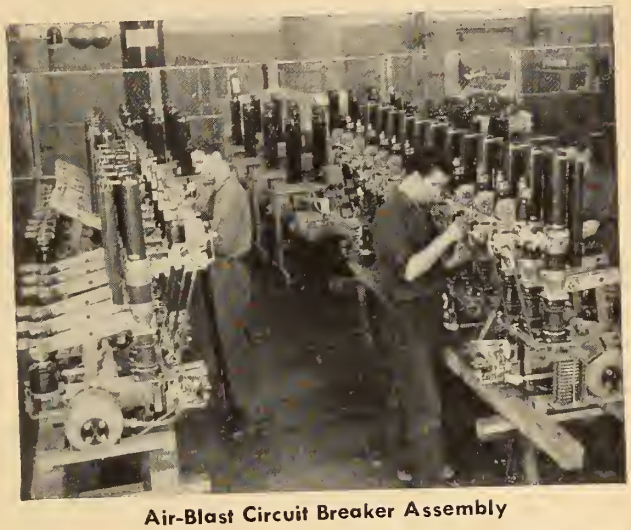
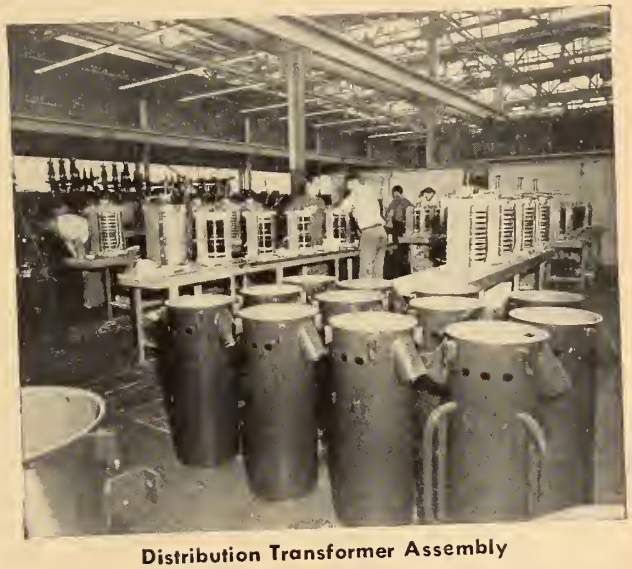


Air-Blast Circuit Breaker Assembly



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BROWN BOVERI

A group of 73 professional engineers and friends gathered for a tour of this modern diesel electric locomotive producing plant.

The group was very heartily welcomed by Harvey Martin, M.E.I.C., of General Motors Diesel engineering staff, in the absence of Don Jenkins, M.E.I.C., chief engineer of the company.

A very interesting film "Diesel — The Modern Power" was shown, after which the group was conducted in parties of about eight, on a tour of the plant by members of the engineering personnel of General Motors Diesel Limited.

At the outset of the tour everyone was issued safety glasses. The visitors saw many component parts of the locomotives moving down sub-assembly lines to the final assembly line where the locomotive is made complete in every detail, before moving on to the paint shop where it is painted in accordance with the specifications of the railway purchasing the unit. When the locomotive is completed it is very thoroughly tested on trackage adjacent to the plant. The parties completing the tour of the plant assembled in the main cafeteria where refreshments were provided.

Branch Chairman I. D. Patterson thanked the General Motors firm for their generous hospitality and for the most educational evening which they provided for our Branch.

Each party then completed the tour by visiting the offices, engineering department and laboratories.

Newfoundland

R. W. Pike, M.E.I.C.,
Secretary-Treasurer

April Meeting

The regular monthly meeting of the St. John's Newfoundland Branch was held at Memorial University on Monday April 27, with the branch chairman S. J. Carew presiding. It had been hoped that the President of the E.I.C. Dr. J. B. Stirling would be present at this meeting. However, because his plane had been grounded at Gander Dr. Stirling did not arrive in St. John's until the following day.

It was decided to hold the annual dinner meeting, the final meeting of the branch until the fall, on Monday May 11, at the Bungalow Bowring Park if available. The special speaker at this meeting was to have been Dr. Stirling, but owing to his absence R. W. Pike, the branch secretary agreed, on a short notice to address this meeting. He chose as his subject "The Bailey Bridge". Mr. Pike, who is a Lieutenant in the R.C.E. reserve, illustrated his talk by a scale model of the Bailey Bridge and gave a step-by-step description of the various steps in its construction. He described the various types of bridges that could be assembled and the type of loading for each. The Bailey Bridge has now been released for civilian construction; one bridge has already been erected by the Department of Public Works in Newfoundland. Mr. Pike invited the members to be present on May 3 at the construction of a Bailey Bridge, across a river on the outskirts of St. John's, by members of the R.C.E.

The interest aroused by the talk was clearly shown by the lively discussion that followed. A hearty vote of thanks was extended the speaker by J. M. Hopkins.

Following adjournment a social period followed. The supper was served by Mrs. Morris and Mrs. Dickerson of the Engineers Wives Club.

President's Visit

Dr. J. B. Stirling, president of the Engineering Institute, accompanied by Mrs. Stirling and Col. Thompson, assistant secretary of the Institute, paid a two day visit to St. John's on April 28 and 29.

Immediately upon his arrival Dr. Stirling went to Memorial University, where he addressed the engineering students. In the meantime Mrs. Stirling was guest at a coffee party, given by the Engineers Wives' Club, at the home of Mrs. E. L. Ball.

At the University Dr. Stirling addressed his listeners as "fellow students," for, he said, an engineering education is a continuing process that does not stop upon graduation. He thought it was a good thing that so many students were members of the Institute. He compared the Institute to a fraternity—a fraternity of engineering graduates. He went on to point out to the students the value of an engineering education. Many graduates did not find their career in the engineering field but their engineering training stood them in good stead whatever their field of endeavour. He told the students that there would be an acute shortage of engineers in Canada for several years to come. This year about 2,000 new engineers would be required, while only 1,200 are expected to graduate this spring. Before he left the University Dr. Stirling signed the University guest book.

He was then guest at luncheon, tendered by the executives of the E.I.C. and the Association of Professional Engineers of Newfoundland, at the Newfoundland Hotel. Dr. Stirling spoke briefly saying he was glad to see the close co-operation between the two groups, as each had distinct functions that did not conflict. An informal discussion followed on the possibility of a joint agreement between the two groups.

Later Tuesday afternoon Dr. Stirling and members of the Institute were guests at Pepperrell AFB, where, at 4.00 p.m., they were welcomed to the base, at the base theatre, by Major Frauth, engineering officer. Then followed a tour of the base, by bus, and a visit to the Petroleum Oil Lubricants Laboratory. From here the group were taken to Red Cliff, a joint U.S.-Canadian defence project—an air warning and control base. At Red Cliff the group were addressed by Capt. David, the supervising engineer, who told of the difficulties met during the construction and of the methods employed to overcome them. Following Capt. David's address a tour was made of the installation, which is now approximately 85 per cent completed. Back at Pepperrell the engineers and their wives were guests at an enjoyable dinner at the officers field ration mess. After dinner S. J. Carew, the branch chairman, introduced Dr. Stirling and Col. Thompson to the gathering. Both gentlemen spoke briefly to the group and expressed their thanks to their American hosts for a very enjoyable visit to the base.

The day ended with a visit to Buckmaster's Field, where, through the courtesy of Brigadier Smith, the engineers and their wives were guests at the officers mess. Here two movies were shown to an appreciative audience. They were "The Big Island" and Lt. Wulff's, "Fishing in Newfoundland".

On Wednesday morning Dr. Stirling visited the studios of CJON. He also visited the construction work going on on the Southside and then some of the buildings and installations there that had been erected under his supervision early in the last war. Wednesday afternoon a joint meeting was held, with the executives of the E.I.C. and the Association of Professional Engineers of Nfld.

From 5.00 to 6.30 p.m. a cocktail party was held by the St. John's branch at the Nfld. Hotel. Among the many guests were His Honour the Lieutenant Governor and Lady Outerbridge; Col. and Mrs. Crawford, representatives from the Provincial Government, the Law Society, the Architectural Society and the U.S. and Canadian armed forces.

At 8.00 p.m. that evening the presidential party entrained for Corner Brook, where Dr. Stirling would install the officers of the newly formed branch of the Institute there. A large number of members and friends were at the station to bid farewell to Dr. and Mrs. Stirling and Col. Thompson.

Corner Brook

M. G. Green, M.E.I.C.,
Secretary-Treasurer

Inaugural Meeting

The White House at Corner Brook Newfoundland, provided a commodious setting for the inaugural meeting of the Institute Branch on Thursday, April 30.

More than sixty-five engineers and their wives were on hand for the occasion at which Will Smith presided. Dinner was served at 7 p.m. following cocktails, and at its conclusion, H. M. S. Lewin, managing-director of Bowater's introduced President J. B. and Mrs. Stirling of Montreal. Dr. Stirling then inaugurated the new Branch and presented its charter to Eric Hinton, the newly-elected chairman. Following the presentation of the charter, G. B. Knight, on behalf of the St. John's Branch presented a cheque together with an Institute banner.

President Stirling then addressed the meeting followed briefly by the Assistant General Secretary Colonel H. G. Thompson after which the remainder of the evening was spent very pleasantly in dancing.

Nipissing and Upper Ottawa

D. Keith Campbell, Jr.E.I.C.
Secretary-Treasurer

Annual Meeting, May 2, 1953

The annual meeting of the Nipissing and Upper Ottawa Branch was held at White Oaks Inn. Temiskaming, Quebec.

The business meeting convened at 6.45 p.m. with G. L. Hood of North Bay as chairman. The treasurer's report, the auditor's report and reports from all committees were read and tabled.

A banquet turkey dinner was served at 8.30 p.m. F. R. Marshall of North Bay proposed a toast to the ladies which was replied to by Mrs. R. R. Prescott of Temiskaming.

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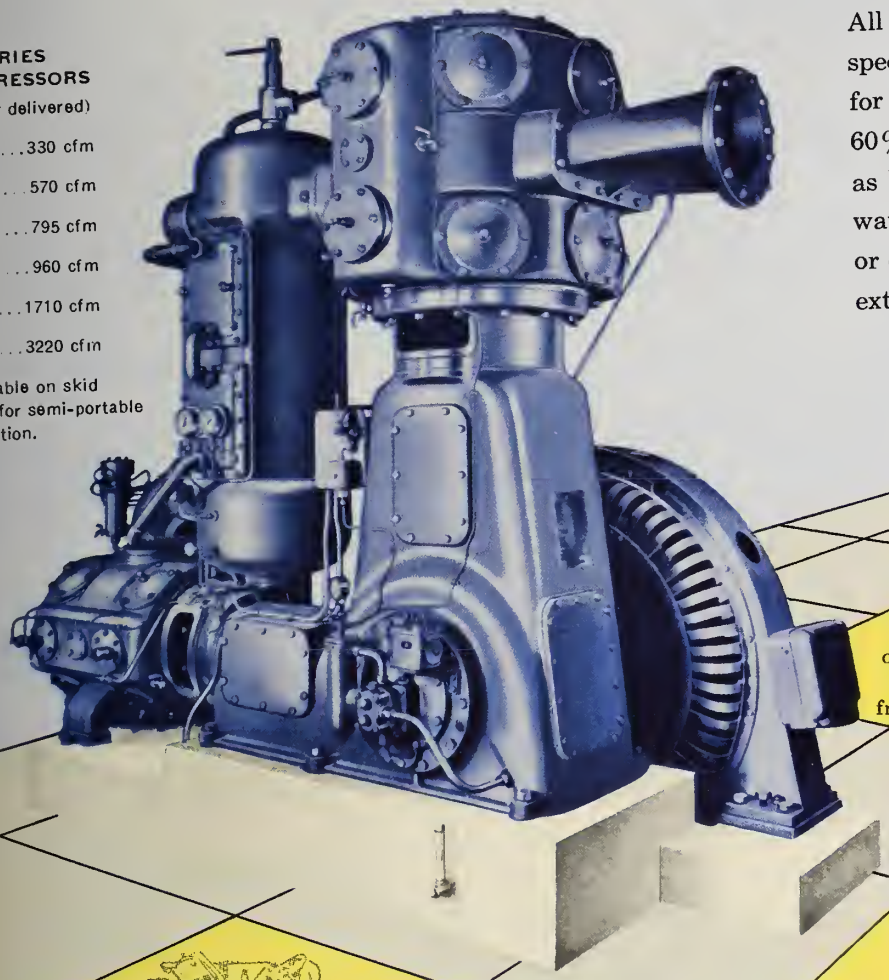

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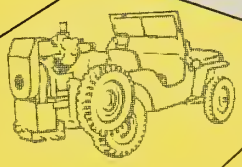
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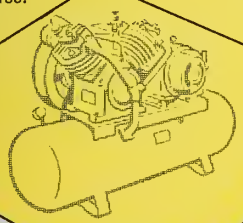
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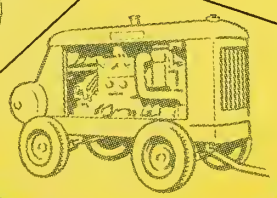
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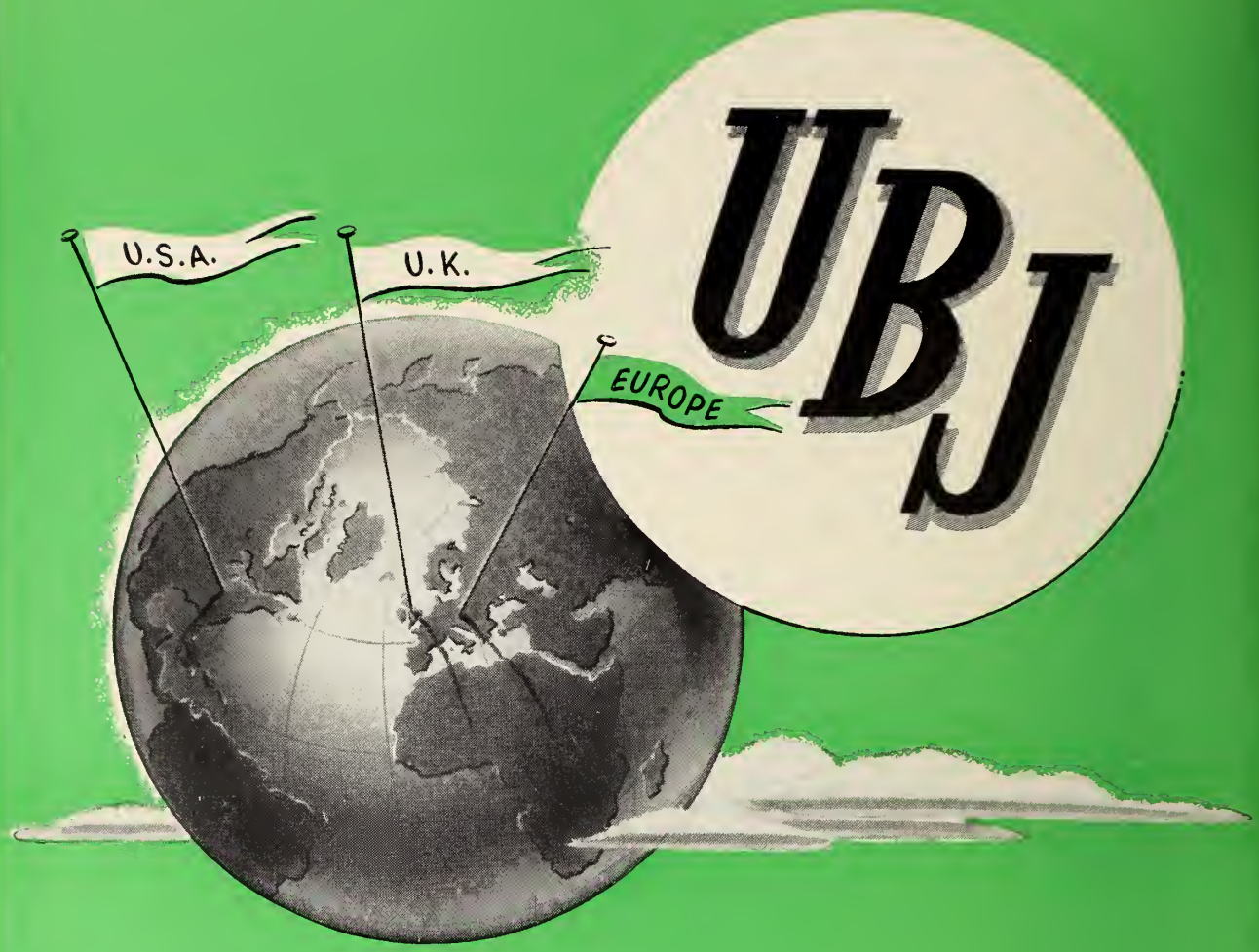

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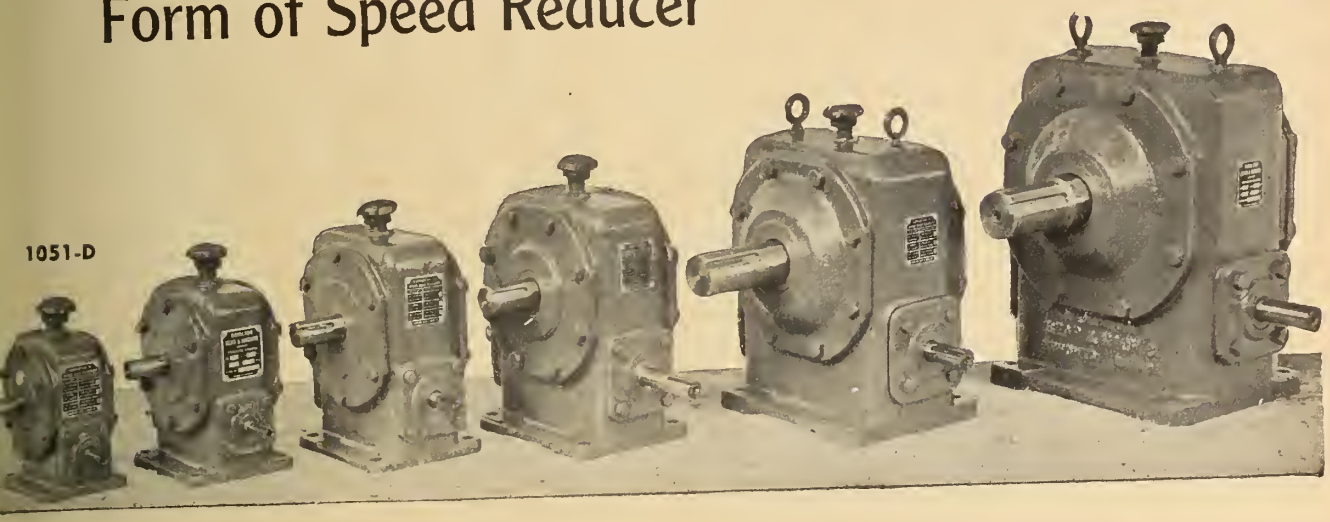

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Temiskaming, addressed the gathering, reviewing the progress of professional development and public recognition to date. In good humour he noted that whereas some professional mistakes were either buried or hung, the engineer's remained as a perpetual memorial to his asinine senility.

Outgoing chairman G. L. Hood spoke of the social and technical services of the Branch and how they justified the Branch's existence. The self-development of individual engineers increases their worth to employers as well as furthering group interests within the profession. He thanked the committees for their effort throughout the past year. He introduced the incoming chairman R. G. Dye, of Temiskaming, as an honours graduate of McGill University in mechanical engineering employed by Canadian International Paper Company as a mill engineer, one of the organizers of the "Tem. Times" newspaper and as one of the strongest supporters of the Branch. Mr. Hood then turned the meeting over to the new chairman.

Mr. Dye made a few remarks about the work of the organizers, reviewed the accomplishments of the year and predicted further successes with the support of the membership.

Following the banquet, refreshments were served and the Northernaires provided music for dancing.

Peterborough

M. V. Powell, M.E.I.C.,
Secretary-Treasurer

G. T. Davis, M.E.I.C.
Branch News Editor

John F. Heard Discusses Astronomy

The speaker at a meeting of the Peterborough Branch on April 15 was John F. Heard, director of the David Dunlap Observatory, the University of Toronto. The subject of his discussion was "The Nature of Other Planets".

Before going into the main subject of his talk, Mr. Heard explained to his audience very clearly the tremendous space covered by modern astronomers. He exhibited a model of the sun, which was 10 in. in diameter and pointed out that, on the same scale, it would be two miles to the furthest planet, Pluto. In the same illustration, the distance to the nearest star would be 4,000 miles.

Of Venus, the nearest planet to the sun, very little is known of conditions on the surface, because of its very cloudy atmosphere.

Concerning the planet Mercury, the reverse is true. The atmosphere is perfectly clear and considerable investigation has been carried on. The period of rotation of this planet is exactly the same as that of its orbit with the result that the planet always presents one face to the sun. The result is that the side which we can see is very cold, while the side facing the sun must have a temperature approximating 700 deg. F.

The planet Mars has always caught the imagination of astronomers, both professional and of the armchair variety. Because of its eccentric orbit there are times when this planet is relatively close to ours and times when it is quite remote. In 1956 it will be its closest for some time, about 34 million miles. Using a more understandable explanation of distance, Mr. Heard explained that it will then appear about as large as a penny at a distance of 400 ft. At that time, observers using the best available telescopes will obtain pictures with a resolution of approximately 50 miles. He explained that the popular understanding of the "canals" of Mars is not quite correct. These were first observed by an Italian astronomer who gave them the name of "cannali" which in Italian means "channels". The Italian word was adopted by the English speaking world rather than the more accurate translation. There is water vapour on Mars, as exhibited by the polar white spots during the winter seasons. This vapour however is very rare and it is thought that the covering of the polar caps is more likely to be a coating of frost rather than heavy snow such as is familiar to us.

The photographs of Jupiter show very distinctly that the poles are flattened. This of course is the case in our own planet but because of the much lighter density on Jupiter the effect is pronounced. Clouds are also visible on that planet, but they appear to be made of ammonia rather than water vapour. There are also interesting horizontal streaks across the equator and parallel to it which are apparently caused by high winds.

The number of pictures of Saturn were displayed and explanations were given of the well known rings of Saturn.

Mr. Heard presented to his audience a conception of Henry Norris Russell on planet evolution. Mr. Russell suggested that the carbon dioxide on a new planet was able to support plant life, which in turn resulted in the production of oxygen. The appearance of oxygen made animal life possible. Following this oxidation took place using up the available free oxygen. This at least explains the condition existing in Mars at the moment where the amount of oxygen is extremely small.

He also mentioned the theory of Kuypur who concluded that the planets did not arise from our sun. Other theories advanced state that the oxygen now available on our earth and other planets is a result of dissociation of water by means of ultra violet light. Still more recent advances in spectroscopy as applied to astronomy are producing new theories of the nature, origin and development of the solar system.

The speaker seasoned his lecture with a very pleasant humour with the result that he retained a most attentive audience. This meeting is considered to be one of the most interesting of the year.

Quebec

Roger Desjardins, M.E.I.C.,
Secretary-Treasurer

Guy Babineau, Jr.E.I.C.,
Branch News Editor

Brigadier Maurice Archer Addresses March Meeting

A meeting of the Quebec Branch was held on March 26, 1953 at the Faculty of Science of Laval University.

Pierre Duchastel, chairman of the Papers Committee, opened the meeting and called on L. R. Talbot to introduce the speaker, Brig. Maurice Archer, vice-president of National Harbours Commission. His subject was "The Engineer and the National Harbours."

After stating what conditions must be met in the selection of a proposed harbour site, the speaker described the nature and numerous facilities of a modern harbour and showed the vital role played by the engineering profession in its design, construction and maintenance. Apart from being well sheltered against the wind and free from swift currents, any proposed harbour location must be easily and safely accessible at all times.

Modern harbour wharfs may be parallel to or at a right angle with the main river banks; they are not only designed in view of ship docking but also in view of serving as supporting walls as well as foundations for warehouse and freight handling equipment. This includes medium capacity cranes as well as conveyor system for grain handling and storing; some harbours also have high capacity floating cranes.

In addition to the above, modern harbours also include roads, railroads, cold storage warehouses, customs buildings and terminus stations; ship maintenance and repair facilities must also be provided together with electricity, water, fuel oil and coal distribution facilities.

The second part of the paper dealt with the administrative aspect of various harbours throughout the world. Describing briefly this aspect for the French, Italian and American harbours the speaker explained more fully the duties and functioning of the National Harbour Board of Canada. Established in 1936 with head office in Ottawa, its legal traffic, financial and engineering departments come under the authority of the three board commissioners who are in turn directly responsible to the Minister of Transport.

The Halifax, St. John, Chicoutimi Quebec, Trois Rivieres, Montreal Churchill and Vancouver harbours as well as the Prescott and Port Colborne grain elevators and the Montreal Jacques-Cartier bridge all come under the authority of the Board. Each harbour has its own local manager and administrative as well as technical personnel responsible for normal routine and maintenance work. All capital investments are planned by head-office in close co-operation with local management and technical staff.

Brig. Archer's paper was accompanied by two recent films on various Canadian Harbours; the conference was well received by the meeting and a number of questions were asked.

As a token of appreciation for numerous services rendered to the Branch as member of its executive committee and chairman of its paper committee and at the occasion of his leaving for Ottawa where he was recently appointed vice-president of the National Harbour Board, Brigadier Archer was presented with a souvenir on behalf of the Quebec Branch by its chairman A. E. Pare.

Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

Dinner Meeting

On November 29, 1952, the Saguenay Branch held a dinner meeting for members and their ladies at the Hotel Chicoutimi. The guest speaker was F. L. Lawton, M.E.I.C., of the Power Development Section of Aluminium Laboratories Limited, who was introduced by the chairman, D. F. Nasmith.

Mr. Lawton presented a paper on the design of the Nechako-Kemano-Kitimat

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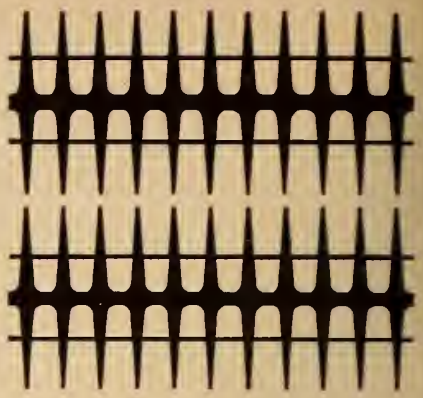

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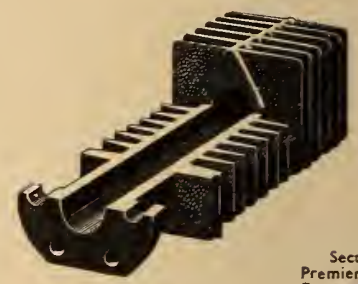

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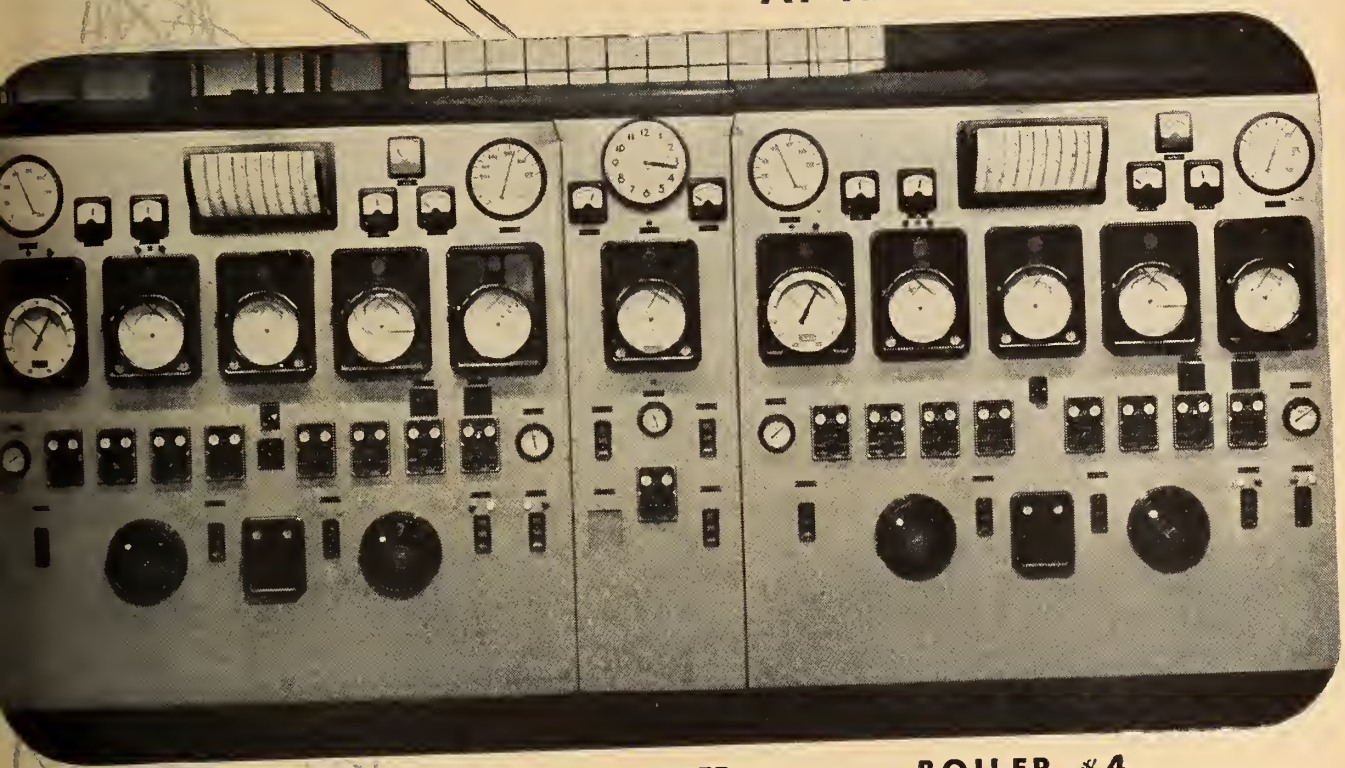

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roject of the Aluminum Company of anada in British Columbia. He described in detail all phases of the design, om the water storage through to the ansmission of power from Kemano the site of the aluminum smelter at itimat.

H. R. Fee, M.E.I.C., councillor of the Branch, expressed the thanks of those resent for Mr. Lawton's excellent paper, nd all present voted the innovation of dinner meeting, a success.

ecture and Field Trip

On March 31, 1953, T. T. Anderson, M.E.I.C., of Aluminum Company of Canada's General Engineering Department, and R. Bolduc, M.E.I.C., of Arvida, presented an illustrated lecture on the design and operation of Alcan's new sulphuric acid plant at Arvida.

Mr. Anderson described in detail the major problems encountered in designing the equipment for processing the zinc concentrates used in this new plant. Mr. Bolduc, who had been responsible for putting the plant into operation, gave an interesting resume of the process and handling of the materials.

Following this lecture, on Saturday, April 4, a field trip was held and a large party was conducted through the acid plant by Mr. Bolduc and his assistants, during which the actual operation was observed.

President's Visit

On Tuesday, April 21, 1953, President J. B. Stirling was welcomed by the Saguenay Branch at an informal smoker in the Saguenay Inn.

On the afternoon of the visit, an executive meeting was held, at which the business of the Branch was discussed. President Stirling and Dr. Wright were entertained at dinner, following which they met informally a large section of the membership at the smoker. The President, in a brief talk, outlined the highlights of his tour of the Branches, and expressed confidence and pleasure in the increasing activity of the profession in the public service, and stated that the public's respect for the profession was reaching a high level, and this condition could be well-nourished by maintaining a strong and active Institute. The rewards of being a member of such a society were many and should be highly valued by engineers.

Dr. Wright reviewed the activities of the Institute and answered the many questions from the floor during the informal discussion which followed.

Following the meeting coffee and sandwiches were served and Chairman D. F. Nasmith, expressed the appreciation of the Branch to Mr. Stirling.

Students' Vocational Guidance

On February 27, 1953, a very successful meeting was held in the Assembly Room of the Saguenay Inn, attended by a group of High School Students of the Saguenay district, under the chairmanship of B. L. Davis, M.E.I.C., student counsellor in the district, and past chairman of the Branch.

The purpose of the meeting was to acquaint the graduating students with the opportunities in engineering as a career. By a series of short talks, presented by a group of senior engineers, the students were told of the various roles open to them, in production, research, sales, and management. All the engineering schools in Eastern Canada had kindly supplied copies of their calendars, so that the questions on fees and curricula were readily answered.

The number and variety of the questions raised by the students in the informal discussion evidenced their keen interest and augured well for the future success of the Branch's counselling program.

Junior Section

H. Erkku, Jr.E.I.C.,
Secretary

Smoker Meeting February 3

A regular smoker meeting was held on February 3, 1953, in the Assembly Room of the Saguenay Inn under the chairmanship of C. C. Louttit.

S. T. Solinski introduced the speaker, L. D. Laventure, Jr.E.I.C. Mr. Laventure presented a talk on "Soaring Flight" which was particularly interesting since the speaker, who has a pilot's licence, had attended various gliding meetings both in Canada and the U.S.A. He illustrated his topic with slides and several films on gliding. J. R. Ledwell thanked the speaker.

After refreshments, the evening was rounded off by the showing of a 1952 Alouette football film.

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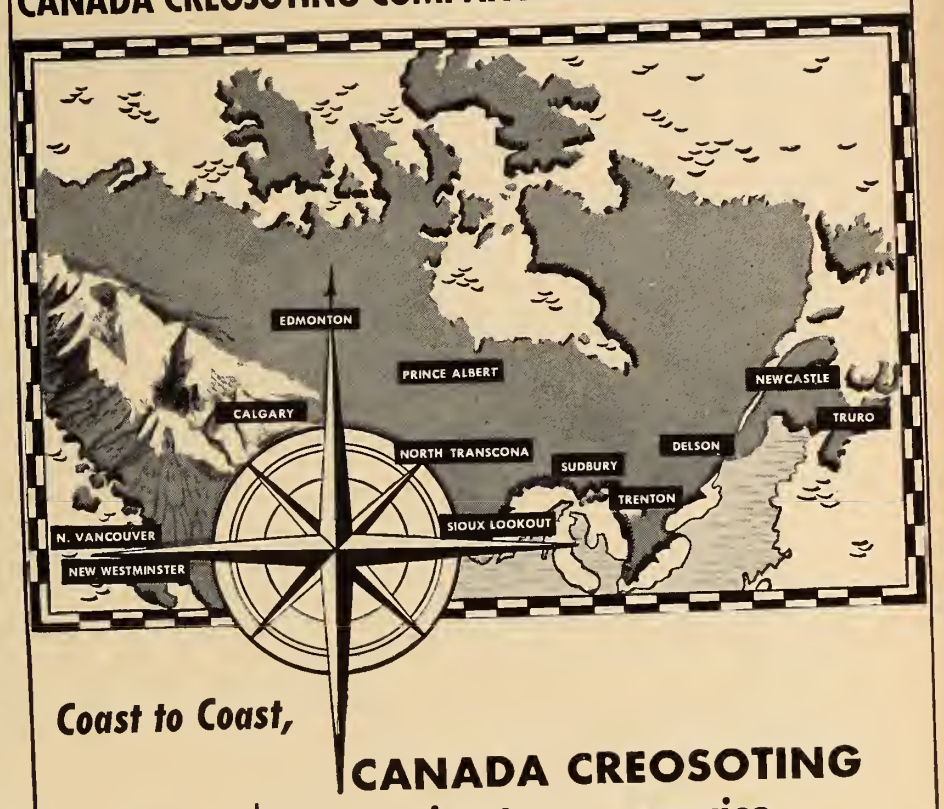

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Branch News Editor

Film Night

A film night was held on February 11 at the Hotel Chateau de Blois, Trois Rivieres. Two films entitled "Belting the Burden" and "The Way over the Mountain" were shown under the auspices of the Goodyear Rubber & Tire Company of Canada Limited.

W. P. Kieran, the company representative, in his introductory remarks preceding the showing of the films, traced the historical development of rubber and stressed the important part which this material played in the development of belt conveyors. The first film, "The Way over the Mountain" illustrated the building of an earth dam on the Boise River in Idaho and showed how belt conveyors were so necessary for the economic construction of such a dam which involved the transportation of large quantities of earth fill in mountainous areas. The other film depicted the important part which belt conveyors play in the mining of coal. A third film, somewhat more entertaining than the two featured films, showed the building of a small suspension bridge by a group of pygmies in the wilds of Africa. Mr. Kieran answered several questions concerning the operation of belt conveyors.

Mr. Kieran was introduced by L. A. Robillard of Shawinigan Falls and was thanked by A. P. Earle of Trois Rivieres.

Meeting With C.I.C.

A joint meeting with the Shawinigan Falls Section of the Chemical Institute of Canada took place on March 16, at the Cascade Inn, Shawinigan Falls. Guest speaker for the occasion was Dr. G. L. Osberg, Division of Applied Chemistry, National Research Council, Ottawa.

Dr. Osberg gave a brief review of the characteristics of a fluidized bed of solids, with particular reference to the work which had been done recently at the National Research Council. A detailed description of the pilot plant for the recovery of bitumen from the Alberta tar sands was described, together with some results showing that this process might some time be placed in commercial use.

Other projects, involving fluidization techniques, which have also been studied by Dr. Osberg and co-workers, included the drying of wheat, the calcination of pyrites, the pyrolysis of wood bark, and the synthesis of ethylene oxide. The extensive application of the fluidized solids technique to the problems outlined above illustrated the important part which this engineering tool may play in the future. Already the extensive application of this technique in the petroleum industry has indicated its extreme value.

Dr. Osberg was introduced by R. M. Kitchen of the Chemical Institute of Canada and was thanked by D. G. Demianiw of the Engineering Institute of Canada.

Dinner Meeting, April

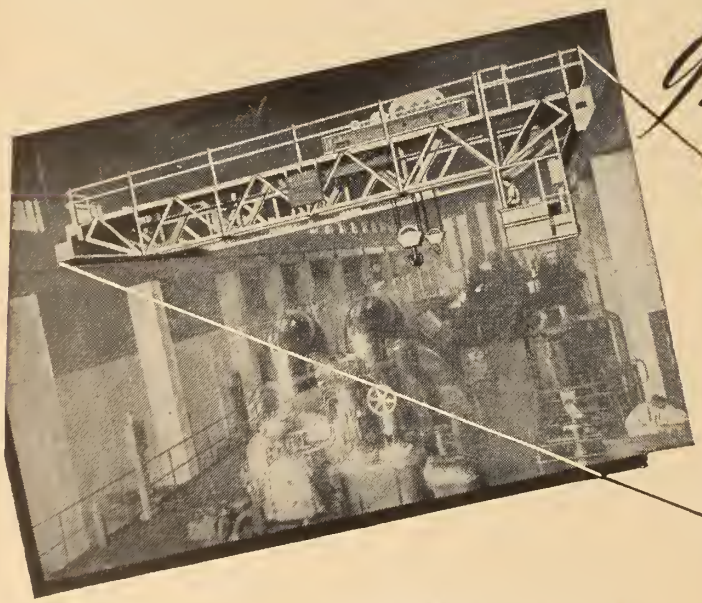
Dr. Lillian M. Gilbreth, Hon. M.E.I.C. noted consulting engineer of Montclai N.J., was the guest speaker at a mixe dinner meeting held at the Cascad Inn, Shawinigan Falls, on April 8, 195 The subject of Dr. Gilbreth's addre was "Some Current Problems Facin Engineers".

Dr. Gilbreth discussed the part whic engineers are taking in world and na tional affairs and some of the problem within the engineering profession.

In world affairs, Dr. Gilbreth state that it is the duty of the engineer t help in the production of those materia things which are needed by those peopl not so fortunate as we in the western hemisphere. It is important that th different countries share in the makin of our many needs and that these thing be made where conditions indicate eco nomical operations. The United State has attempted to improve the worl conditions by sending productivity teams overseas.

In most cases these productivity teams were usually well equipped tech nically but the importance of humar relations with these foreign groups wa found to be more important in deter mining the reception of these people to the ideas of the productivity teams It is most important to employ co operation and close team work rather than to give help in a charitable fashion.

Concerning the national sphere (U.S.A.), Dr. Gilbreth suggested that there should be more participation and appreciation. In recruiting for the military, attempts are being made to adopt a less formal attitude and to make the recruit feel that service in the



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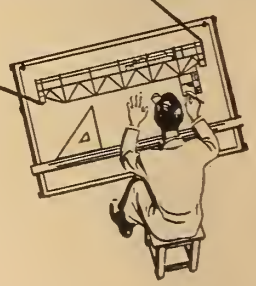

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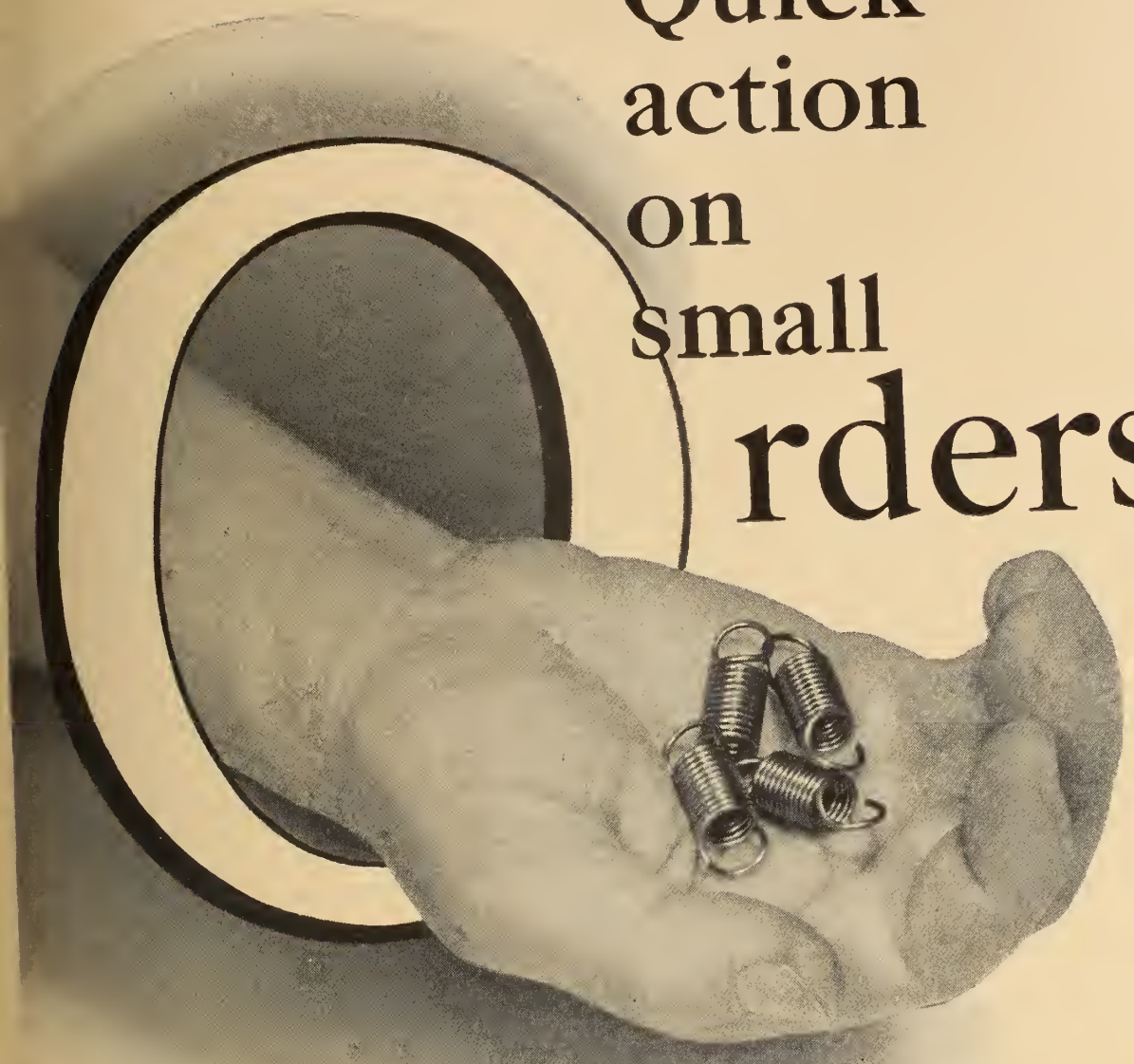

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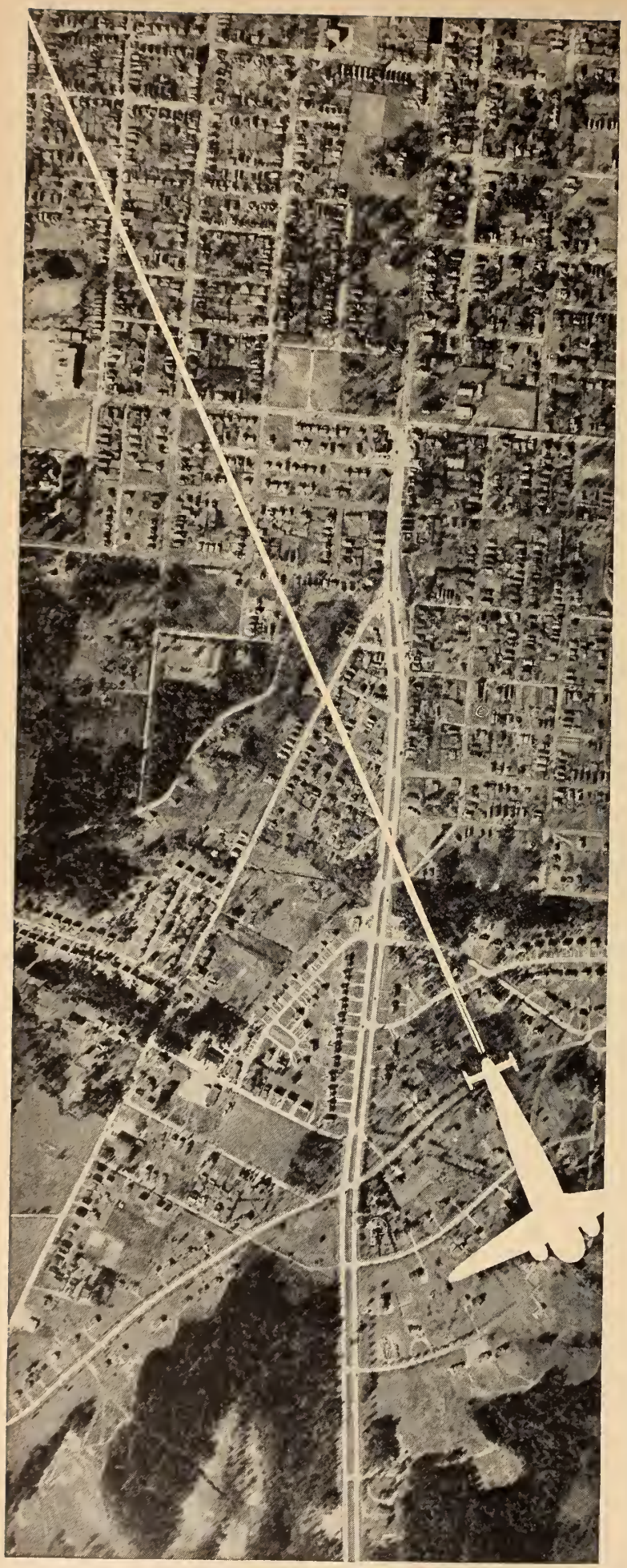

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Within the engineering profession itself, Dr. Gilbreth stated that industrial engineering was growing rapidly, again emphasizing the importance of human relations in the profession. Evidence of this was the recent organization of the American Institute of Industrial Engineers.

Another problem was the difficulty encountered by women within the engineering profession. Large industrial firms fail to recognize women engineers on the same basis as men. The greater portion of the female engineers are in the fields of aeronautical and electrical engineering. Dr. Gilbreth asked the audience to encourage and support them and to prepare them for disillusions but not discourage them by stating the many difficulties.

In her concluding remarks, Dr. Gilbreth indicated that more understanding is required in business and industry. A good example of this need for emphasis in human relations has been presented in a current novel entitled "Executive Suite" by Cameron Hawley. She also recommended that the business periodical "Factory" be required reading for those who desire to obtain a more complete understanding of the problems in human relations.

Dr. Gilbreth was introduced to the audience by D. E. Covey, branch chairman, and was thanked by E. R. McMullen of Trois Rivieres. Approximately 200 people were in attendance.

Prior to the meeting Dr. Gilbreth was invited by Mayor Francois Roy of the city of Shawinigan Falls to sign the city's golden book.

Shawinigan Falls Junior Section

Lecture Meeting

"Centrifugal Pumps, Theory, Selection, Installation, and Maintenance" was the subject of an illustrated lecture by Mr. W. G. Mayberry of the Canadian Allis-Chalmers Limited.

The lecture, consisting of a series of slides together with a recorded commentary, was the basis for a training program for employees of the Allis-Chalmers Corp. The presentation was excellent, as evidenced by the extreme interest shown by the audience during the question period.

Mr. Mayberry was introduced by W. G. Brooks of the Shawinigan Water and Power Company and was thanked by W. Odinotski of the Shawinigan Chemicals Limited. The speaker distributed booklets containing copies of all the slides that had been shown.

Trois Rivieres Junior Section

November Meeting — Plant Visit

The plant of the Aluminum Rolling Mills Limited, situated at Cap de la Madeleine, was visited on November 26, 1952. Mr. Pape, manager, welcomed the members and gave a brief outline of the products manufactured and the various processes involved. Mr. J. Korcz, prior to the tour, described in more detail the general layout of the buildings and the associated processes.

February Meeting

A film night was held at the Club Touristique on February 4, 1953 when two films entitled "Pheasant Island" and "Adventure Perilous" were shown. The first film illustrated the preservation and restricted hunting of pheasants on Pelee Island while the second described the life and habitat of the comparatively rare woodland caribou.

The films were made available through the courtesy of R. J. Clark of the St. Maurice Valley Chronicle, Trois Rivieres.

March Meeting — Plant Visit

On March 11, 1953, the local plant of the Canadian Westinghouse Company was visited. Mr. A. LeWarne briefed the members on the products manufactured in the plant and the various processes. The members were most impressed by the number and complexity of the processes involved in the manufacture of an ordinary light bulb.

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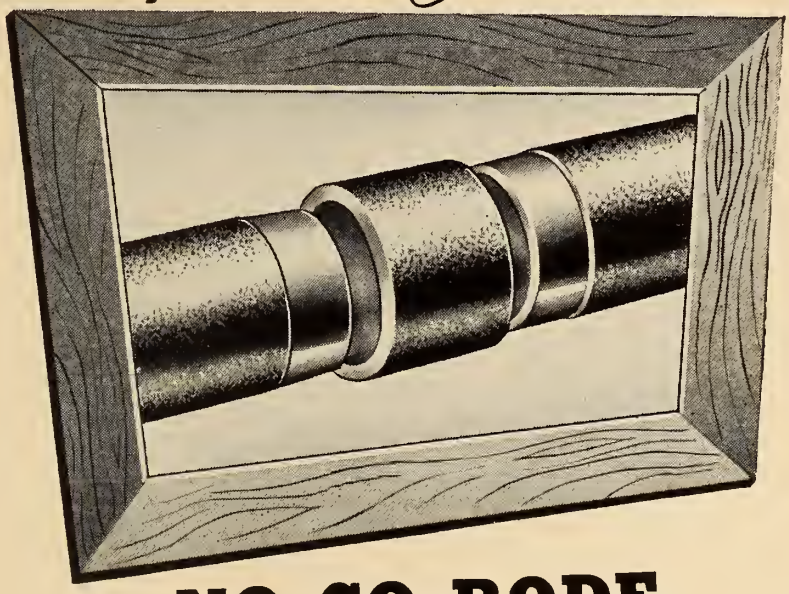

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Sudbury

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Branch News Editor

Annual Meeting and Dinner Dance

The Sudbury Branch of the Institute held its annual general meeting and dinner-dance at The Sudbury Granite Club on Friday, May 8, 1953.

Following dinner Bert. Cooper delighted the members and their guests with selections on the xylophone. Mr. Cooper was accompanied at the piano by Ed. Saville.

W. F. Miller the branch chairman. gave a short address on the objectives of the Engineering Institute. This was followed by reports from various committee chairmen. Alastair Finlayson the membership and attendance chairman stated that the new card system by which members were notified of the coming meetings had turned out very satisfactorily, and it would be well worth while to continue with this method.

John Quance spoke briefly on papers and publicity, mentioning the many interesting speakers that the members had had the pleasure of hearing in the last few months. Lennox Lane outlined the educational program, with particular emphasis on the benefits derived from the public speaking course which had been inaugurated this year.

George Green the entertainment committee chairman was unable to attend. The financial report was given by secretary-treasurer George Fleming, who stated that the Sudbury Branch was financially sound and the books were in good order.

The election of branch officers then took place, and the incoming members were: W. J. Ripley, chairman; F. A. Orange, vice-chairman; J. E. Quance and L. T. Lane, resident committeemen; the non-resident committee man is J. F. McCallum of Espanola.

W. F. Miller thanked the committee chairmen, their committee members and the other members for the splendid co-operation which had helped to make the past season a very pleasant and successful one. Mr. Miller then turned the meeting over to the incoming Chairman, Mr. W. J Ripley who said a few words about the coming 1953-54 season.

The meeting was then adjourned, and shortly after dancing was enjoyed to the music of the St. Onge orchestra.

Toronto

H. M. Kolesar, Jr.E.I.C.
Secretary-Treasurer

E. R. Davis, M.E.I.C.
Branch News Editor

Joint Meeting With I.A.S.

J. T. Dyment, Director of Engineering, Trans-Canada Airlines, spoke on March 19, 1953, to a joint meeting of the Branch with the Institute of the Aeronautical Sciences. Speaking on a broad and complex subject, Current Trends in Design of Airline Transports, Mr. Dyment presented his information in clear and concise form, conveying to his audience a new understanding of the probable course of development in this interesting field.

Mr. Dyment told the gathering that in spite of the phenomenal pace of development in the last ten years, which marked the beginning of the turbine era, and the greatest advances of any similar period since the first flight fifty years ago, the airplane designers and the airliners have not sacrificed any efforts towards continuous improvements for safety. Last year's safety standard achieved by the scheduled domestic airlines exceeds even the record established in rail travel in previous years, although, to be fair, the railways are expected to surpass all previous records when the 1952 figures are complete, and remain ahead of air for the present.

The fantastic progress in aviation today is due to the great numbers of people engaged directly or indirectly in the industry — hundreds of thousands, including over 6000 on pure research alone in the U.S.A., with $100,000,000 worth of equipment at their disposal.

Speeds, weights, costs, and complexities (the latter particularly in military development) — are increasing at astronomical rates. Civil development costs have not risen in proportion, but the development of a new medium sized airplane, by an experienced manufacturer of successful civil transports, now involves an outlay of 25 to 30 million dollars, a development cost which would take the sale of the first 300 airplanes to break even. This explains why manufacturers can no longer undertake, unassisted, the task of developing new airplanes.

This explains also the pressure for acceptance of new features and improvements which may, until fully developed, compromise some essential characteristic by which past standards have been maintained. The essential compromise in design is illustrated by the need for improved aerodynamic shape, reduced drag, to take advantage of the characteristics of the new types of power available, as against for retaining the slow speed characteristics of existing airplanes required for safetv in landing and takeoff, the limitations of the human element being the same as before.

Some sacrifice in the ultimate performance must be made by the designer, to provide an airplane that can be flown and handled safely by the average pilot, not just by the manufacturer's test pilot.

Consideration of safety above everything else demands a conservative outlook, and accounts for the long time lag between advances in military design and their application to civil transports.

New types entering service now or in the immediate future are: the Convair 340 and Martin 404, in the twin-engine class; Douglas DC-7 and Lockheed Super-Constellation, powered with the new Wright turbo-compound engines, probably the last of the big reciprocating powered transports.

New British types, Vickers Viscount, DeHavilland Comet, and Bristol Britannia, will outclass anything in their respective fields, from a performance standpoint, although they will no achieve anything like the economy o their American counterparts for thei first two or three years of service. Th new American types, being direc descendants of successful types, hav the advantage of a tremendous back ground of operating experience and re finement.

A comparison of power plant type and performance indicates the factor which will govern the course of airplane development. Table I.

While turbo-jet power offers tremendous possibilities for high speed operation, its inherent limitations make it inefficient when operated outside an extremely narrow range of conditions, and will require another few years development to bring it to the performance and versatility of present-day turbine-propellor power.

Design requirements for airline service differ according to the range of distances between station stops on a route, as follows:

Distances Up To 200 Miles

This type of operation represents the service used by about 28 percent of passengers carried by U.S. airlines last year. The present DC-3 is still by far the most suitable and economical airplane for this type of service, and will remain so for another 5 to 7 years. At the end of that time. a simple, pressurized airplane seating 30 to 35 passengers, with reciprocating power, or a development of the helicopter may replace the DC-3.

Ultimately it is predicted that fixed-wing designs with boundary layer control, or capable of hovering by jet reaction only, will provide the features now possessed only by helicopters.

Distances 200 To 500 Miles

This range, popularly termed the "short haul", includes services used by 66 percent of air travellers in the U.S.A The Convair 340 will dominate this field in the U.S.A. for the next five to ten years, pending development of satisfactory turbo-propellor designs or corresponding size.

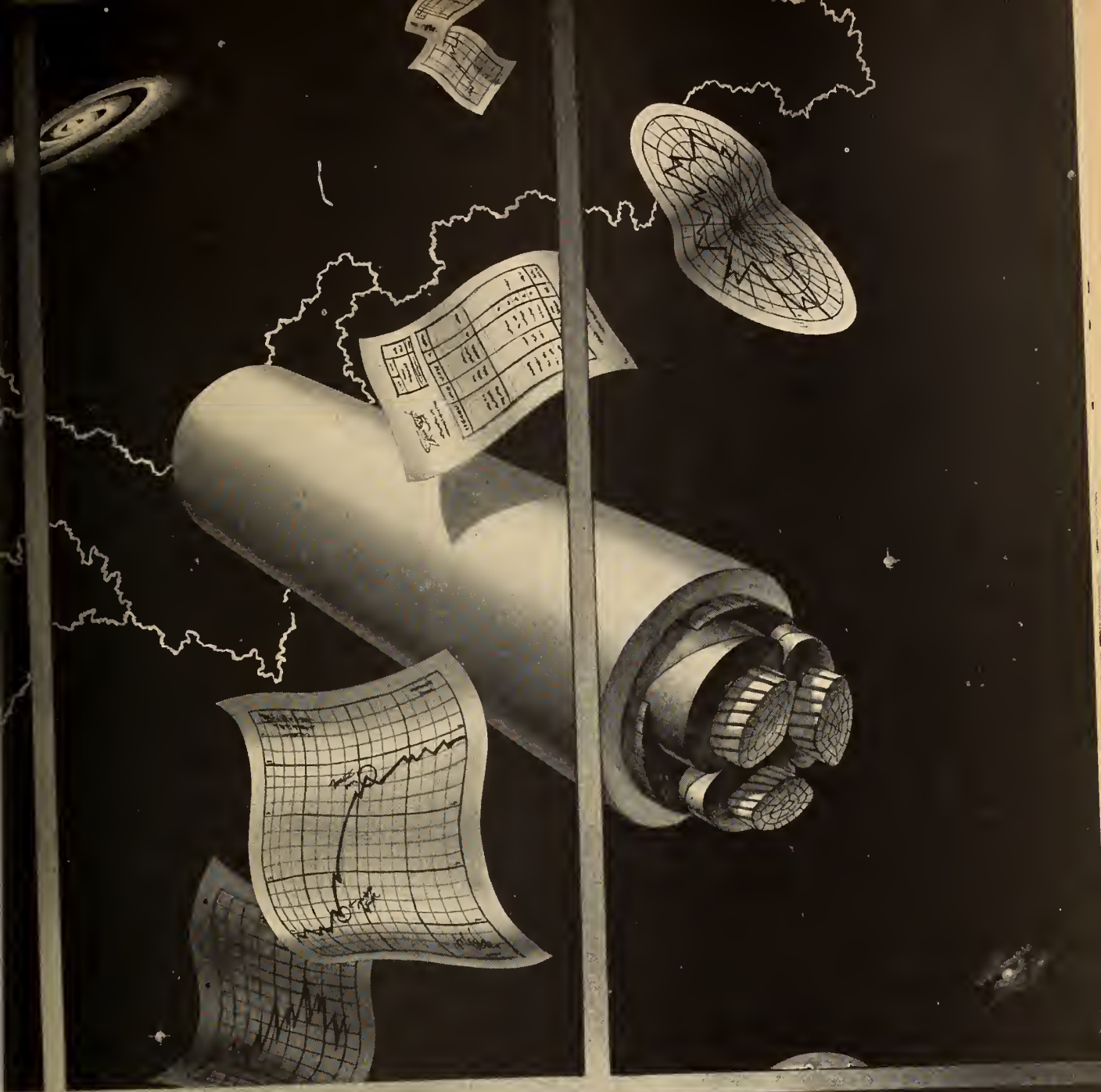
In Europe, and in Canada, this type of service will be taken over by the Vickers Viscount, a four-engine turbo-propellor type airplane, of which fifteen are now on order for TCA.

Distances 500 To 1,500 Miles

This represents the long haul domestic services, transcontinental services with one or two stops only with suitable aircraft. The present types, Constellation, DC-6B, and North Star, will probably continue in this service for another ten years, giving way to the Super-Constellation, the DC-7, and on a few services to the Comet. Extensive use of turbo-jets is considered unlikely before 1960.

Table I

Type	*Classification*	*Specific Fuel Consumption*
Reciprocating	Conventional	0.43 to 0.48 lb./b.h.p.hr.
	Turbo-compound	0.41 to 0.43 lb./b.h.p.hr.
	Compr. ign. (Napier)	0.36 lb./b.h.p.hr.
Turbo-propellor		0.5 to 0.65 lb./b.h.p.hr.
Turbo-jet	Centrifugal	1.1 to 1.5 lb./hr./lb. thrust
	Single spoon axial	0.85 to 0.95 lb./hr./lb. thrust
	Two-spool axial	0.74 lb./hr./lb. thrust
	By-pass axial	0.5 lb./hr./lb. thrust



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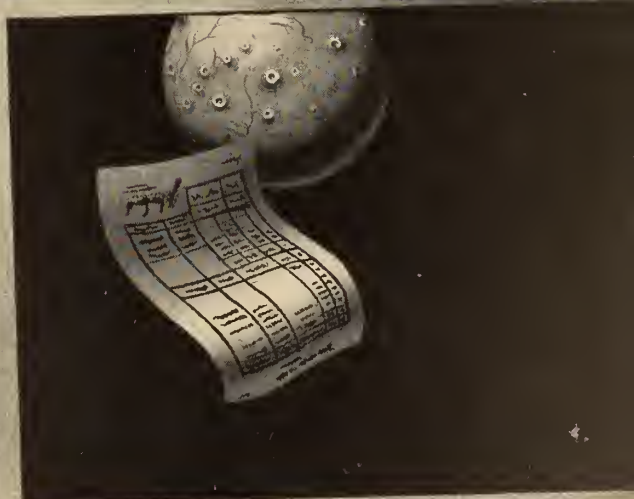

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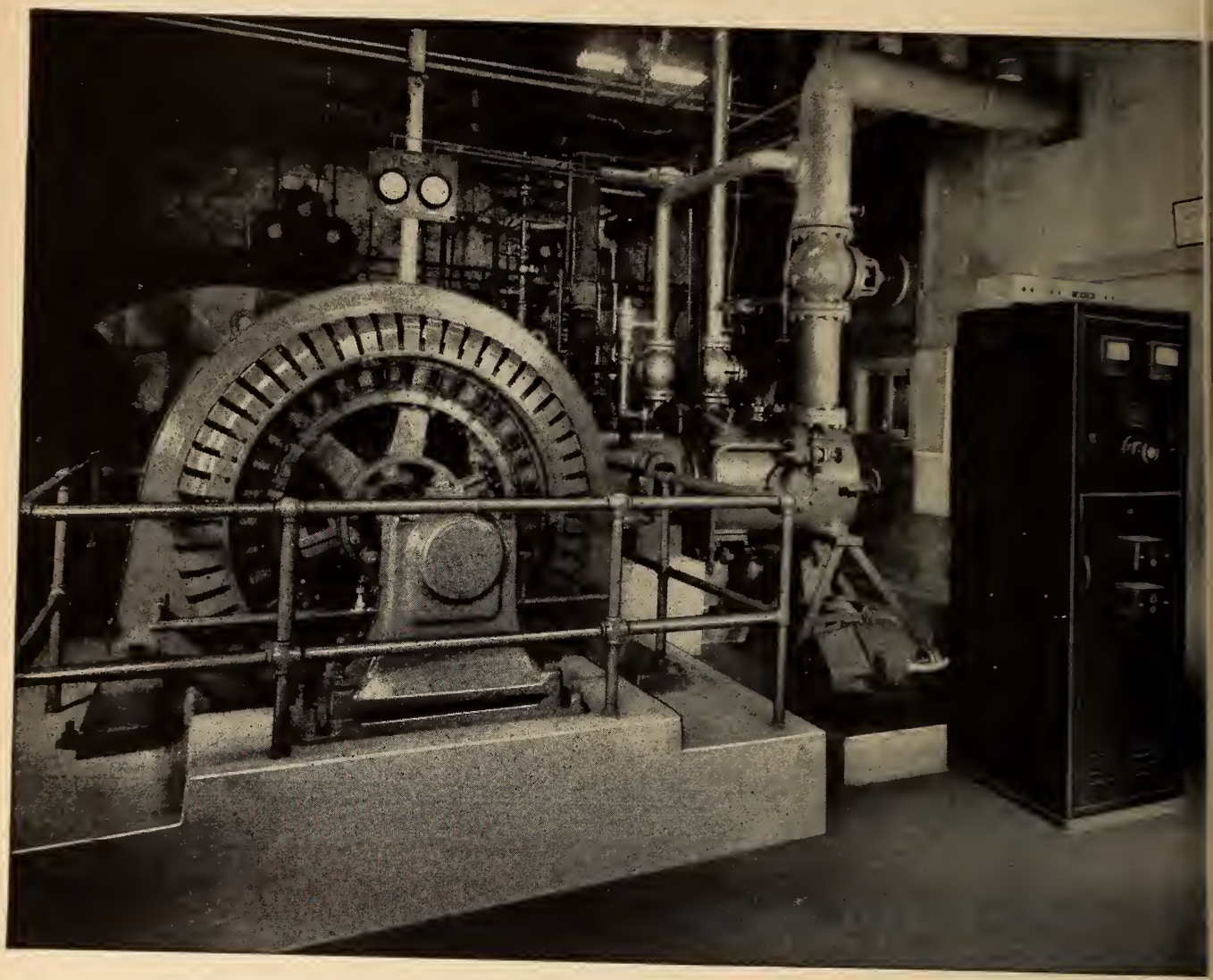

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Table II

	Super-Constellation	*Britannia*	*Comet*
Payload, lbs.	21,680	20,830	8,960
Fuel consumption, lbs.	11,030	19,420	20,610
Fuel reserve, lbs.	5,840	9,430	14,510
Block speed, m.p.h.	246	289	337

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Trans-oceanic services present much the same picture as long haul domestic, except that the use of the Bristol Britannia turbo-prop airplane may bring about the appearance of turbine-propellor versions of the Super-Constellation and DC-7, which would delay the adoption of turbo-jets.

Some of the differences and limitations of turbo-jet airplanes are strikingly illustrated in the following comparative table of performance of various types on a flight from Toronto to Winnipeg with Regina alternate. Table II.

Because of high fuel consumption, and relatively low efficiency at low altitudes, turbo-jet airplanes must be operated at the highest altitudes possible. From the practical operating standpoint, the climb to top altitude from the initial cruising altitude must be done in steps to maintain safe vertical intervals with respect to other traffic. In marginal weather conditions, present standards of completion cannot be maintained with turbo-jet airplanes unless sufficient fuel is carried to permit a descent down to the prescribed limits, and return to a suitable altitude if necessary to proceed to the alternate airport; otherwise diversion from altitude would be necessary in marginal cases. It is interesting to note that a margin of 135 m.p.h. cruising speed in favour of the turbo-jet airplane is reduced to a difference of only 48 m.p.h. in terms of block speed.

The future of turbo-jet power in airline service will depend on the achievement of practical solutions to many basic problems: better approach, landing and take-off characteristics; automatic unloading of structures encountering gusts at high speed; reduction of noise; reduction of fuel consumption and of sensitivity to changing flight and atmospheric conditions. In this field the Comet is pioneering an entirely new concept of air transportation, and everyone owes a debt of gratitude to the British Government, the DeHavilland Company, and B.O.A.C., for their contribution to progress.

Vancouver Island

P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer

Ronald D. Dyson, Jr.E.I.C.,
Branch News Editor

Three April Meetings

April proved to be a very full month for the Vancouver Island Branch of the E.I.C., with the regular monthly meeting being augmented by a dinner meeting on the occasion of Colonel L. F. Grant's visit to Victoria and also a field trip to Messrs. Yarrow's Shipyard.

On April 14 some 40 members attended a dinner meeting at the Oak Bay Hotel in honour of Colonel L. F. Grant, field secretary of the Institute, on his annual visit to Victoria. In his address, Colonel Grant very ably acquainted the members with the activities of the other branches of the Institute and with possible future developments.

Twenty-five members were present for a very interesting and enlightening conducted tour of Messrs. Yarrows Shipyards at Esquimalt. The chief source of interest in this tour lay in the construction of the aluminum towers which will carry the transmission lines through the mountain passes between Kemano and Kitimat.

The regular monthly joint meeting of the Vancouver Island branches of the E.I.C. and B.C. Engineering Society took place April 14th. The Guest speaker for the occasion was A. B. Sanderson,

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assistant bridge engineer, Department of Public Works of B.C. He spoke on "The Construction of the First Prestressed Bridge in Canada". This bridge was built at Mosquito Creek, Vancouver, and proved that there is definitely a future for this type of bridge. The bridge in question had a 60 ft. span and carried four traffic lanes and two side walks. Both economically and structurally the bridge was a success.

This photograph, taken at the annual meeting of the Vancouver Branch, on April 17, shows (left to right) Dr. D. B. Turner, the guest speaker, E. L. Hartley, Branch chairman, and W. O. Richmond, the vice-chairman.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

April Meeting

At the regular meeting of the Winnipeg Branch, held on April 23, members were privileged to hear an address by J. G. Somers, provincial forester for the Province of Manitoba. Chairman of the meeting, which was held in the Manitoba Government Building on Broadway Avenue, was Maj. J. L. Charles.

Mr. Somers began his paper, titled "Forestry in Manitoba", with a brief background picture of the importance to Canada's national economy of her forests, which occupy 1/3 of the total land area of the country. A glance at the external trade situation showed that of the commodities registering favourable trade balances in 1951, over half the total balance was accounted for by wood and paper products, clearly indicating the importance of forest industries to Canada.

With the national background sketched in, Mr. Somers proceeded to give the meeting a close-up of the forestry picture in Manitoba, whose forests, while being by no means of the size and importance of those in Ontario and British Columbia, nevertheless accounted for a production of $26 million in 1952. While Manitoba's productive forests occupy an

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area approximately equal to its agricultural area, only part of this forest area is presently economically accessible. However, the accessible area has increased greatly in the past ten years, and the increase is continuing, as more roads are constructed, and as more efficient logging and transportation equipment is developed.

Mr. Somers then went on to describe the work of the Forest Service, a branch of the Manitoba Department of Mines and Natural Resources. Defining forestry as "an art, a science, a business, and a public policy capable of, and occupied with, the continuous production and management of forests, and their promotion for the beneficial use of mankind", led to essentials of successful forest practice: permanent forest boundaries, and adequate forest protection.

In the matter of permanent forest boundaries, soil and land classification surveys which have been carried out by the Manitoba government, have led to the setting aside of Forest Reserves, of which there are at present seven in Manitoba, with three more proposed for possible setting up this summer. In the matter of forest protection, while insects are a problem, the greatest forest menace is fire, and protection against fire is one of the Forest Service's important works. Mr. Somers described the methods of detection and suppression, and mentioned some new developments in the field of suppression—such as water bombing with paper bags full of water, and the dropping of equipment from aircraft.

The ultimate aim of forestry, as pointed out by the speaker, is forest management to produce a sustained yield—involving four fundamental principles: forest protection, maintaining a productive state of the land, balancing harvest against productive ability, and improving quality and quantity. To achieve the ultimate objective of sustained yield forest management, the Canadian government assists in: the taking of forest inventories; the problem of artificial reforestation to replace cut timber; forestry, entomological and forest pathology research.

In conclusion, Mr. Somers stated that, although Manitoba's forests were not as large as those of some of the other provinces, no aim short of sustained yield forest management should be entertained in Manitoba, and the practice of silviculture was doing much to achieve this aim.

In the question period following the talk, the discussion indicated the interest which Mr. Somers' paper had aroused on a subject, which, while not being of a strictly engineering nature, nevertheless is of importance to every engineer.

Civil Section

N. S. BUBBIS, M.E.I.C.
Chairman

Civil Section Organized

A new section of the Winnipeg Branch of the Institute was organized in February 1953. It is intended that the new Civil Section will hold monthly meetings, with the exception of the summer months.

At a meeting on March 12, Professor C. Hovey of the University of Manitoba gave an address on the subject "Behaviour of Structural Steel in Service". At the second meeting on April 9, Philippe A. Benn, general manager of Precompressed Concrete Engineering Co. Ltd., Montreal, spoke on "Prestressed Concrete and its Application in Canada".

A visit to the Canada Cement Company's plant at Fort Whyte, Man., was planned for Tuesday, May 19, with the program rounded out by a talk on the use of admixtures and special cements by D. O. Robinson, chief engineer of the Canada Cement Company.

There has been a good support of the meetings, both of which were excellent, with attendance at each of about 100. The interest in the papers was great, and active question and discussion periods followed.

The executive of the Section is as follows: chairman, N. S. Bubbis; vice-chairman, W. B. White; executive members, W. L. Wardrop; papers committee chairman, A. F. Thomson; executive delegate to section, J. C. Trueman; executive member appointed, H. Brekke; section secretary, E. H. Martin; membership committee chairman, S. J. Borgford; section reporter, Keith Ebbern; trips and visits, Angus Laughlin.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Prestressed concrete. Kurt Billig. Toronto, Macmillan, 1952. 470 pp., $6.85.

With the rapidly increasing use of prestressed concrete, it seems strange that up until now there has not been a general textbook on the subject.

"Prestressed concrete is a development of reinforced concrete and shows improvements in all characteristics to such a degree that it may be regarded as a new material. It is highly elastic, performs well as a load-carrying structure, has small dead weight, and saves up to eighty-five per cent in the weight of the steel as compared with re-inforced concrete".

A study of European engineering structures will show great strides in its use, particularly in France, Belgium, Great Britain and Germany. In these countries, pre-stressed concrete has been used for the construction of bridges, large girders, floor-beams, shell roofs, hydraulic structures, trussed girders, masts, railway sleepers, piles, pipes and frame buildings, to mention only some of the newest developments.

General division of the book is in three parts; part one, general data and fundamentals, specifications, processes, types of structures, plants required, and some typical examples. Part two. entitled Design of prestressed concrete structures, includes: notations, loading stages, losses in prestress, bond and end anchorages, diagonal tension, etc.

Design problems is the title of part three, and it includes eccentrically prestressed I-joists and box girders; uniformly precompressed joists; a girder bridge and a slab bridge; a Vierendeel transmission pole; a radio pole; a radio tower; shell roofs; an aeroplane runway and highway; compound-reinforcement; a railway tie; a pressure pipe; and a fluid storage tank.

Extensive bibliographies accompany each chapter, which include patents from all countries.

The Appendix is "A draft code of practice for prestressed concrete", which also includes bibliographical references.

It seems incredible that a book of this type published by one of the world's most reputable publishing houses should be without an index, but such is the case.

Although this seriously detracts from the value of the book, the arrangement and presentation of the information is otherwise excellent.—E.K.

BOOK NOTES

Prepared by the Library

The Engineering Institute of Canada

The agricultural tractor. P. H. Southwell. London, Temple press, 1953. 169 pp., illus., 15/-.

Although a British publication, this book deals with the principles underlying the design of agricultural tractors rather than with individual makes and will be valuable to engineers in this country. There are separate chapters devoted to the various components of the tractor—the engine, the transmission system and the ground drive. The author also deals with fuels, oils, steering systems and accessories, including mounted implement control. The final chapters cover the economic utilization and efficient operation of agricultural tractors, with reference also to the present position and future developments in design. The book has a detailed index and numerous illustrations.

Architectural graphics. C. L. Martin. Toronto, Macmillan, c1952. 213 pp., illus., $4.00.

Written for students in architectural courses, this book will be of interest to designers and draftsmen also. The whole subject of architectural drafting methods is covered, beginning with multi-view orthographic drawing. The three parallel line types of pictorial drawing, isometric, dimetric, and oblique, and their shadows are treated, as well as exploded drawings. Perspective drawing and shades and shadows constitute the major portion of this book. In each case the characteristics of the type of drawing and the principles used are explained, followed by simple examples. Several examples of professional architectural graphics are given in the last chapter, which serve to illustrate the foregoing text. The book is well indexed.

Britain's railway liveries; colours, crests and linings, 1825-1948. E. F. Carter. London, Burke; Toronto, Saunders, 1952. 360 pp., illus., 36s.

This will be the standard reference work for modellers and other enthusiasts to the linings, lettering, colours, crests, heraldic devices and identification of the railways of the United Kingdom, from the first steam passenger railway in the world until railway rolling stock lost its distinctive identification under Nationalism. It lists alphabetically, within broad sections entitled "Pre-group liveries, 1825-1922" and "Group liveries, 1923-1948" over one hundred companies, tracing their history and development as the successive changes of their colours are recorded chronologically. These include famous museum pieces, minor railways and Irish railways. Appendices include a classified list of colour plates and a list of initials borne by pre-group rolling stock and wagon-sheets. Colours in the plates have been keyed to a specially composed colour chart, matched with the actual rolling stock. In addition to these colour plates there are twenty pages of diagrams, line drawings, linings, crests, and photographs.

Le calcul des tuyaux en béton armé et non armé. A. Guerrin and G. Daniel. Paris, Eyrolles, 1952. 316 pp., illus. 3300 fr.

The first of two volumes on concrete pipes, this deals with the design and calculation problems connected with these pipes, either reinforced or not. The theory of soil mechanics, as applied to the pressures exerted on pipes, is part of the basis of the computations which the author have worked out. Other chapters are devoted to internal pressures and moments and computations in regard to cracking and breaking of pipes are given. The last chapter covers calculations of special types of concrete pipes—e.g. ringed pipes and those egg-shaped, oval or elliptical

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The text is profusely supplemented with formulae and diagrams, and the table of contents at the end of the book serves as an index.

Electronic engineering principles, 2nd ed. J. D. Ryder. New York, Prentice-Hall, c1952. 505 pp., illus., $9.00 (U.S.).

The author states that he is here endeavouring to supply the physical fundamentals needed for an understanding of basic electronics. The circuit concept of electronic tubes has been stressed, but only after consideration of the physical and nonlinear limitations of the devices. Thus the use of calculus and a-c. circuit analysis becomes a desirable prerequisite to study in the electronic area, and the author presupposes some knowledge of these subjects on the part of the reader. In separate chapters he describes such fundamentals of electronics as the movement of charged particles in fields, the cathode-ray tube, emission of electrons, space charge in vacuum tubes, the vacuum triode, a general treatment of amplifiers and feedback, gas diodes, photoelectric cells, solid-state devices and the transistor. Problems, illustrations and references are found in each chapter, and the book is fully indexed.

Fatigue and fracture of metals. W. M. Murray, ed. New York, Wiley, c1952. 313 pp., illus., $7.20.

In this symposium of fourteen papers the problem of metal fatigue is considered in both its theoretical and applied aspects. Three papers consider brittle fatigue and fracture in airplane structures, in ships and in machinery. Other experts discuss the internal mechanisms probably involved in fatigue damage, the significance of various metallurgical phenomena to fatigue (transition temperature and crystal variation of metals, for example), and the value of different research methods to disclose more about the mechanism behind the phenomenon itself. The success of designing to counteract metal fatigue is also covered. There is no index but illustrations are fairly numerous and most chapters close with a comprehensive list of references.

The high-speed internal-combustion engine, 4th ed. H. R. Ricardo. London, Blackie & son, 1953. 420 pp., diagrs., 40/-.

The writer does not claim to have covered a wide field of this extensive subject but has rather concerned himself with general trends and principles. Much of the material presented stems from the research and experiments carried out in the author's own laboratories, dealing with such subjects as cylinder wear, piston aero-engines, sleeve-valve engines, and two-stroke sleeve-valve engines. He goes into some detail in the chapters on ironmongery, attempting to "bridge the gap between the scientist and the practical engineer". He makes no attempt, however, to discuss the gas-turbine. The book is well illustrated, with several folded diagrams of engines, and is indexed.

High-speed photography, its principles and applications. G. A. Jones. London, Chapman, Toronto, British book service, 1952. 311 pp., illus., $8.50.

Although not highly detailed, this book will interest the so-called "photographic engineers", those engaged in scientific or industrial research and technicians interested in modern methods of machine performance analysis. The author outlines the fundamentals, the current practice and the scope of high-speed photography. The various chapters deal with photographic materials, types of cameras, and a wide range of scientific, industrial and commercial applications of this kind of photography. A large number of interesting illustrations add to the value of the text, and extensive references, both in English and in other languages, are an important feature. An index of names and a detailed general index complete the book.

A history of civil engineering. Hans Straub. London, Leonard Hill, 1952. 258 pp., illus., 25/-.

How modern construction technique and present-day civil engineering have gradually developed is the subject of this book. With many interesting photographic illustrations, it is written for both the engineer and the layman, with the emphasis on the close relationship between civil engineering proper and other spheres of cultural history. The development of the theories of statics and of the strength of materials is sketched in broad outline and theoretical mechanics are barely mentioned. Biographies are included of those men who have made the greatest contribution to the development of civil engineering. The chapters are arranged chronologically, followed by a table of important scientific works and great scientists and engineers from the 15th to the 19th centuries. A selected bibliography and three indices, covering personal and place names, are found at the end of the book.

Industrial science — present and future. A. T. Bonnell, comp., R. C. Christman, ed. Washington, American association for the advancement of science, c1952. 152 pp. (pa.). $2.00 (U.S.).

This collection of papers attempts to correlate the scientific research carried out in laboratories and universities with its practical application in industry. The five leading industries treated are petroleum, steel, communications, chemical and pharmaceutical. The future of industrial science is discussed from the viewpoints of the consultant, the educator, the research institute and the government. The closing four papers deal with such public aspects of industrial science as its contributions to scientific education and community health. The lack of an index does not seriously impair the value of this symposium.

Interim rules for the evaluation of restriking voltage severity. Association of short-circuit testing authorities. London, The association, 1952. 16 pp., diagrs., 5/-.

These Interim rules were drawn up to meet the difficulty arising when it is necessary to compare the severity of circuits that produce restriking-voltage transients having widely different waveforms. They provide a means whereby comparison may be made on a uniform basis during the testing of circuit-breakers in ASTA stations. The definitions used conform to the appropriate British standards. Several figures and formulae illustrate the rules.

Marine refrigeration. R. Munton. London, Modern refrigeration, 1952. 90 pp., diagrs., 7s. 6d.

This short but comprehensive monograph deals first with general problems of refrigerating food shipments, dividing these into live and dead produce. The theory of thermal insulation is summarized, followed by a description of refrigerating machinery and refrigerants, and methods of cooling the cargo chambers. Other details of marine refrigeration — cleanliness, atmosphere control, stowage and carriage, and the heat loading of refrigerating plant — are also covered. The book contains a number of diagrams and bibliography, but no index.

Pneumatic tyre design. E. C. Woods. London, Institution of the rubber industry, 1952. 96 pp., illus., 21/-.

The author begins with the factors affecting the design of tires, such as the many types and sizes which are used in this modern age, then goes on to chapters discussing tread and mould design. Cord angles and other constructional details such as fabric stretch, casing strength, stability and cushioning constitute a chapter. After the broad principles of design have been described the author proceeds to details of the tire section, i.e. ply widths, building drum widths, etc., illustrating his text with drawings and formulae. Further calculations and tables are found at the end of the book, as well as a bibliography and index.

Polarized light in metallography. G. K. T. Conn and F. J. Bradshaw, eds. Toronto, Butterworth, 1952. 130 pp., illus., $3.80.

A new development in reflection microscopy, of great value to practising metallurgists, is the subject of this book. The theory of polarized light, reflection and absorption is considered in some detail, with particular attention to microscopic studies. Experimental methods and the instruments required are discussed, followed by a survey of past work in the field and of the conclusions reached in the study of metals and alloys. The final chapters consider the topics of inclusions and of ores and slags, with a closing survey of what the technique has achieved. The book is illustrated and well indexed and contains bibliographical references and a glossary of optical terms.

Problems in hydraulics. R. S. Paradise. Glasgow, Blackie and son, 1953. 342 pp., illus., 17/6.

The chapter headings in this volume correspond to most of the important elements of hydraulic engineering, e.g. hydrodynamics, flow in channels and in pipes, impact of jets, pumping machinery and dimensional and model analysis. The brief introduction to each chapter is merely a resume of the principles and formulae required to solve the examples which follow. Of the 449 problems, 126 are completely solved; the answers to the remainder, or the skeleton solutions, appear at the end of the book.

Radio and television workshop manual. S. A. Dimond and D. M. Anderson. New York, Prentice, 1952. 301 pp., illus., $4.50 (U.S.).

This workshop manual will appeal to those interested in producing radio and television plays as a vocation or as an avocation. It is not a technical book, but deals with voice and "mike" technique, uses of sound and music, auditions, production analysis of scripts, script writing and narration. The writing of radio commercials and news is covered, and practice scripts are given for both audio and visual presentation of plays. There is a short bibliography and an index.

Recurrent electrical transients. L. W. Von Terach and A. W. Swago, New York, Prentice-Hall, 1953. 399 pp., figs., $10.35 (U.S.).

This textbook is intended primarily to teach a technique of analysis while describing representative types of circuits in which the steady-state waveform may be considered as a series of recurring transients. The analysis stresses the time-

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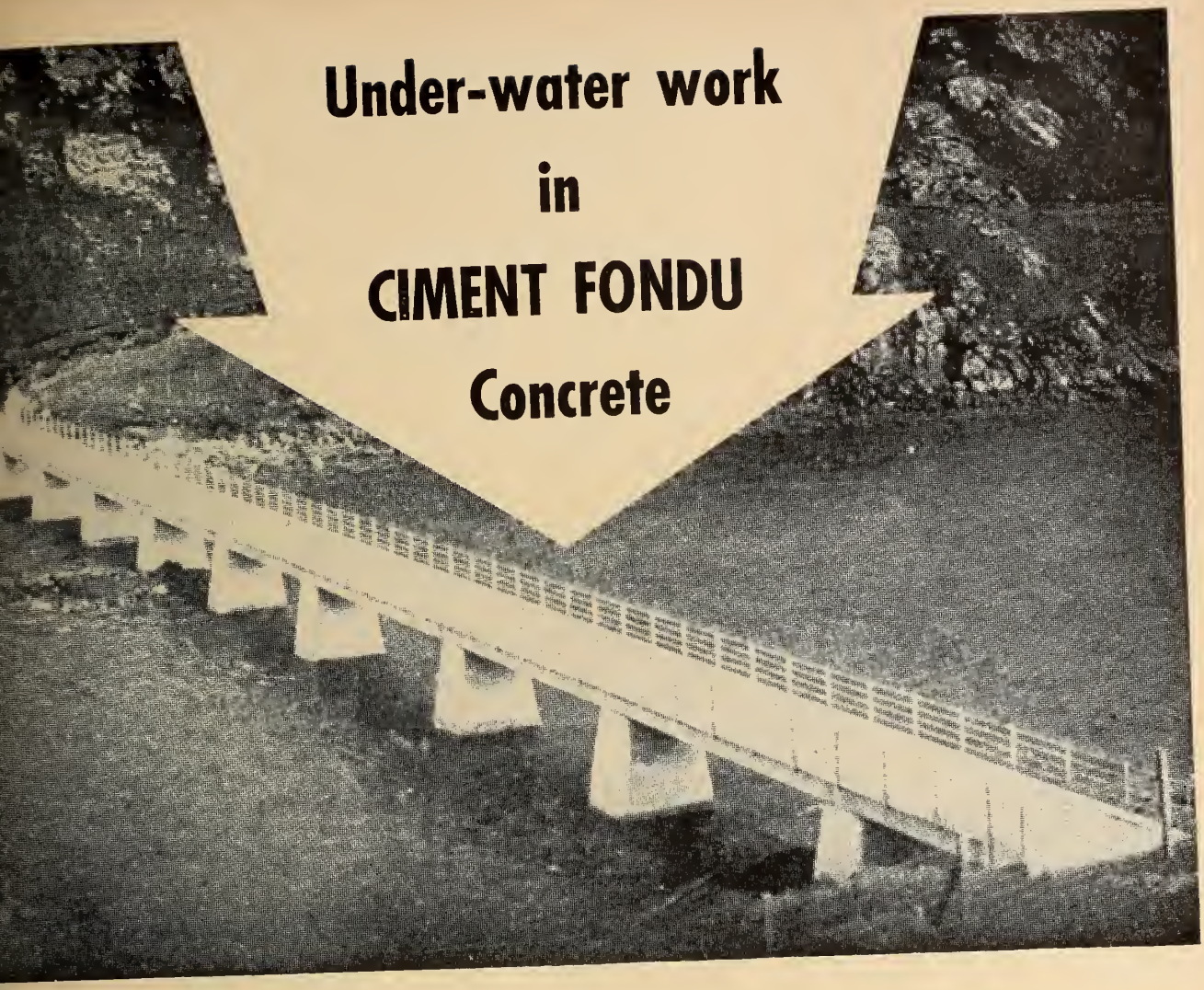

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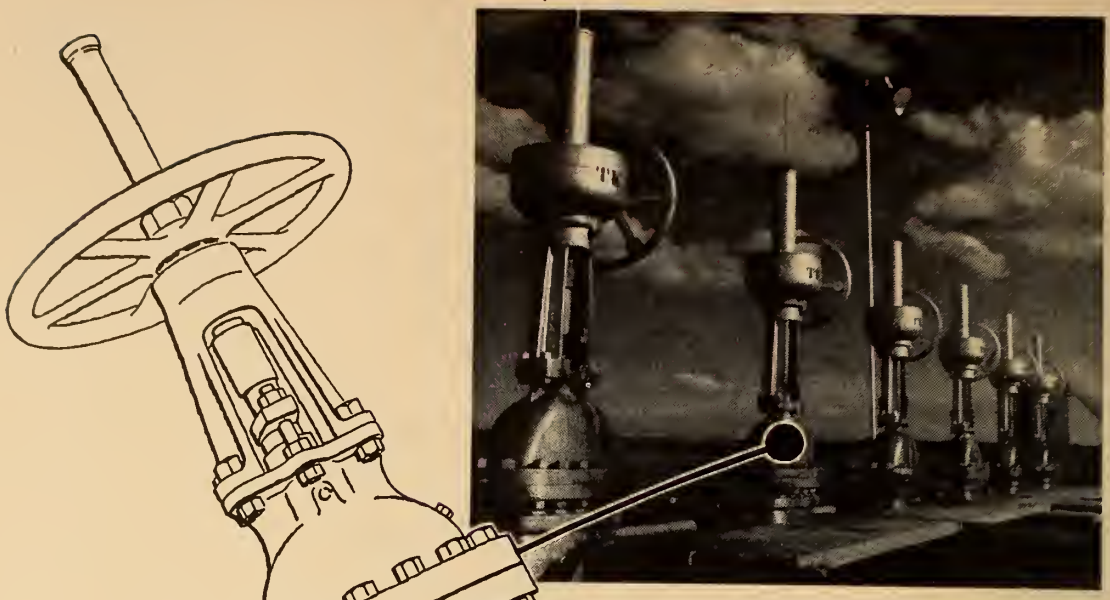

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nstant concept in preference to frequency nsiderations, and rationalized mks units ave been used. These component circuits mphasized include clamping and clipping ircuits, circuits for the electric and mag- etic deflection of cathode-ray tubes, and rigger circuits. The last chapter deals ith multivibrators. Many illustrative xamples and problems, to be used as upplementary material, are included. A arge number of references are noted and he index is detailed.

Strength of materials. F. J. McCormick. Toronto, Macmillan, c1952. 177 pp., illus., $3.75.

The author states that this is not a handbook but rather that it attempts to give some understanding of the significance of the formulas and of the physical phenomena behind them. He discusses stress and strain, welded and riveted joints, torsion, stresses in beams, beam deflections, statically indeterminate beams (these last two chapters deal more fully than is usual in textbooks written for third and fourth year students), combined loading and columns. Tables condensed from the Steel Construction Manual of the American Institute of Steel Construction are found in the Appendix. The book is indexed and is well illustrated with figures.

TV manufacturers' receiver trouble cures, vol. 1. M. S. Snitzer, ed. New York, John F. Rider, c1953. 115 pp., diagrs., $1.80 (U.S.).

This is not generalized instruction manual on curing television troubles. It lists alphabetically twelve tv receiver manufacturers with their various chassis or model numbers and gives exact directions to the specific operations to be performed. In all cases where components are identified, the manufacturer's own circuit symbol is used. Special attention is given to troubles which may occur in areas of high humidity, in fringe areas, in strong-signal areas, etc. A complete index in which trouble cures are listed by brand and chassis or model number appears at the end of the volume, and diagrams of various models are included.

Weight-strength analysis of aircraft structures. F. R. Shanley. Toronto, McGraw-Hill, c1952. 394 pp., illus., $10.65.

Instead of analyzing structures to determine stresses, the author has taken a new direction of approach in treating the subject from the viewpoint of force transmission. The principles of optimum structural design, or design for minimum structural weight, have been used, thus permitting the structural weight equations to be derived on a sound scientific basis. Another new feature in the volume is the use of the "structural index" as a basis for determining the allowable stresses of structures which fail through instability. Included also is much material on recent developments in the theory of plasticity, with separate chapters devoted to the inelastic-column theory and the principles of creep buckling. The book is fully indexed with many illustrations and examples.

The following book notes appear here through the courtesy of the Engineering Society Library of New York. The books may be consulted at the Institute Library.

Atomic theory for students of metallurgy, 2nd ed. William Hume-Rothery. London, Institute of metals, 1952. 331 pp., diagrs. $4.25. (Monograph and report series, No. 3).

The electron theory of metals involves a general background of atomic theory with which the metallurgical student is often unfamiliar. The present book is written primarily for advanced students and research workers, and is intended to provide a bridge by which they may be led to an understanding of the underlying ideas. After an introductory chapter, the chapter headings are as follows: structure of the free atom; assemblies of atoms; free-electron theory of metals; Brillouin-zone theory of metals; electrons, atoms, metals, and alloys. The properties of metals discussed are restricted to those for which the theories provide a reasonably straightforward explanation.

Basic electronic test instruments. R. P. Turner. New York, Reinhart, 1953. 254 pp., illus., $4.00.

A broad, comprehensive list of instruments is treated covering the radio, television, and general electronics fields. Basic principles, construction, operation, and practical applications are discussed in such a manner as to be useful to the technician, service man, or engineer. For aid in proper selection for use as well as to provide a logical treatment, the instruments are dealt with in 16 classified groups —simple meters for current and voltage, vacuum-tube voltmeters, inductance checkers, frequency-measuring devices, oscilloscopes, etc.

Introduction to hydraulics and fluid mechanics. J. O. Jones. New York, Harper, 1953. 403 pp., illus., $6.00.

The author's intent is to provide a text which can be covered in the time allotted in an engineering curriculum, and yet include the topics most likely to be of use to engineers and to serve as an introductory course to advanced study. Approximately the first half of the book is concerned with basic material on fluid pressure, similitude, flow through pipes, flow in open channels, and dynamics of streams. The remainder deals with hydraulic machinery—pumps, the impulse wheel, reaction turbines — with the measurement of rate of flow, and with the fundamental aspects of compressible flow.

The radio amateur's handbook, 30th ed. Headquarters staff of the American radio relay league, West Hartford 7, Conn., 1953. Various paging (pa.). $3.50.

This standard manual of amateur radio communications covers the entire field from the fundamentals to the latest techniques in equipment, design, and construction. The considerable amount of technical data provided includes a comprehensive, up-to-date section of vacuum-tube data tables. The advertising section contains condensed manufacturers' catalogs. As usual, the new edition has been revised to conform to current practice.

Radio and radar technique. A. T. Starr. New York, Pitman, 1953. 812 pp., diagrs., $15.00.

The essential information in the field of radio and electronics is condensed here into one volume covering the extensive literature of the past twenty years. This volume, chiefly concerned with methods and techniques for the electronic engineer and designer, stresses the role of noise, waveforms, micro-wave techniques, and fundamentals of electron tubes. Where possible, mathematical analysis is relegated to appendices which form a considerable part of the text. Bibliographies with each chapter give several hundred references to specialized texts and original papers.

Tables and formulas for fixed end moments of members of constant moment of inertia. Paul Rogers. New York, Frederick Ungar publishing co., 1953. 95 pp., $3.75.

A comprehensive manual for structural design engineers that gives solutions of fixed end moments for rigid frames and continuous beams, thereby eliminating the solution of any formulas. Each loading condition is separately indicated with a loading diagram, mathematical formulas, tables of fixed end moment coefficients, and charts.

STANDARDS REVIEWED

American Standards, American standards association, 70 East 45th Street, New York 17, N.Y.

ASA B18.10-1952—Track bolts and nuts. $1.00.

The committee based this standard on all types of track bolts and nuts used by railroads and electric railways in the United States and Canada. Specifications are given for the heads, necks, and bodies of track bolts, and the dimensions of track bolt nuts. Illustrations and tables of dimensions are given for oval and elliptic neck bolts, and for nuts.

ASTM Specifications, American society for testing materials. 1916 Race Street, Philadelphia 3, Pa.

ASTM A1-52T—Steel piping materials. $3.75.

This edition contains the specifications for carbon-steel and alloy-steel pipe and tubing, including stainless. Materials covered include: pipe used to convey liquids, vapors, and gases at normal and elevated temperatures; boiler, superheater, and miscellaneous tubes; castings; bolts and nuts. Some new specifications are for quenched and tempered alloy steel bolts and studs with suitable nuts, and for iron-chromium and iron-chromium-nickel alloy tubular centrifugal castings for general applications.

ASTM B260-52T—Tentative specifications for brazing filler metal. 40c.

Every type of brazing filler metal in common use today is covered in these specifications. The 33 different classifications include those for aluminum-silicon; copper-phosphorous; silver, magnesium; and heat-resisting filler metals. An appendix contains information for the selection of the brazing filler metal best suited for a given application.

British Standards, British standards institution, 24-28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 46, part 1: 1953—Keys and keyways. 5/-.

In this revision, the table of Woodruff key dimensions corresponds with American practice in that the numbers for the keys and the keyway cutters are now identical and give information on the nominal dimensions of the key. Tolerances on the dimensions of keys and keyways for the ordinary types of rectangular and square, parallel and taper, plain and gib head series, include a minimum hand fitting allowance.

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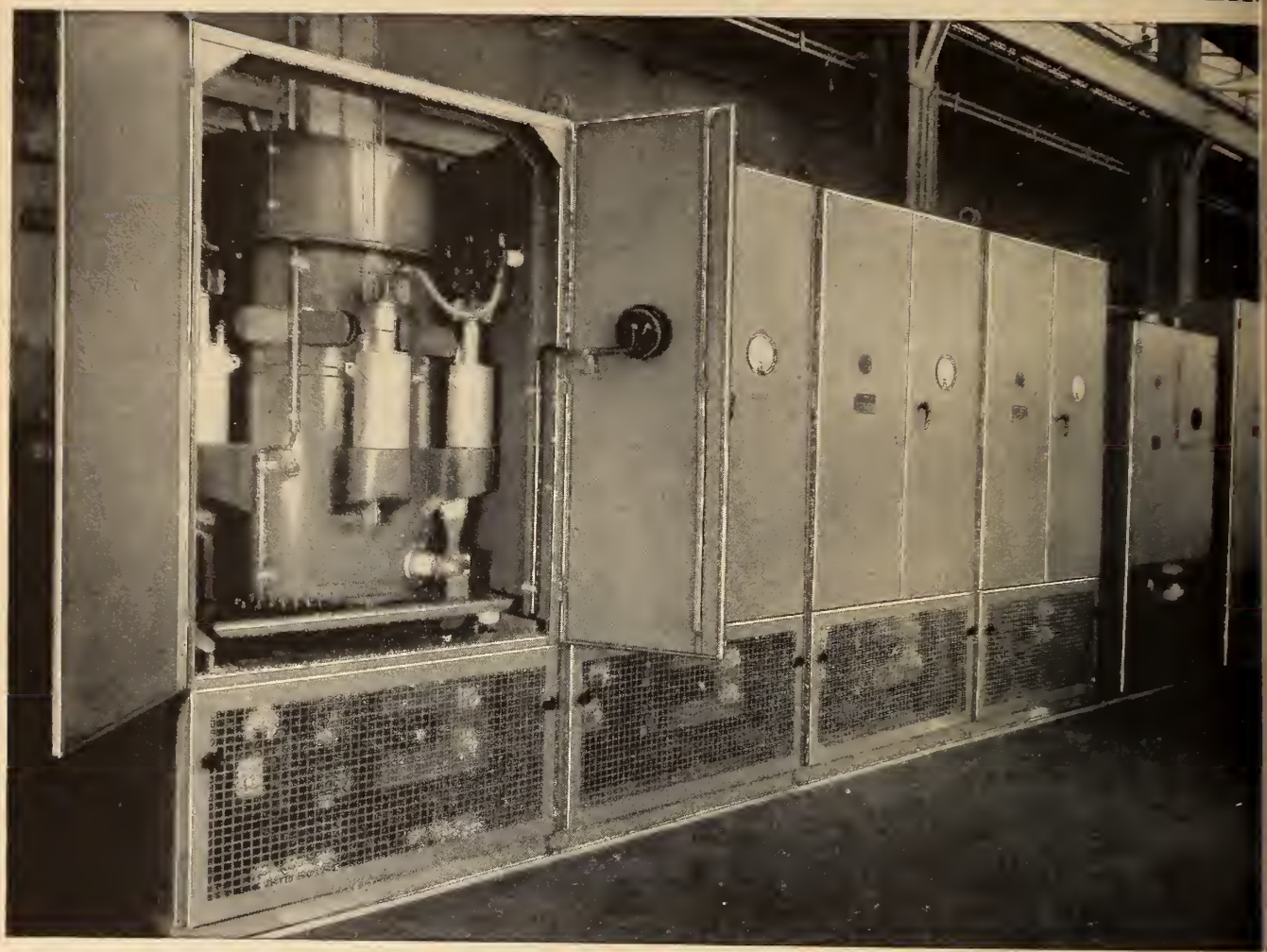

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. 1432: 1953—Copper for electrical urposes, sheet and strip. 4/-.

his revision includes provisions for ealed, half hard and hard conditions, has two diagrams of recommended s of sheet and strip for transformer dings and the windings of rotating trical machinery respectively.

5. 1937: 1953—Engineers' ratchet races and drilling pillars. 4/-.

The various types of brace and the mponent parts are defined and specific uirements for the materials, heat treatnt and hardness, finish and assembly of tools are given. A series of tables es a range of dimensions for the ratchet aces. The standard is intended to apply y to the most commonly used types of l and pillar.

S. 1951: 1953—Thermosetting synthetic-resin honded-paper round tubes for use at radio frequencies. 2/6.

Requirements of two grades of circular cross-sectioned tubes for use at radio frequencies are here specified. Specifications for tubes up to one inch external diameter are given and the electrical and physical properties covered include power factor and permittivity; insulation resistance along laminae; density; water absorption; cohesive strength between layers, and dimensional tolerances. Testing methods are fully described in appendices.

B.S. 1961: 1953—Enamelled round copper wire (oleo-resinous enamel). 4/-.

In this edition all quantities are expressed in metric units, and the range of diameters covered is 0.025 mm. to 4 mm. Details of diameters, resistances, and thickness of enamel (including tolerances), together with tests on the enamel insulation are given. These tests relate to hardness, flexibility and adherence, heat shock, cold test at 0°C., heat aging and electric strength.

BOOKS RECEIVED

dvanced mathematics in physics and engineering Arthur Bronwell, Toronto, McGraw-Hill, c1953. 475 pp., figs., $7.50.

eronautical drafting manual, 4th ed. New York, Society of automotive engineers, 1953. 13 sections, illus.

ir conservation engineering, 2nd ed. Henry Sleik and Amos Turk. Danbury, Conn., Connor engineering corporation, c1953. 76 pp., illus., $5.00 (U.S.).

Consulting engineers who's who and year book, 1953. London, Association of consulting engineers, 1953. 306 pp.

Drafting by the model method. J. B. Musacchia, H. A. Fluchere, and M. J. Grainger. New York, Arco, 1953. 143 pp., illus., (pa.), $3.50 (U.S.).

Earth manual: a manual on the use of earth materials for foundation and construction purposes, tentative edition. U.S., Department of the interior, Bureau of reclamation. Denver, 1952. 332 pp., illus., $2.50 (U.S.).

Electric control systems, 3rd ed. R. W. Jones. New York, Wiley, c1953. 511 pp., figs., $9.30.

Elements of propeller and helicopter aerodynamics. D. O. Dommasch. New York, Pitman, 1953. 178 pp., illus., $4.50 (U.S.).

Engineer buyers guide, 1953 ed. London, Morgan brothers, 1953. 606 pp.

Equipment for the thermal treatment of non-ferrous metals and alloys. Institute of metals. London, The institute, 1953. 103 pp., illus., $2.50 (Monograph and report series, No. 14).

The Gantt chart; a working tool of management, 3rd ed. Wallace Clark. London, Pitman, 1952. 168 pp., figs., $2.50.

Historical metrology. A. E. Berriman. London, Dent, 1953. 224 pp., illus., $3.50.

Industrial electronic engineering. W. L. Davis and H. R. Weed. New York, Prentice-Hall, 1953. 514 pp., illus., $11.35 (U.S.).

Lexicon of terms used in connexion with international civil aviation, English-French-Spanish. International civil aviation organization. Montreal, ICAO, 1952. 197 pp., $1.00.

Mechanics of materials. Seibert Fairman and C. S. Cutshall. New York, Wiley, c1953. 420 pp., illus., $6.40.

La méthode de Cross et le calcul pratique des constructions hyperstatiques: théorie et applications. P. Charon. Paris, Eyrolles, c1953. 302 pp., figs., 3800 fr.

Route location and surveying, 3rd ed. T. F. Hickerson. Toronto, McGraw-Hill, c1953. 543 pp., figs., $7.50.

Sewerage and sewage treatment, 7th ed. H. E. Babbitt. New York, Wiley, c1953. 674 pp., illus., $8.80.

La spectroscopie d'émission et ses applications. Pierre Miehel. Paris, Colin, c1953. 224 pp., 260 fr.

Surface water supply of Canada: Pacific drainage, British Columbia and Yukon Territory; climatic years 1946-47 and 1947-48. Canada, Department of resources and development, Engineering and water resources branch, Water resources division. Ottawa, 1952. 389 pp., $3.00. (Water resources paper, No. 106).

Television and radar encyclopaedia. W. MacLanachan, ed. New York, Pitman, 1953. 216 pp., illus., approx. $6.00.

TV manufacturers' receiver trouble cures, volume 2. M. S. Snitzer, ed. New York, Rider, c1953. 117 pp., figs., $2.50.

Television receiver design; I.F. stages, monograph 1. A. G. W. Uitjens. Eindhoven, Holland, Philips, 1953. 177 pp., figs., $4.50 (U.S.).

Tennessee Valley authority. Annual report, 1952. Washington, U.S. government printing office, 1952. 76, 99 pp., illus., 50c.

Tungsten; its metallurgy, properties and applications. C. J. Smithells. New York, Chemical publishing co., c1953. 326 pp., illus., $8.50 (U.S.).

The welding of austenitic corrosion- and heat-resisting steels. British welding research association. London, The association, 1953. 207 pp., illus., $5.50.

TECHNICAL BULLETINS RECEIVED

American society of mechanical engineers. Boiler and pressure vessel code:

Section 3—Rules for construction of boilers of locomotives, 1952 ed.

American water works association. Standard specifications:

AWWA B202-52T — Tentative standard specifications for quicklime and hydrated lime.

British electrical and allied industries research association. Technical reports:

No. G/T261 — Simplified calculations for rate of rise of restriking voltage, by J. A. Callow. No. G/T266 — The performance of 440 v. a-c. cartridge fuses with small over-currents, by H. W. Baxter and M. T. Cree. No. G/T268 — Intrinsically safe electrical apparatus: relation of igniting current to circuit inductance for inflammable mixtures of benzene and cyclohexane with air, by E. M. Guenault and E. Atherton. No. L/T257 — Report on researches with ferroelectric materials, by H. F. Kay. No. O/T9 — Tests on Italian design of a 275 kv single-circuit suspension tower, by P. J. Ryle. No. Z/T90 — Review of the technical and economic position of selenium, by A. M. Cassie.

Canada. National research council. Canadian government specifications board. Specifications:

39-GP-2 — Hammers; sledge. 39-GP-4 — Shovels, spades, and scoops. 39-GP-5 — Hoes, mattocks and picks. 39-GP-6 — Scythes and snaths. 39-GP-7 — Forks. 39-GP-8 — Hoes, garden. 39-GP-9 — Adzes.

Council for codes of practice for buildings. British standard code of practice. General series:

CP (B) 1107, 2nd proof — Central heating by low pressure hot water. CP (B) 1113, 2nd proof — Small sewage treatment works.

Institution of electrical engineers. Proofs:

M1393-97-99-1410 — Symposium of papers on insulating materials.

Organisation Européenne de cooperation économique. Mission d'assistance technique. Rapports:

No. 70 — Les problèmes de la construction d'hiver.

St. John X-ray laboratory, Califon, N.J. Bibliographies on industrial radiology:

4th supplement — 1950-1952.

Underwriters' laboratories of Canada. Standards:

C896 — Proposed standard for oil burning stoves.

United States. National research council. Highway research board. Bulletins:

No. 60 — Road-user characteristics.

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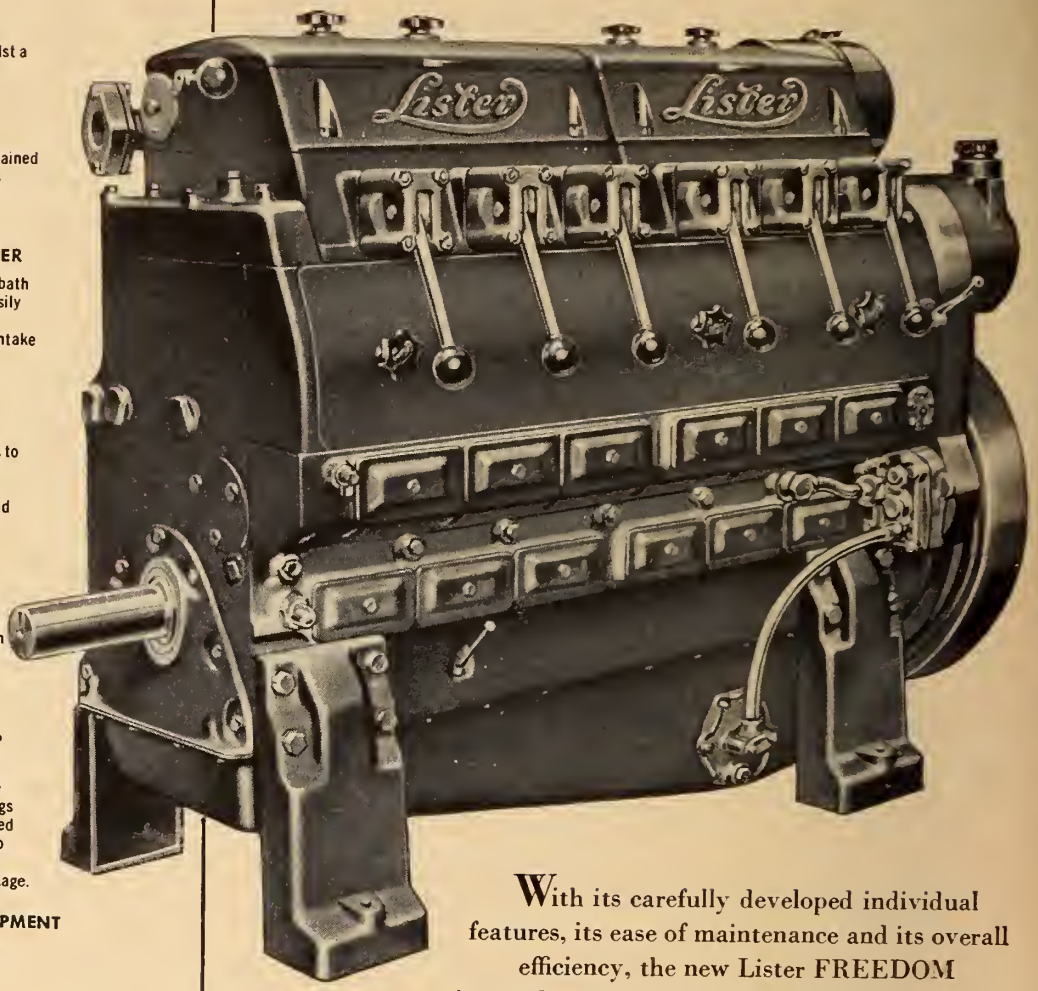

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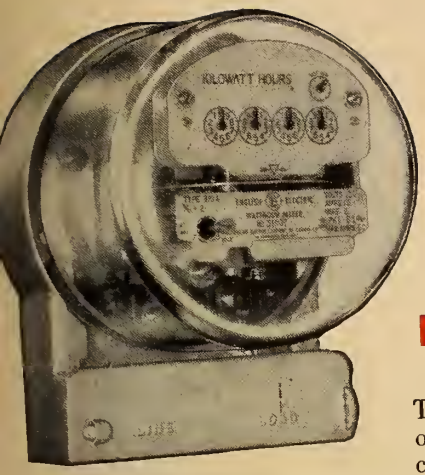

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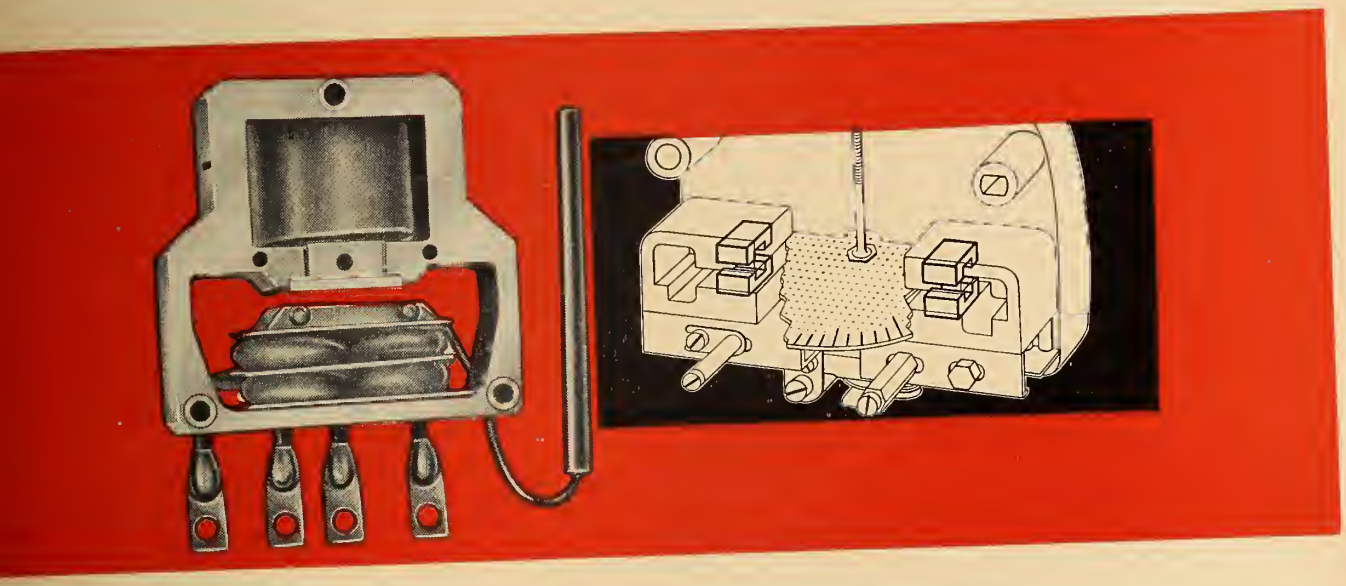

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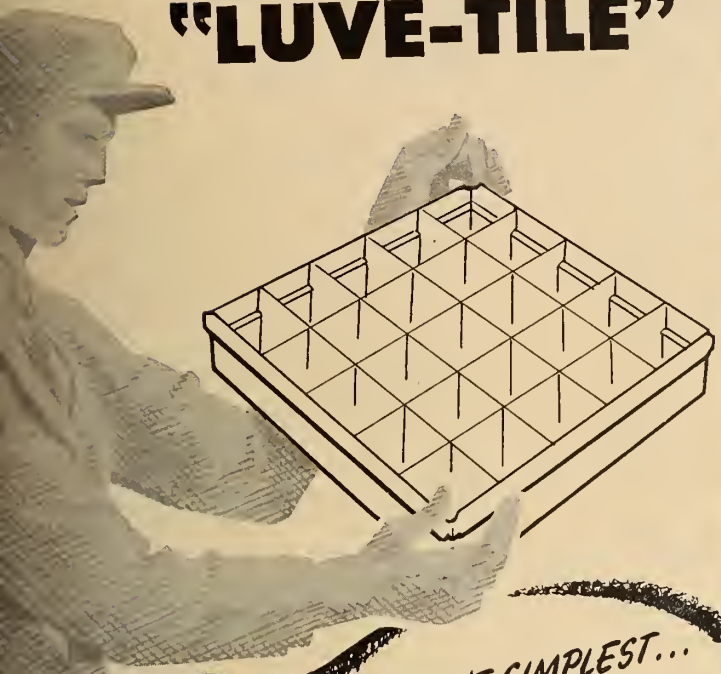

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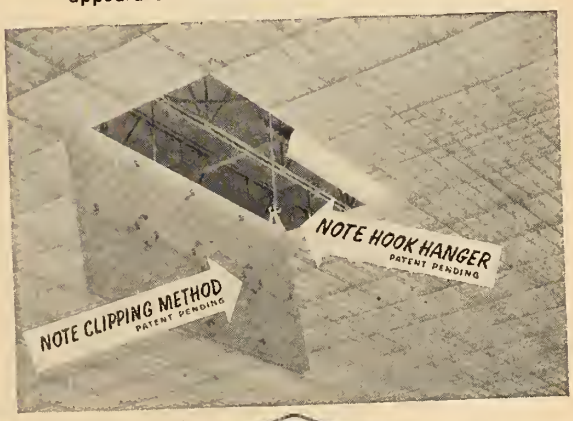
● Luve-tile was a major factor in achieving the modern appearance of this retail store.



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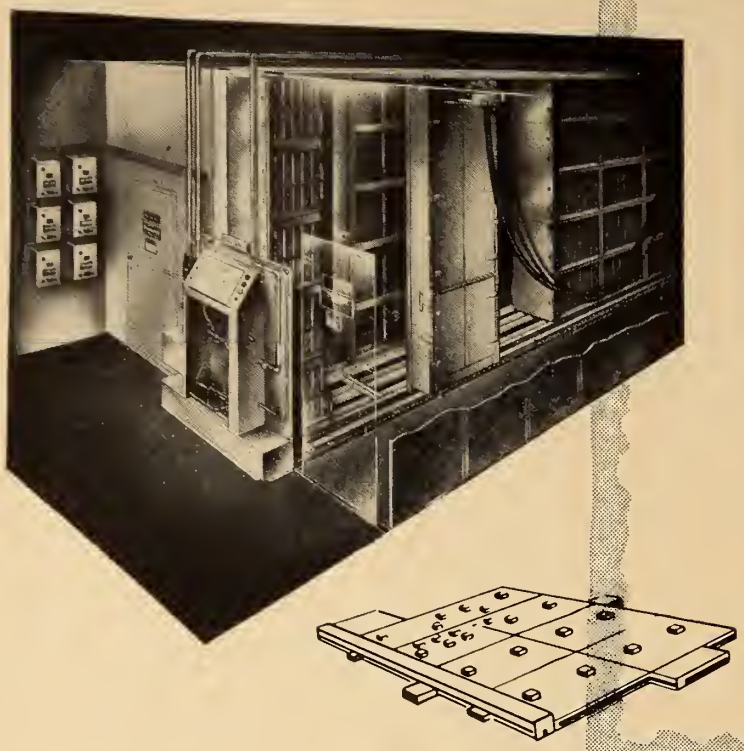

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The ultimate in air cleaning efficiency, these electrostatic units remove dust, dirt, soot, pollen and other damaging dirt particles from the air supply for Ford's giant Paint Spray Booths.

The air supply passes through fine mesh fly screens where the larger airborne particles are stopped and immediately on through large air intake louvres at the end of each penthouse. From there it passes through a double row of preheat coils, through the air distribution baffle and then through the PRECIPITRON, where the microscopic dirt particles down to 1/10th of a micron are removed electrostatically. The clean air is then discharged downward into the ductwork leading to the Paint Spray Booths.

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For application data and other information write

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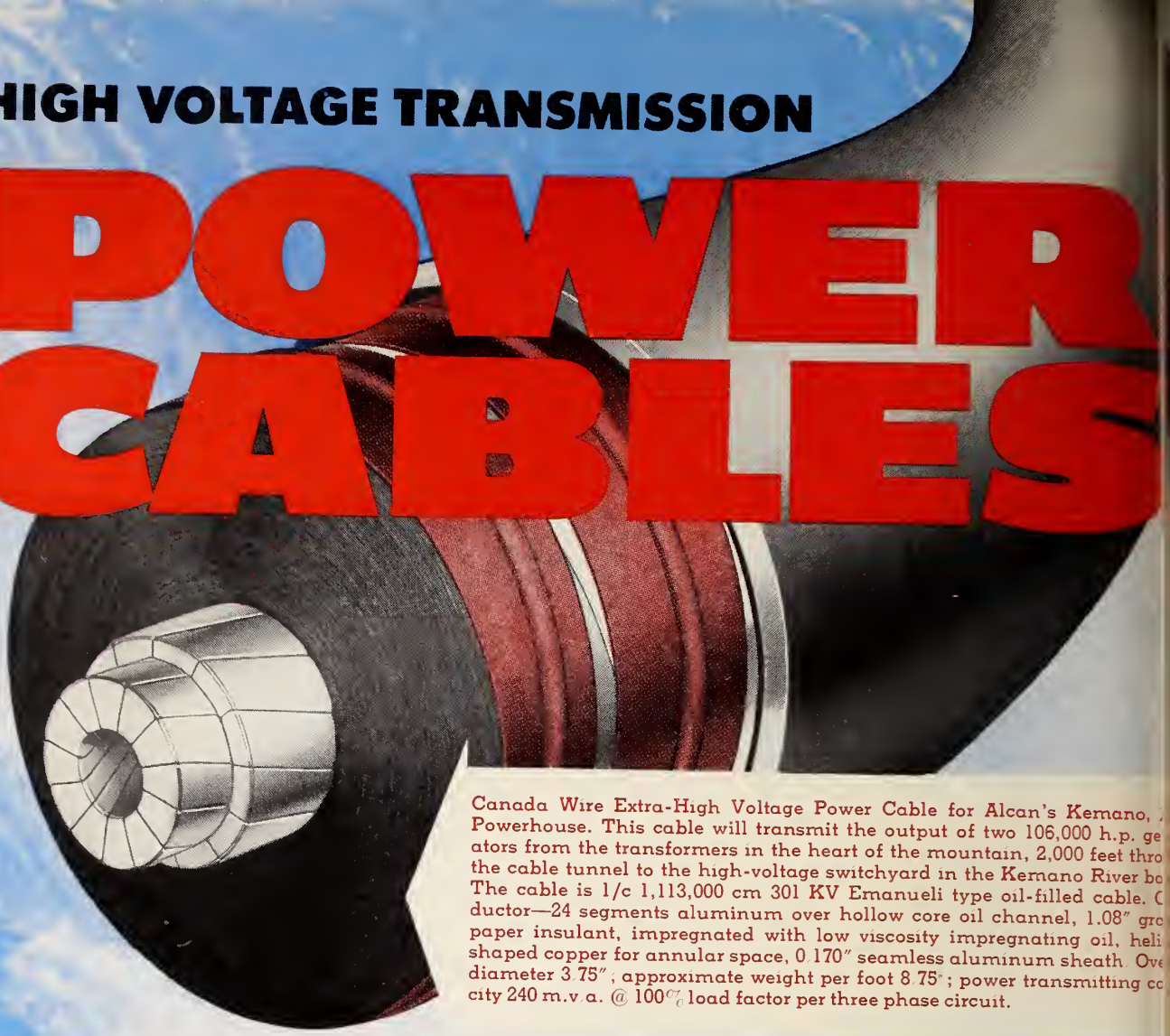
"Dagmar Farm" by George Broomfield, A.R.C.A., O.S.A., expresses the peaceful winter beauty of this Ontario farmland. This is one of a series of paintings by contemporary Canadian artists being reproduced by Canada Wire. A reprint, suitable for framing may be obtained by writing Canada Wire and Cable Co. Limited, Postal Station "R", Toronto 17, stating the name of this publication.

HIGH VOLTAGE TRANSMISSION

POWER CABLES



Canada Wire Extra-High Voltage Power Cable for Alcan's Kemano, A
Powerhouse. This cable will transmit the output of two 106,000 h.p. ge
ators from the transformers in the heart of the mountain, 2,000 feet thro
the cable tunnel to the high-voltage switchyard in the Kemano River bo
The cable is 1/c 1,113,000 cm 301 KV Emanueli type oil-filled cable. C
ductor—24 segments aluminum over hollow core oil channel, 1.08" gro
paper insulant, impregnated with low viscosity impregnating oil, heli
shaped copper for annular space, 0.170" seamless aluminum sheath. Ove
diameter 3.75"; approximate weight per foot 8.75"; power transmitting ca
city 240 m.v.a. @ 100% load factor per three phase circuit.

HIGH VOLTAGE TRANSMISSION POWER CABLES DEVELOPED AND DESIGNED BY CANADA WIRE:

- 3 c 1,150,000 cm 161 KV and 120 KV Atkinson-Fisher type pipe-type cable with seamless aluminum sheath terminal ends—for H.E.P.C. of Ontario, Toronto.
- 1/c, 850,000 cm, 120 KV Emanueli Type Oil Filled cable, H.E.P.C. of Ontario, Hamilton.
- 1/c, 650,000 cm, 120 KV Emanueli Type Oil Filled submarine cable, Q.H.E.C.—Baie d'Urfe, Quebec.
- 1/c, 650,000 cm, 120 KV Emanueli Type Oil Filled cable with seamless aluminum sheath—Q.H.E.C.—Rockfield, Montreal.

For over 25 years, Canada Wire has led the way in the field of Extra-High Voltage Power Cables, both gas pressurized and oil-filled. We pioneered in associated production of the first Type H installation in the world; designed, manufactured and installed the world's first Atkinson-Fisher type pipe-type gas pressurized cables, employing the hollow conductor principle. Also the first pipe-type installation using seamless aluminum sheathed terminal ends, rated at 161 kv. We work unceasingly to maintain our established reputation for leadership by employing the twin forces of intensive research and advanced engineering practice.

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lectric Hoist, Type 223. rope. Hoisting speed 23 /min. Motor driven, single il trolley.

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Munck Electric Hoists, used extensively throughout Europe for many years, are now available in Canada.

Before you buy again, or start major repairs on present equipment, look into Munck Hoists. There are over 100 models—fixed mounts as well as motor-driven, hand-geared and push-type mounts. Also special low-headroom mountings. Capacities range from ½ ton to 10 tons.

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Built-in motor, inside drum, saves space, weight
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Automatic two-way limit switch
Ingenious cable guide to prevent overriding

For lower first costs, overall operating economy and safe, foolproof performance—equip now with Munck Hoists. *Fast* delivery. *Complete* servicing in Canada.

Approved by the Canadian Standards Association

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STREET.....

CITY.....PROV.....

TYPE OF INDUSTRY.....

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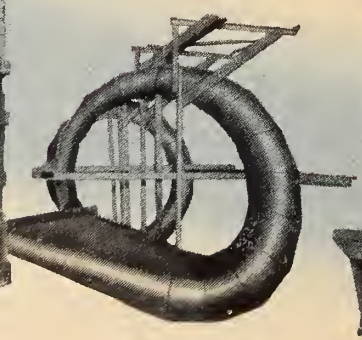
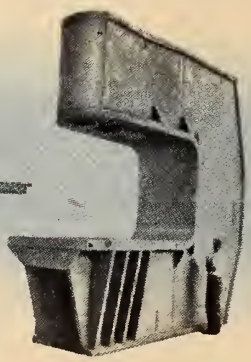


Spirol chute for cool briquettes



Large Press Frame (Weight 60 tons)

Hydro Scroll cose (Inlet Diom. 22')

Digester for Paper Mill (48' high)

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BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information received by The Editor

Appointments and Transfers

mpany Name Change. — Canadian ittall Metal Window Limited is the w name of a company known for- erly as Canadian Metal Window and eel Products Ltd.
Plant and head office of the Company e 139 Stephenson Ave., Toronto 13. ie telephone number is OX. 9646. iere is a branch of the Company at 62 Wilson Ave., Montreal 29.
President of the Company is John W. ooch and the chairman of the board Lord Braintree who is also chairman the Darlington Rolling Mills and a rector of the Bank of England.
Last January, Crittall Manufacturing o., Ltd., of Braintree, England, bought anadian Metal Window outright to btain a fully operated large scale anufacturing and service organization n Canada. Canadian Crittall, which as been in business for 35 years, has, hrough this change, extended its varied ne of steel and aluminum windows which have been merchandised under he name "Fenestra".

●

C.G.E. Changes.—J. W. Milne, manager of the marketing department of Canadian General Electric Company's Apparatus Division, has announced the following appointments:

Section managers are: S. E. Erskine, manager-sales; G. G. Klein, manager-export sales; I. M. MacLean, manager-customer relations; J. D. Willis, manager-product planning and marketing research; H. Rose, manager-advertising and sales promotion; H. W. Moxon, manager-installation and field service; J. D. Duncan, manager-administrative service; G. W. Painter, manager-M.L.W. locomotive equipment.

The marketing department is responsible for the sales and service of the Company's apparatus product lines through the offices and representatives in principal Canadian cities from coast to coast.

●

Imperial Oil Vice Presidents. — Imperial Oil Limited has appointed two new vice-presidents: J. K. Jamieson, M.E.I.C. and Trevor F. Moore. Both were previously members of the board of directors of the Company. (For additional information on Mr. Jamieson see "personals".)

●

More Westinghouse Changes. — Canadian Westinghouse Company Limited has announced four appointments in the industrial products division.

W. J. Porter, formerly manager of the motor and control section of the apparatus engineering department is now manager of the division's engineering department.

Mr. Porter has announced the following appointments to managerial posts in his new department. G. E. Creed, is manager of industrial motors engineering; C. R. Vrooman, is manager of distributing apparatus engineering and M. C. Edwards, M.E.I.C., is manager of the control engineering. (For additional information on Mr. Edwards see "Personals".)

●

Josam Appointment. — Howard F. Paget, Managing Director of Josam Canada Limited, has announced the appointment of Louis C. Moore as eastern Quebec representative. Mr. Moore will make his headquarters at 169 des Franciscains, Quebec City. His telephone No. is 3-7185.

●

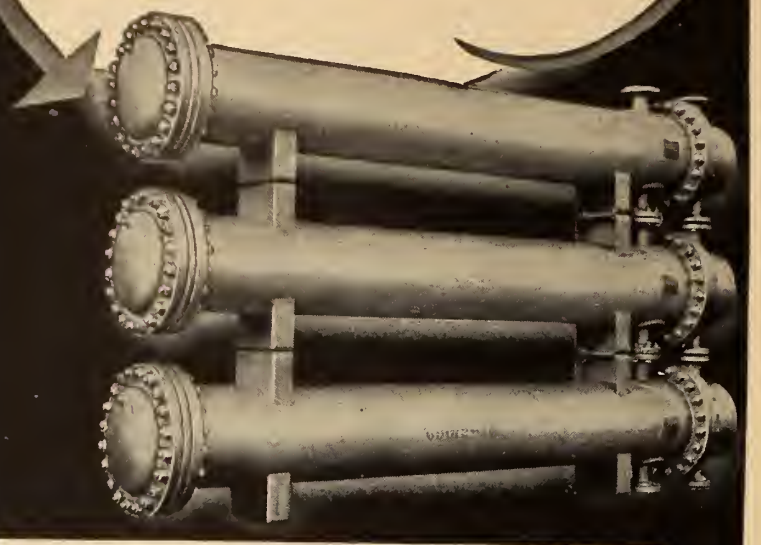
Defence Production.—The Right Honourable C. D. Howe, HON.M.E.I.C., has announced that Stanley Marsland of Kitchener, Ont., previously director of

W. J. Porter

C. R. Vrooman

G. E. Creed

HEAT EXCHANGERS



Toronto Iron Works Heat Exchangers are supplied to the petroleum, chemical and other industries where high grade construction is necessary to ensure safe handling of hazardous fluids and high pressures and temperatures.

Toronto Iron Works builds to your designs, or rate and design for you.

THE T.I.W. STEEL PLATE PRODUCTS

TORONTO IRON WORKS LIMITED

DESIGNERS, FABRICATORS, ERECTORS • TORONTO • CANADA

the machine tools division is now assistant co-ordinator of production.

R. Mosher of Ottawa, formerly the deputy director of machine tools division has been appointed a director.

●

International Nickel Directors. — The following retiring directors were re-elected by shareholders at the annual meeting of The International Nickel Company of Canada Limited held in Toronto on April 29th.

Edwin G. Baker, R. Leslie Beattie, Lewis W. Douglas, Reg Halladay, H. R. MacMillan, C.B.E., The Rt. Hon. Viscount Margesson, P.C., M.C., R. Samuel McLaughlin, H. C. F. Mockridge, Q.C., R. L. Prain, O.B.E., G. C. Sharp, Dr. John F. Thompson and the Rt. Hon. Viscount Weir, P.C., G.C.B.

●

M. Rene Kayser. — M. Rene Kayser manager, transformer engineering, of the English Electric Company of Canada Limited, has been appointed Canadian representative on the transformer committee of Conference Internationale des Grands Reseaux Electriques.

Mr. Kayser's first job, as far as C.I.G.R.E. is concerned, will be to organize into working order a Canadian subcommittee, set up previously by his predecessor, M. B. Mallett, general manager of the Company. Mr. Kayser succeeds Mr. Mallett on the committee. Mr. Mallett has had to relinquish his post on the committee owing to his appointment to the position of general manager. The Company is very proud of the fact that the post on the committee has been kept by a member of the English Electric staff.

●

Canadian Testing Laboratories. — The Association of Canadian Testing Laboratories made the following appointments at their fourth annual meeting held recently, in the Laurentien Hotel, Montreal: president R. Billinghurst, Donald Inspection, Toronto; vice-president J. White, Bell-White Laboratory, Haileybury, Ont.; sec. treas. E. R. Bolton, Toronto Testing Laboratories, Toronto. The following directors were also appointed: W. Trochu, Montreal, representing Quebec and the Maritimes; J. Burgener, Toronto, representing Ontario; W. Cruickshank, Regina, representing the Middle-West; S. Merler, Vancouver, representing the West Coast.

●

B. Dixon. — Ben Dixon, director and sales manager of Dominion Wheel and Foundries, vice-president and general manager of Dominion, Scott, Barron Limited, was recently elected chairman of the Ontario Chapter, American Society for Metals.

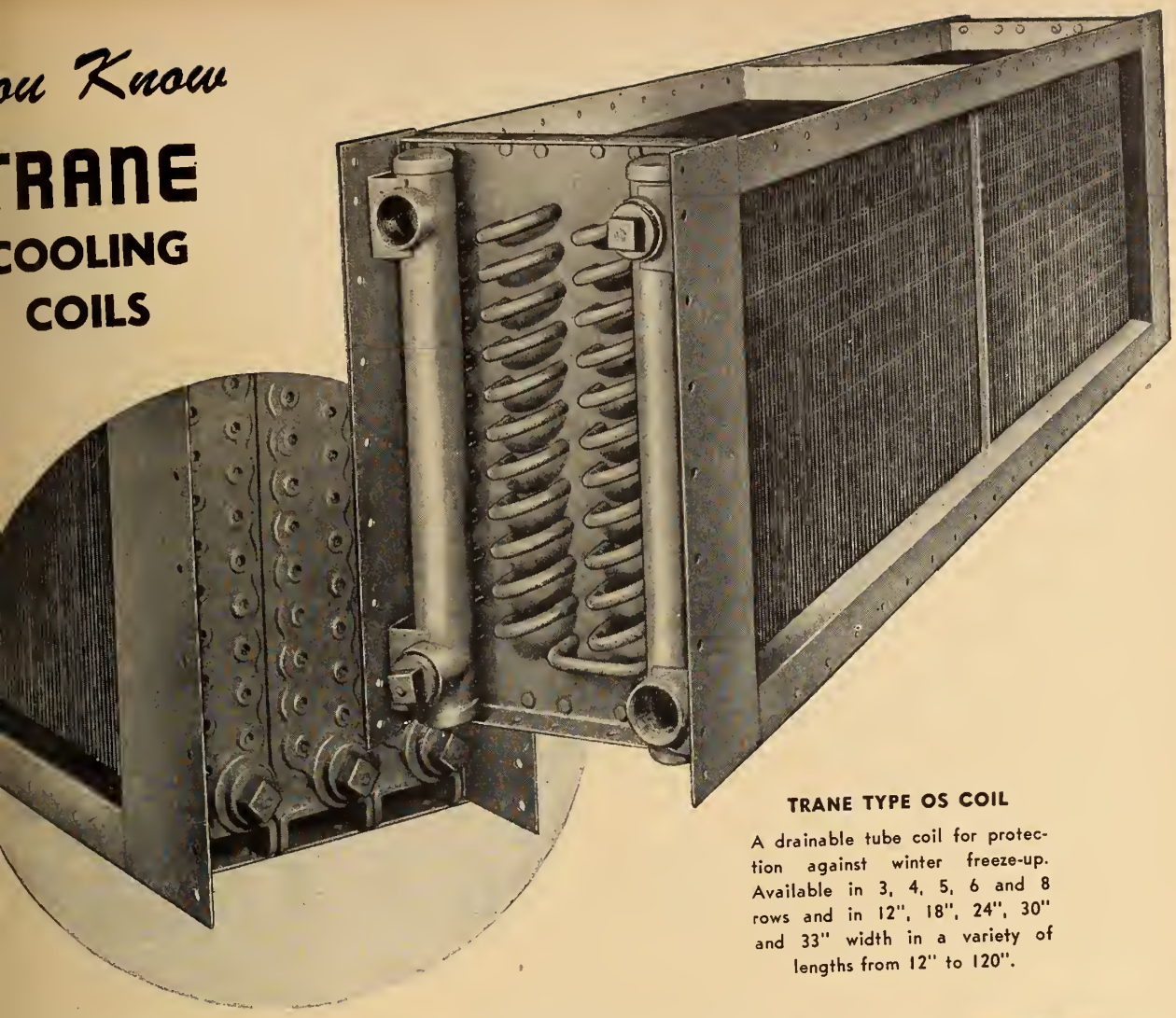
●

Donald A. Wilson.—Donald A. Wilson often referred to as "Dean of Canadian purchasing agents" has retired after many years of service with Canadian Westinghouse Company. Mr. Wilson joined the Company in 1904 when his department consisted of five persons. Today there are more than one hundred persons in the purchasing department and a total of 12,000 persons on the company payroll.

Mr. Wilson is a charter member and past president of the Hamilton Purchasing Agents' Association which was formed in 1920. He is also past president of the Council of Canadian Purchasing

ou Know

TRANE COOLING COILS



TRANE TYPE OS COIL

A drainable tube coil for protection against winter freeze-up. Available in 3, 4, 5, 6 and 8 rows and in 12", 18", 24", 30" and 33" width in a variety of lengths from 12" to 120".

The Trane Type OS Coil is designed for draining and for use with average quantities of water. It is particularly suitable for the system in which the amount of water used is an economic factor.

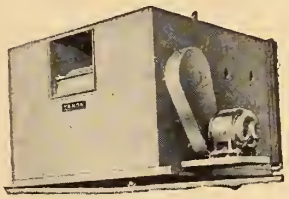
Type "OS" Coil Supply and Return Headers are equipped with both top and bottom tappings which facilitate convenient on the job piping to obtain counter flow of the entering air and the entering water. This factor makes the selection of this type of coil most convenient for, while it does not require consideration during the design period, it allows the coil to be piped so as to determine the maximum capacity.

Where turbulators are used, positive draining is insured by removing all plugs and turbulators.

In its operation chilled water enters a header connected to the first row of the coil. From the header the water passes the length of the first row of tubes, returns through the second row, and continues in this one row serpentined arrangement until all the tubes of the coil have been traversed. The last row of tubes in the coil is attached to the outlet header. In 4, 6 and 8 row coils, inlet and outlet headers are on the same end of the coil. In 3 and 5 row coils, inlet and outlet headers are on opposite ends.

All general coil features such as the solderless mechanical bond, dual fin contact, precision fabrication, etc., which have made Trane Coils famous, are incorporated in Trane Type OS Coils.

Write for literature and full information.



TRANE CLIMATE CHANGERS

The Trane Climate Changer is a complete air conditioning unit. It heats and cools. It extracts or adds moisture as the need arises. It filters dust and dirt from the air and moves the conditioned air where it is needed—one of the finest air conditioning units ever designed.

TRANE COMPANY OF CANADA LIMITED

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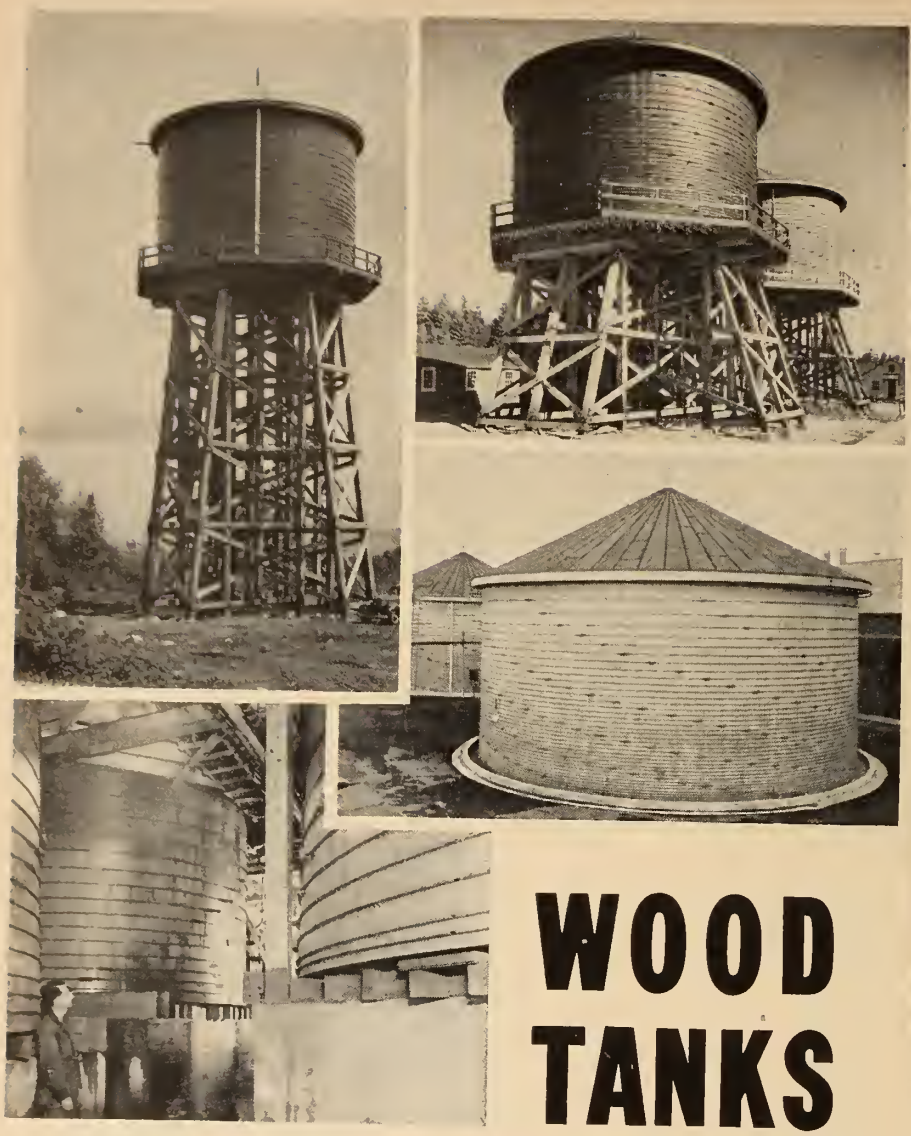

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FOR ECONOMY WITH COMPLETE SATISFACTION

Perfect service over a long period of years is the record of Canadian Wood tank installations. From domestic water supply systems to acid storage for industry, Canadian Wood Tanks have proved their worth and practicability. Each tank is individually and soundly designed for its specific purpose by seasoned, practical engineers. Built only from the finest quality old-growth Douglas Fir by skilled craftsmen—the finest in their trade. These are the essentials that go to make a good tank—that make Canadian Wood Tanks your best buy—the most economical solution to your tank problem.

CW-5

Canadian

WOOD PIPE & TANKS LIMITED

550 PACIFIC STREET VANCOUVER 2, B. C.

Agents and vice president, District No. 5, National Association of Purchasing Agents. Mr. Wilson was secretary of the Canadian Westinghouse Senior Veterans Employees Association for 21 years.

●

Westinghouse—Power Products.—The following new appointments in the power products division at Canadian Westinghouse have been announced by A. A. McArthur, manager of sales.

R. C. Mitchell, M.E.I.C., is manager of power generating apparatus sales; J. G. Walach is manager of power transformer sales and E. W. Hill, M.E.I.C., is manager of switchgear sales. (For further details on Mr. Mitchell and Mr. Hill see "personals".)

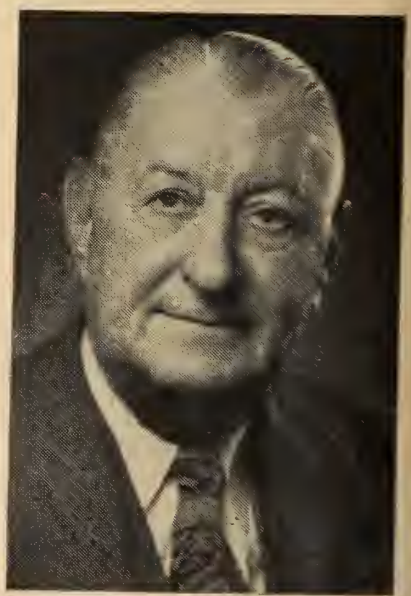
●

J. G. Walach

Jack C. Dowell.—Jack C. Dowell has been appointed representative for Toledo Pipe Tools in Canada. The territory he will serve extends from the east coast as far west as Winnipeg. Mr. Dowell will make his headquarters at 330 Ferguson Ave., London, Ont.

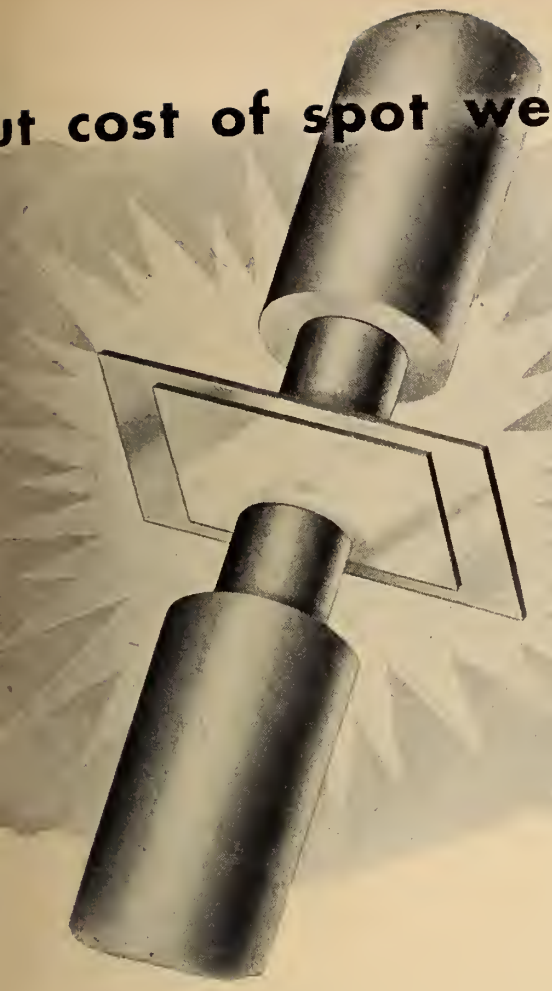
●

A. S. Turnbull.—A. S. Turnbull, one of the earliest members of the staff of



A. S. Turnbull

...ut cost of spot welding stainless steel . . . with MALLORY 100 METAL FLUTED ELECTRODES*



If you're spot welding stainless or other high strength steels — or any alloys having relatively high electrical resistance — you'll get more welds per dollar with fluted electrodes of Mallory 100 alloy. Outstanding features of these electrodes are:

1. **Fluted water cooling hole:** Provides 70% more heat transfer area for cooling water. An exclusive Mallory design now produced in Mallory 100 metal electrodes through new manufacturing techniques.

2. **High hardness and strength:** The higher hardness and strength of Mallory 100 metals coupled with excellent abrasion resistance and high annealing temperature, provide the ideal electrode for spot welding stainless steel, Inconel and other high-strength, heat-resisting alloys.

3. **Maximum electrode life:** Mallory 100 fluted electrodes produce the maximum number of welds of good strength, quality and consistency per dressing. By reason of the high strength and hardness of the electrode material and the most efficient design for cooling, the deformation of the welding face is held to a minimum.

Fluted electrodes of Mallory 100 are available in all standard shapes, and can be supplied in special forms to meet your individual requirements. For full details, call, Johnson Matthey & Mallory today.

Behind every J. M. & M. Product . . .

. . . stand more than 25 years of metallurgical development and application experience in all types of resistance welding. This wealth of engineering knowledge is at your service, ready to work on your welding problems.

For low-cost, high-production welding, look to Johnson Matthey & Mallory for electrodes, holders, dies, castings, forgings, rods and bars.

*Trade Mark, Patent Pending

In U.S. made and sold by P. R. Mallory & Co., Inc., Indianapolis 6, Indiana.

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Resistance Welding Materials
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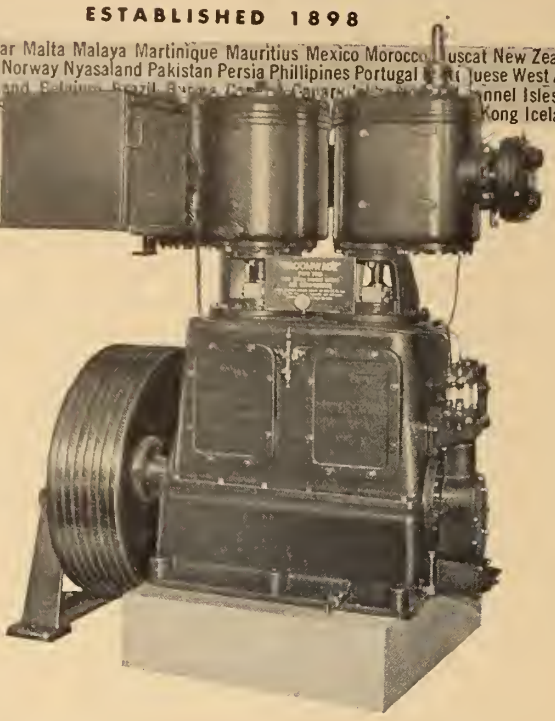

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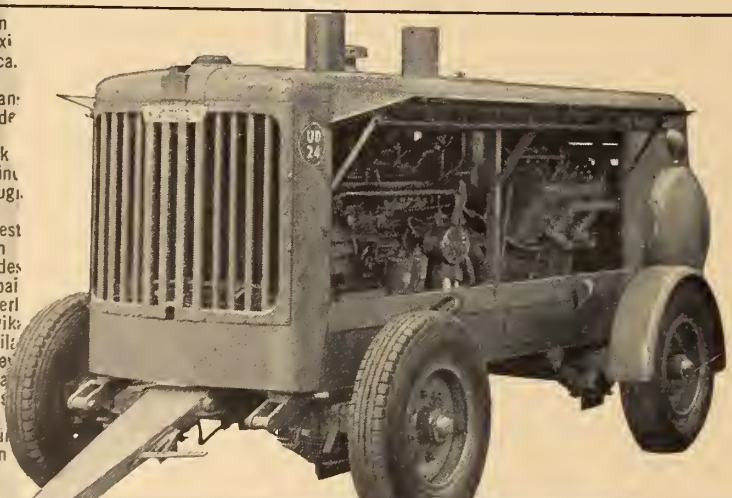

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Sheridan Equip't Co. Ltd., (Portable) 33 Laird Drive
MANITOBA & SASKATCHEWAN: Medland Machinery, 576 Wall Street
BRITISH COLUMBIA: B.C. Equipment Co., Ltd., 551 Howe Street

the Canadian Liquid Air Company, Ltd., has retired from active duty with the Company.

On the occasion of his retirement he was honoured by a banquet at the Ritz-Carlton Hotel, Montreal.

Mr. Turnbull was presented with several gifts, including a silver tray engraved with the names of all who were present at the banquet.

He entered the service of the Company in Canada in 1913. After successfully opening and managing branch offices, he was appointed to the head office in Montreal in 1921 as general sales manager, which position he held for over 25 years. At the time of his retirement he was manager of general services. He has been a director of the Company for over 12 years.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Steam Trap Catalogue.—Kent-Norlantic, Ltd., Horner Avenue, Toronto 14, have just released a new Kent-Norlantic "Mil" steam trap and accessories catalogue. It is designated as No. Mil/100/533. It is the Company's first completely illustrated publication, giving all data on the full range of "Mil" bimetal operated Steam Traps, Air Vents, Stop Valves, Check Valves, Strainers and Sight Glasses, together with a very useful article on "Choosing the Correct Steam Trap". For copies write to F. Rose, at the address given above and mention the Journal.

●

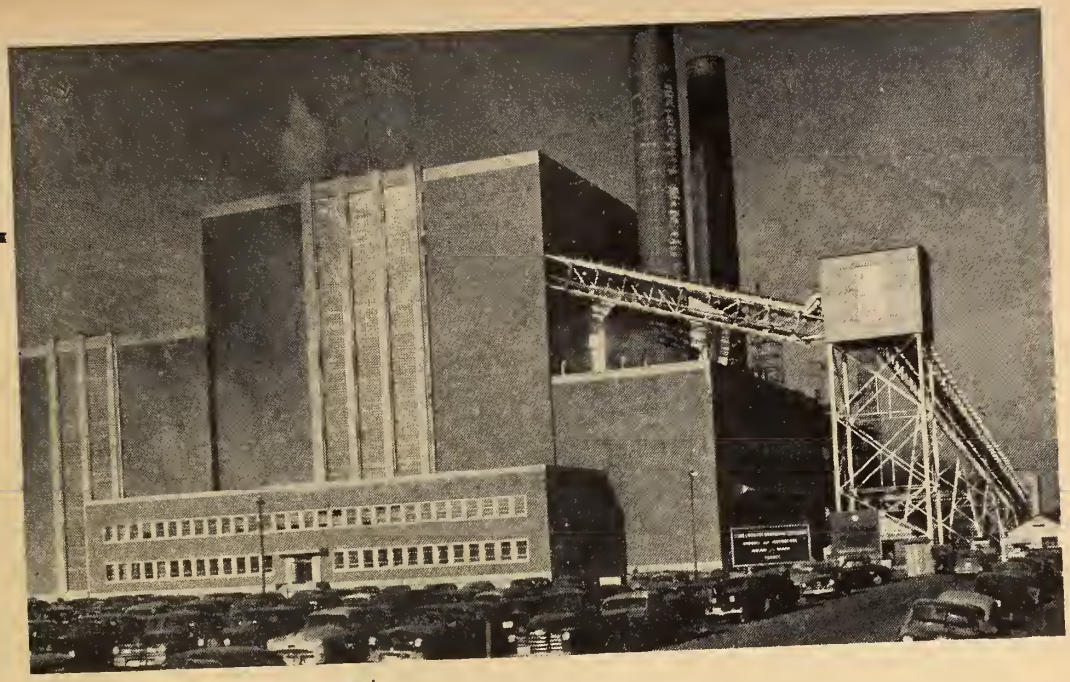
Rinse Water Treatment. — The treatment of electroplating rinse waters in industrial plants through the use of iron exchangers has been one of the most attractive methods considered in recent years for the elimination of complex water pollution problems. One of the most successful applications of this process has been toward the recovery of chromic acid from electroplating solutions. Now, the process has been extended to the treatment of mixed chromate rinse waters, the recovery of cyanide from cyanide plating rinse baths, etc.

Valuable information on these newer applications is contained in Bulletin No. 3865, an 8-page preprint of a paper "Plating Waste Treatment" given by C. F. Paulson, of the Permutit Company, New York 36, N.Y.

To obtain copies write to the Permutit Company of Canada Limited, 6975 Jeanne Mance St., Montreal, Que.

●

C.L.M. Catalogue. — Canadian Line Materials Limited, have issued a new catalogue which describes their "Elemex" Shunt Capacitors. Wider in scope than previous editions, a variety of hangers are described to accommodate most of



Richard L. Hearn, Toronto, Ontario

Boilers at Ontario's New Hydro Steam-Electric Generating Stations

equipped with Ljungstrom Air Preheaters

Clark Keith, Windsor, Ontario

Both the Richard L. Hearn and J. Clark Keith Steam-Electric Generating Stations are equipped with Ljungstrom Air Preheaters.

Air Preheaters for these two stations are supplied by The Superheater Company, Limited, Montreal, Canadian representative of The Air Preheater Corporation.

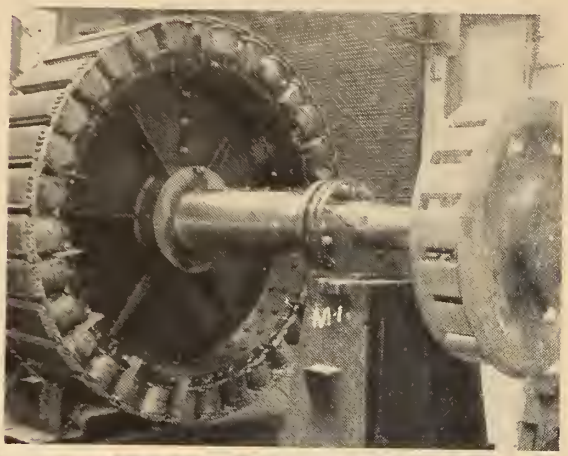
Since the war, Ljungstrom Air Preheaters have been specified for boilers furnishing a total of more than 285,000,000 lb. of steam per hour.

THE SUPERHEATER COMPANY, LIMITED
540 Dominion Square Building
Montreal, P.Q.

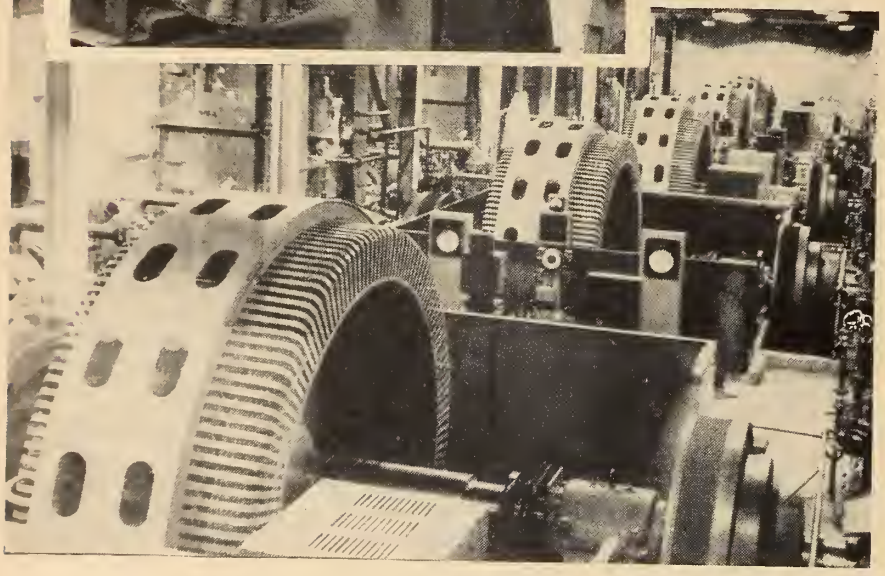
Canadian Representative for:
The Air Preheater Corporation
60 East 42nd Street
New York 17, N.Y.

Canforge

HUGE GRINDER MOTORS SPIN ON CANFORGE SHAFTS



Five 5,000 H. P. Synchronous Motors equipped with Canforge shafts, installed by the Canadian Westinghouse Company Limited, are required in this grinder operation at the Thunder Bay Paper Company. Inset shows rotor, shaft and assembled grinder motor.



Typical of Canforge service to the great Canadian pulp and paper industry are the heavy forged shafts used in this important paper mill installation. Through a continuous programme of research and improvement in facilities and capacities, the two great Canforge plants at Welland have steadily aimed at ever-higher standards to meet Canada's rapidly expanding industry. You'll find Canforge quality forgings in the mines, in shipbuilding, in electric power plants, in the railways and in the manufacture of a host of heavy industrial equipment.

Enquiries for Light or Heavy Forgings are always welcome at our Welland plant or through any of our District Offices.

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the capacitor mounting problems which might be met in the field. Details of their present line of open rack capacitor assemblies have been added. Write to Canadian Line Materials Limited, Toronto 13, Canada, and ask for bulletin PC1.

●

Water Filter Catalogue. — A comprehensive and well illustrated 24-page booklet (No. 2539A), which should be of great interest to consulting and architectural engineers dealing with water problems has been prepared by the Permutit Company.

It shows the complete line of gravity filters, which are made in three basic types of concrete, steel and wood. For copies write to the company The Permutit Company of Canada, Limited, 6975 Jeanne Mance Street, Montreal.

●

Liquid Air Review. — Canadian Liquid Air Company Limited, 1111 Beaver Hall, Montreal, release at regular intervals a well illustrated, semi-technical, publication entitled "The Liquid Air Review". This publication is not only very informative in its content, but it is well produced and profusely illustrated. To obtain copies write to the Company at the address given above.

●

Link Belt Publication. — Comprehensive information on screw conveyors and screw feeders is provided in a new 92-page book No. 2289, just released by Link-Belt Ltd.

The book gives engineering information with selection tables and horsepower formulas, layouts and arrangements, dimensional data and part numbers, to permit selection of screw conveyors and screw feeders for many types of applications. Write to the Company at 1960 Eglinton Ave. E., Scarborough Toronto, and specify Book 2289.

●

"Dominion Engineer".—No. 2 of Volume 20 of Dominion Engineer features highlights in the manufacturing activities of the Company during the year 1952. To obtain copies write to The Dominion Engineering Company Limited, Box 220, Montreal.

●

R.C.A. Victor Releases. — RCA Victor Company, Limited, 1001 Lenoir Street, Montreal, offers Journal readers the following publication. "RCA Review", a technical journal pertaining to radio and electronics research engineering. The supply of this publication is very limited and application should be made on official letterheads. "Ham Tips", a small booklet which will appeal to the communication enthusiasts. "Radio Age", a publication which covers research, manufacturing, communications, broadcasting and television. "Communications News" which deals with mobile and microwave radio.

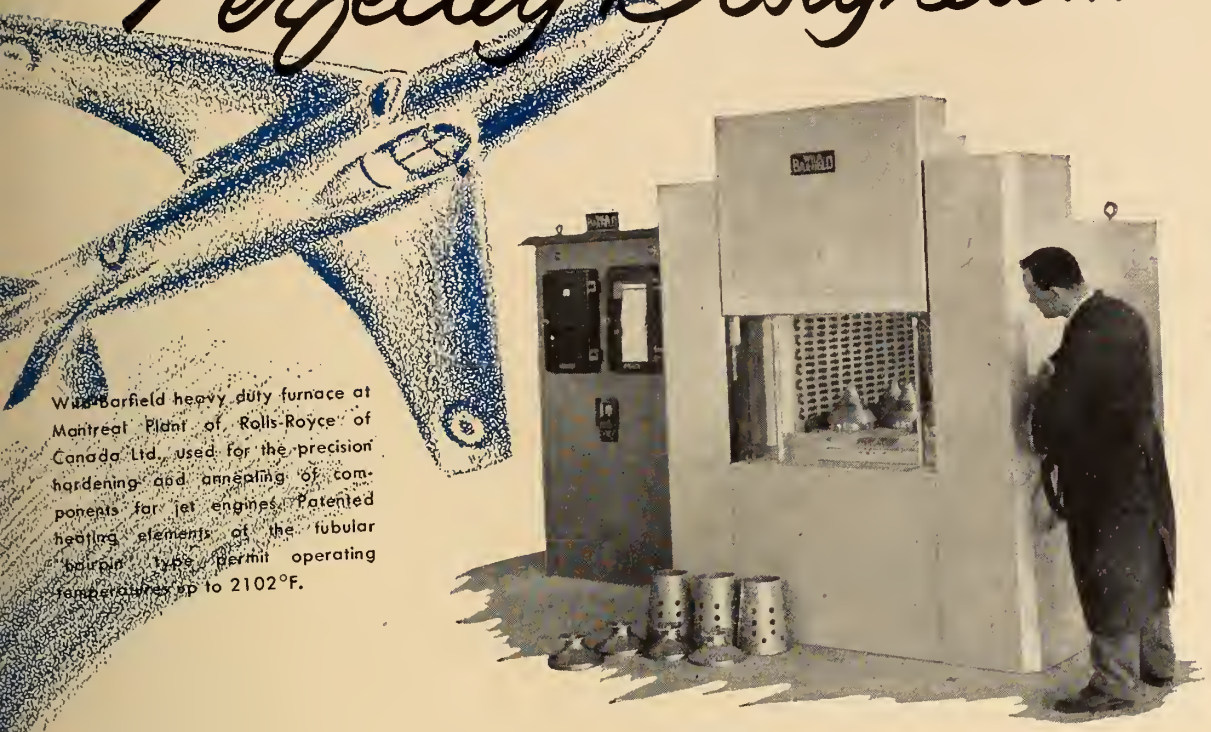
As stated above, the supply of some of these publications is limited, and requests for copies should be addressed to the Press Bureau.

●

Barrell Finishing. — A new 16-page manual on barrel finishing processes has been announced by the Minnesota Mining and Manufacturing of Canada, Limited, P.O. Box 757, London, Ont.

Use of the "honite" barrel finishing method, a low pressure, random honing

Perfectly Designed...



Wild-Barfield heavy duty furnace at Montreal Plant of Rolls-Royce of Canada Ltd., used for the precision hardening and annealing of components for jet engines. Patented heating elements of the tubular "hairpin" type permit operating temperatures up to 2102°F.

...to do the job

Like the Canadian-built "Nene" jet engine — this Wild-Barfield heavy duty production furnace is perfectly designed for its job. Both represent the culmination of ceaseless research and long practical experience.

Like Rolls-Royce of Canada Ltd. — leading firms across the Dominion are turning to Wild-Barfield for expert assistance in the solution of their heat-treatment problems.

Backed by excellent spares and service facilities — Wild-Barfield offer to Canadian users an outstanding and complete range of heat-treatment equipment for every industrial application. Illustrated catalogues will be sent on request.

Complete service and spares facilities available in Canada.

WILD BARFIELD ELECTRIC FURNACES LTD.

WATFORD, HERTS, ENGLAND

Manufacturers of Electric Furnaces, Salt Baths, Electrode Melting Furnaces, Low Frequency Induction Melting Furnaces and Protective Atmosphere Equipment

Associated with G. W. B. Electric Furnaces Ltd., The Applied Heat Company Ltd.

CANADIAN OFFICE: 72 GRENVILLE ST., TORONTO, ONT.

process for deburring and burnishing small metal parts, is described in detail in this illustrated booklet. Copies may be obtained by applying to the Company.

●

Roof Drain Catalogue.—Josam Canada Limited, 267 Davenport Road, Toronto, Ont., has recently released a new roof drain catalogue.

The Company claims that it is "the first complete roof drain catalogue of its kind ever issued". The publication contains illustrations, descriptions and installation details of drainage products for every type of roof construction—visual flow which shows all adaptations of one series of a product in one view for easy comparison and specification. It also contains feature pages, which illustrate the important features of each series of products and sizing procedures, tables and data relative to the correct sizing of roof drains and leaders are included.

Copies of this new catalogue are available to Journal readers. Write to the Company and ask for Catalogue RK.

●

New Minneapolis-Honeywell Catalogue. — Minneapolis Honeywell Regulator Company, Leaside, Toronto 17, Ont., offer Journal readers copies of their complete Catalogue No. 8305.

This catalogue describes and illustrates non-indicating electric, electronic and pneumatic controllers for temperature, pressure and humidity, also pneumatic and electric valves, switches and relays. The publication contains 80 pages and it has been designed to facilitate reading and filing.

●

Decimal Equivalents.—*Journal* readers may secure a convenient decal showing decimal equivalents in 64ths by writing to The Meyercord Co., 5323 West Lake Street, Chicago 44, Illinois.

This complementary decal is only 6" by 1¼" and is desigfined for application to slide rules, T-squares, drawing boards desk tops and other similar drawing equipment. The figures are very easy to read, printed in sharp black and red type on a white background.

●

New Portable Viscometer. — Ferranti Electric Limited announces a new portable viscometer. To measure the viscosity of a liquid, the cylinders of the viscometer are simply immersed in the liquid, the motor is switched on and the viscosity is read on the calibrated dial at the top of the instrument. Should there be any change in the viscosity due to such causes as change in temperature, chemical composition or thixotropy of the liquid, these can be observed continuously.

The Ferranti viscometer consists of a rotating outer cylinder driven by a small motor with a second cylinder located coaxially within it. The inner cylinder is free to rotate against a calibrated spring with a pointer to show the angular deflection. The mechanism for driving and measuring is encased at the top of the instrument with a glass window for viewing the dial. A convenient handle is provided through which passes a three core flexible main lead approximately 8 feet long.

For further information write for bulletin List IN 125. The address is Ferranti Electric Limited, Mount Dennis, Toronto 15, Ont.

●

New Honeywell Valve.—A new Honeywell on-off, bellows-sealed fuel valve (Type 27) is fully described and illustrated in a new specification sheet. These valves are particularly designed for handling volatile and toxic mediums.

The new sheet gives pertinent data regarding size, construction, materials and complete mounting dimensions. Write to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario, and ask for Specification Sheet No. 424.

●

Torch Catalogue. — Dominion Oxygen Company Limited, 40 St. Clair Avenue East, Toronto 5, Ont., offer copies of a new Heliarc Torch Catalogue.

It contains details and specifications of the newest heliarc torches. The catalogue contains charts giving selection data on electrodes, nozzles, and argon cylinders as well as detailed information on argon regulators and flow meters.

To obtain copies write to the Company at the address given above and ask for form No. 7979.

●

Our customer's answer was:

"SPUN ROCK WOOL* INSULATION NEVER SETTLES IN THE STEEL CASE!"

"You see," he explained to his foreman, "Spun Rock Wool* consists of extra long fibres. Because they have a natural resiliency, no binders are needed in the industrial blankets. That's how Spun Rock Wool* avoids the fault of some other insulators whose binders often break down at high temperatures, causing the insulation to settle in the steel case.

"There are other advantages, too. For instance, Spun Rock Wool* is non-corrosive. It is also lightweight and fireproof."

So remember — when you want to save money through more efficient insulation in boilers, refrigerators, drying ovens, oil refineries or other industrial installations, it will pay you to investigate Spun Rock Wool*.

For samples and technical data write:

SPUN ROCK WOOLS LTD.

THOROLD ONTARIO

Represented by
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Toronto and Montreal

*Reg'd.

SPUN ROCK WOOL HEAT COLD SOUND INSULATION

Got a refractory problem . . .

CONSULT PLIBRICO

Is it selecting the right grade for the job?
Whether it's a boiler, an incinerator, or an industrial furnace, Plibrico can give you expert assistance. Plibrico manufactures a full range of refractories, including Plibrico Jointless Firebrick—the original plastic refractory—and Plicast castables.

Is it a question of construction?
Plibrico has broad experience with refractory linings for all types of service and has developed construction features adapting Plibrico monolithic linings to every need. Plibrico monolithic construction assures long-lived refractory linings in boiler furnaces, incinerators, and industrial furnaces.

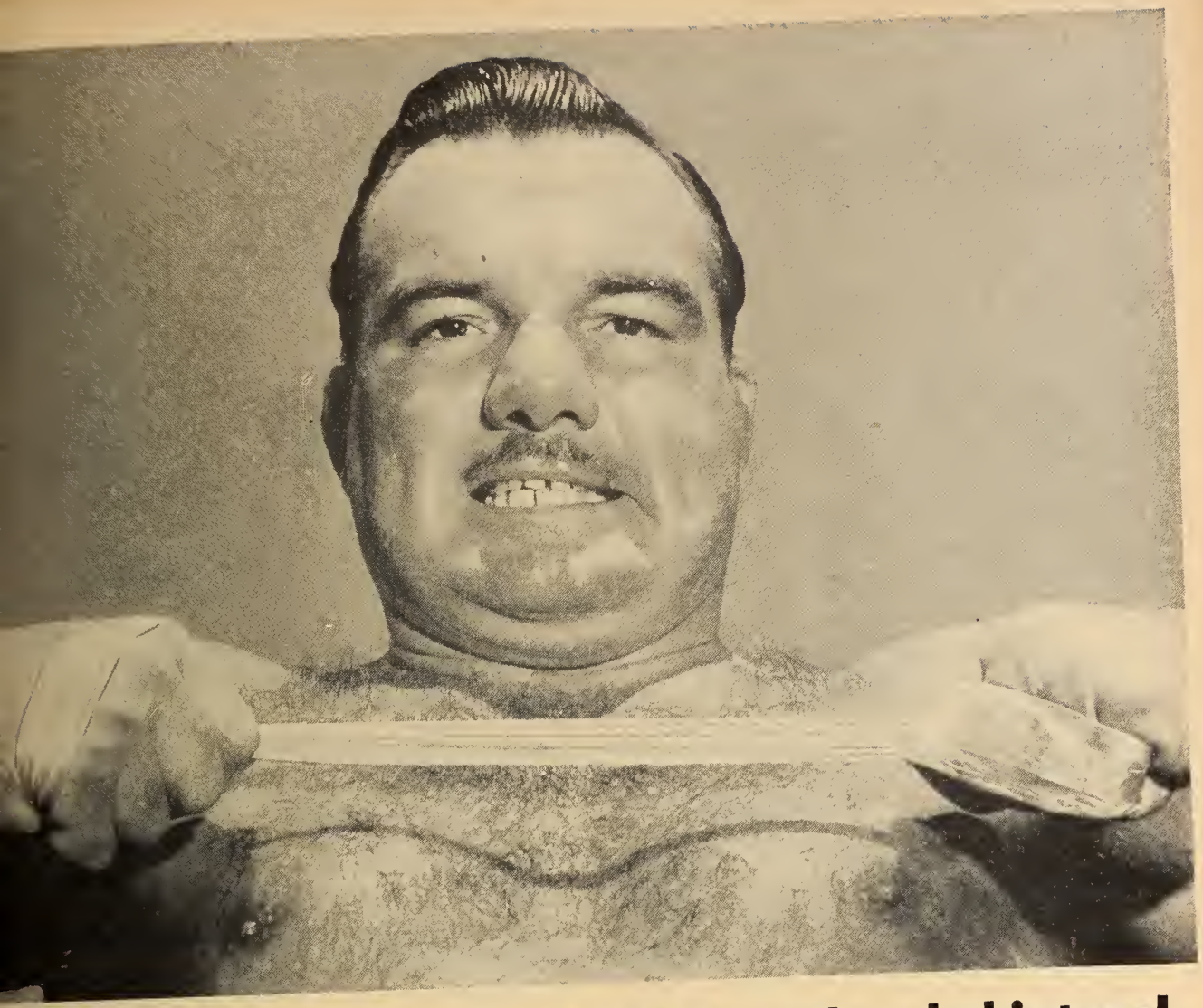
Is it a question of efficient design?
Designing boiler settings and incinerator furnaces for maximum combustion efficiency is an everyday thing with Plibrico. In the incinerator field for example, Plibrico has developed standard models for every disposal need.

Plibrico has the answers to these, and any other questions about refractory linings. Let us assist you in planning your refractory work, preparing specifications—yes and even with actual installation. How may we help you? *Write us your problem.*

Plibrico (Canada) Limited

P. O. Box 10, New Toronto 14, Ontario

REFRACTORY ENGINEERING & CONSTRUCTION FOR BOILERS • INCINERATORS • INDUSTRIAL FURNACES



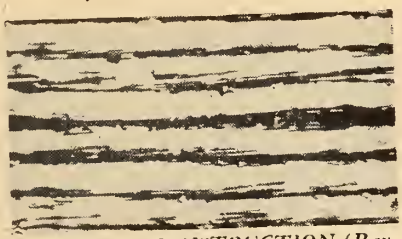
Even "WHIPPER" BILLY WATSON can't break this tape!

Not even wrestling champion "Whipper" Billy Watson can break it. Use this amazing new tape for your toughest bundling, packaging, or strapping jobs . . . wherever you need strength plus flexibility.

This tape has a strong, pressure-sensitive adhesive that sticks instantly with only hand pressure. "SCOTCH" Brand Filament Tape is quick and easy to use, will not cut or injure workmen or handlers.

HEAVY PAPER ROLLS are strapped for palletizing—securely and with no damage to outer layers.

HEAVY METAL RODS and STRIPS turn into easy-to-handle bundles firmly held with "SCOTCH" Brand Filament Tape.



FILAMENT CONSTRUCTION (Rayon #880 and Fiberglas #890) of "SCOTCH" Brand Filament Tape is shown in this microphoto.

REG. TRADE MARK

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BRAND
FILAMENT TAPES

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Position.....

Company.....

Address.....

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Quality Products

90 years of continuous production

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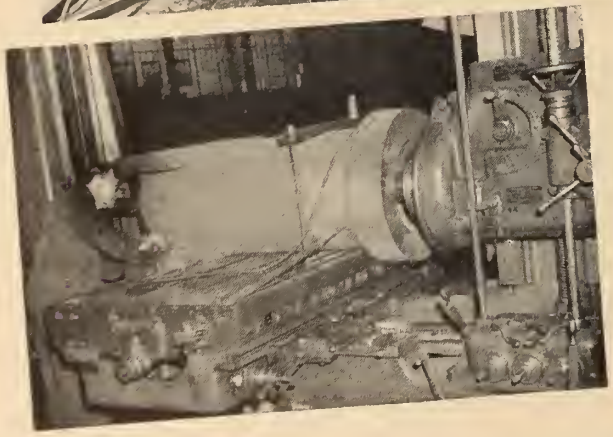

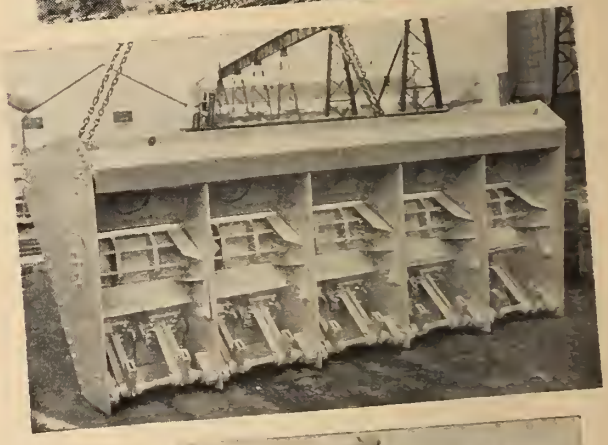

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skilled and experienced craftsmen,
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— of materials and workmanship on general construction and foundation work for buildings, bridges and roads.

— of electrical and mechanical equipment during manufacture.

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THOMSON ELECTRICAL WORKS LTD.

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New Equipment and Developments

ircraft Tools. — H. Scheunert, M.E.I.C., s opened his own tool design office nder the name of Aircraft Tool Engi- eering Reg'd. Before starting his own usiness, Mr. Scheunert was chief tool esigner at Canadair Limited. He has een associated with Canadian aircraft dustry for 22 years. From 1930 to 1935 e was service engineer and manager ith Canadian Junkers Limited; from 937 to 1941 he was project engineer nd chief tool draughtsman, Canadian ar and Foundry, Aircraft Division, fter which he was superintendent with Noorduyn Aviation, Montreal, which roduced North American Harvard rainers and the Noorduyn Norseman. here, during the war years he was also anagement chairman of the joint pro- luction committee.

●

Petrochemical Plant.—The new petro- hemical plant of B.A. Shawinigan Lim- ted, in Montreal East, was officially pened by Resources and Development Minister R. H. Winters on May 28. At the opening of the plant were, among others, R. E. Irwin, JR.E.I.C., plant manager, J. A. Fuller, President of Shawinigan Water & Power Company, Ole Berg, jr., president of the British-American Oil Co., Ltd. and V. G. Bartram, president of Shawinigan Chemicals Ltd. The new firm is a joint undertaking of B.A. Oil and Shawinigan Chemicals.

●

Liquid Air Expansion. — Canadian Liquid Air Company Limited has made another major step in its continuous expansion of manufacturing and distributing services. It is announced that the Company has just taken over the Cranbrook, B.C. plant and business of Western Oxygen Company. William B. Campbell of Liquid Air's Edmonton Branch has been appointed manager at Cranbrook.

This addition to the L.A. plant makes it the third in British Columbia. The fourth is expected to be completed this year at Kitimat—the first manufacturing plant at the side of this huge aluminum project.

●

New Shawinigan Transmission Lines. —The Shawinigan Water & Power Company, Limited, is planning a $1,600,000 expenditure on two new transmission lines—one from the Quebec City terminal to Chaudiere, and the other from Chaudiere to Beauceville in Quebec. The ten-mile Quebec to Chaudiere line is being built at a cost of $827,000 and will have an eventual capacity of 220,000 volts. The Chaudiere Beauceville line, 45 miles long, will operate at 66,000 volts and will cost $780,000. Both lines are expected to be in operation by July of next year.

●

Link-Belt Address Change. — Headquarters for Link-Belt Limited, including general offices, district sales, engineering, purchasing, order and accounting, were moved on May 19 to the Company's new Scarboro Plant at 1960 Eglinton Avenue, East, Scarboro Township which is approximately 10 miles from downtown Toronto.

The new plant is located on a 20-acre tract, permitting future enlargement to several times its present size.

●

BOOTHS Steel Rolling Shutters

articularly Effective where Unobstructed Floor Space is an Advantage

PECIAL FEATURES. Extra Strong Steel Laths of a shape which prevents lodgment of corrosive dust in the joints. Machine-cut worm-driven hoisting gear making shutters safe in any position. Operated by electric motor and/or hand chain.

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Canadian Distributors {Eastern & Maritime}
DAVID McGILL & SON
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Grain must move!

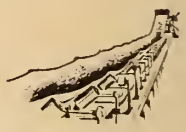
Potential supplies of Canadian wheat for 1952-53 are estimated at 901 million bushels. This includes a carryover of 213 million bushels.

The movement of so vast a quantity of "prairie gold" from farms . . . to elevators . . . to grain boats . . . is a colossal task. At each point of transfer there must be modern high speed conveyor systems *plus* specialized engineering to move the grain efficiently, safely and economically. This would be impossible without expert knowledge of materials handling equipment—such as United Steel offers.

United Steel Corporation engineers and manufactures all types of grain conveyors and handling equipment as well as practically every type of industrial equipment where materials handling plays a necessary part.

DODGE SCREW CONVEYOR

DODGE GRAIN TRIPPER



DODGE BELT CONVEYOR

For assistance with your *materials handling problems, write to—*

UNITED STEEL

DODGE MANUFACTURING DIVISION **CORPORATION LIMITED** CANADIAN MEAD MORRISON

TORONTO • WELLAND • MONTREAL • WINNIPEG • KIRKLAND LAKE

thetic Latex. — Construction of a thetic latex unit was started early month by Dow Chemical of Can- Limited at Sarnia.

'he unit which is expected to be production by early 1954 will be structed at a cost in excess of a lion dollars.

●

w Dominion Oxygen Equipment.— new, lightweight sigma (shielded rt gas metal arc) welding machine, signated as SWM-3 has been an- unced by the Dominion Oxygen mpany Limited.

The machine features arc voltage ntrol which, it is claimed, eliminates welding problems that are due to fluctuating arc voltage. Electronic ntrols maintain the proper balance of elding conditions by instantaneously eeding up or slowing down welding re feed rate as required by changing c conditions. As a result uniform elds are made.

Voltage control was developed for gma welding by Dominion Oxygen ompany Limited and Linde Air Pro- ucts Company, a division of Union arbide and Carbon Corporation. The ectronic control unit does not get in ie way of the welding operator or ther work going on in the shop. It oes not have to be moved with the elding machine from one job to another. It can be permanently mounted in any convenient position.

For complete details communicate with Dominion Oxygen Company Limited, 40 St. Clair Ave., East, Toronto 5, Ont.

●

New Stelco Product.—The Steel Company of Canada Limited is now placing on the market an assembly consisting of flattened head lag bolt and stove bolt assemblies. The new assemblies consist of a round head stove bolt, complete with nut, inserted through a hole punched in the flattened head of a lag bolt.

They are generally used for suspension work with perforated suspension strap for installing exposed piping such as sprinkler systems.

The screw thread of the lag bolt has a gimlet point to permit an easy and positive insertion in joists and overhead surfaces. The suspension strap can be secured quickly to the lag bolt by inserting the stove bolt through one of the perforations in the strap.

Stock sizes consisting of 5/16" by 3" and 3½" lengths; ⅜" dia. by 2½", 3, 3½ and 4" lengths and 7/16" dia. by 4" length. They can be obtained in plain finish or hot galvanized when specified. Samples may be obtained by contacting The Steel Company of Canada Limited, P.O. Box 460, Montreal.

●

Robertson-Irwin Anniversary.—Robertson-Irwin Limited of Hamilton, Ont., celebrated its 90th anniversary by expanding its role as supplier of many of the basic requirements of Canadian industrial and commercial construction. The Company was founded under the name of Thomas Irwin & Son Limited by the grandfather of the present president, Thomas Arnold Irwin. In those days there were fifteen employees, the annual payroll was $5,800. Three generations of Irwins have watched their business grow with Canada's industrial expansion. Meanwhile, a firm with similar interests, founded by New Brunswick-born H. H. Robertson was making its reputation in the United States. In 1945 its Canadian subsidiary, the H. H. Robertson Company Limited and Thomas Irwin & Son Limited amalgamated and became Robertson-Irwin Limited. Robertson Thain Limited, a similar organization in the United Kingdom, is an affiliate.

Since 1945 Robertson-Irwin sales have jumped over 700% compared with the combined sales of the two companies before amalgamation. The principal products of the Company range from cellular steel "Q" floorings and insulated metal "Q" panels, to metal roofing, ventilators, skylights and sash, storage tanks, steel culverts and materials handling equipment.

The Company has highly skilled erection crews whose supervisors travel

MILLIONS of running hours to their credit for

THOUSANDS of users on

HUNDREDS of applications

Proof of endurance comes back to us from all quarters of the world

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Dependable power for Industry and Agriculture

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Yes, for over 30 years we have been delivering concrete pipe—when *it's needed*, to municipal, highway and railway construction jobs. We have a well-earned reputation for producing dependable, long-lasting piping that operates efficiently.

In our plants we have the most up-to-date equipment available to the concrete pipe industry. Add to this a staff of qualified engineers, regular uniformity and strength checks on all piping—and you have a product that is the best in the concrete pipe field!

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INDUSTRIAL PLANT STORM DRAINAGE • TOWNSHIP DRAINAGE SYSTEMS

coast to coast. Another widely service provided by the Company e custom fabrication of metals.

●

ds and Defence.—A warning that Federal Government's refusal to nowledge the military role of roads jeopardizing the joint defence of North American continent was n by C. W. Gilchrist, managing ctor of the Canadian Good Roads ociation, when speaking to the erican Society of Civil Engineers in shington on May 26.

Ir. Gilchrist declared "the roads of ada at present could not withstand mass movement of troops from the ited States to Alaska or the North- t Territories". Any large-scale move- nt of Canadian troops from east to st would place an intolerable strain Canada's transportation system.

Ir. Gilchrist said "We are at present onstructing western highways to dest specifications. The western pro- ces have pointed out to the Federal vernment that their roads are not ilt for military traffic and if, in fact, ds have any part in the nation's de- ce plans, now is the time to build se roads to adequate specifications.

●

ew Pen Plant. — The new Canadian ant to be started soon for the W. Sheaffer Pen Company of Canada td., at Goderich, Ontario, will mark e first use of The Austin Company's "convertible design" in an industrial plant outside the United States.

Adoption of this design for the 36,000 sq. ft. manufacturing plant, where Sheaffer pens, pencils and other products will be produced, was based on a desire to maintain the best possible working conditions at all times.

●

Representatives Wanted. — A well known United States manufacturer of sluice gates of three types—cast iron, heavy timber and steel—needs Canadian representation in Canada. The Company has supplied sluice gates and accompanying equipment to waterworks, waterpower developments and sewage disposal plants in the United States and Canada.

Journal readers who are interested in communicating with this Company to obtain further details are invited to write, confidentially, to the Publications Manager, The Engineering Institute of Canada, 2050 Mansfield Street, Montreal 2, Que. Mark the letters "confidential".

●

The Employment Situation.—According to information released jointly by the Department of Labour and the Dominion Bureau of Statistics, an accelerating pace of employment expansion was the highlight of the Canadian manpower picture during April of this year. A sharp increase in seasonal activities and the steady growth of labour requirements in the consumer goods, defence material, building supplies and residential and commercial construction industries are the main causes.

For the first time since early last fall there was a marked increase during April in the total number of people in Canada working full time. Labour surpluses declined considerably during the month, not only in urban areas where this trend had begun earlier but also in the rural districts where employment was increasing in agriculture, construction and logging. By the end of April, labour demand and supply were in approximate balance in areas covering 60 per cent of all paid workers in Canada. Hiring activity was strongest in the Ontario and Prairie regions with labour surpluses continuing, although diminished, in most other parts of the country.

●

R. G. LeTourneau Sold.—On May 12 it was announced that the Westinghouse Air Brake Company had purchased the earth-moving and related business of R. G. LeTourneau, Inc., including all fixed assets and machinery at Peoria, Illinois, Toccoa, Ga., and its interest in the Australian subsidiary for approximately $19,500,000. Westinghouse will also take over certain current assets of the LeTourneau company, consisting principally of inventory, at book value less reserve, at an estimated price of $6,000,000 to $8,000,000.

The new business will be operated as the LeTourneau-Westinghouse Company. No change in personnel is contemplated and all key executives will remain with the new company.

●

HOW TO MAKE 1000 CALLS A WEEK

...IN CANADA

With even the largest sales force you must inevitably ignore some accounts at times . . . unless you also use selective business paper advertising to keep your customers informed.

No matter what your product or service, there are one or more Canadian business papers to carry your messages to exactly the field you want to reach. Supplement your personal calls by regular contacts through business papers, and keep *all* your customers informed, *all* the time.

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OBTAINABLE FROM ALL CANADIAN PACIFIC AGENTS AND MOST BANKS

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Sheet metal is a standard material in all branches of construction. PEDLAR'S offer one source of supply for their "Metal-Built" Products through nation-wide sales offices and warehouses.

PEDLAR'S "*Rainbow*" *Rib Roofing*, a weatherproof and fire-resistant sheet roofing for barns, warehouses, arenas and industrial buildings; designed for many years of service.

PEDLAR'S *Metal Lath*, an expanded mesh, flat lath that insures speedy application, a big saving in plaster, plus a smoother and better plastering job on all interior surfaces. PEDLAR'S "Cornerite" is recommended for use in corners and junctions of walls and ceilings.

PEDLAR'S *Metal Culverts*. These drainage pipes are made in five types, each designed for a special drainage purpose. If you have a drainage problem, our nearest office will gladly forward advice on the type of culvert required for the job.

Among the many PEDLAR Products are, Barn & Stable Equipment, Ventilators, Well Curbing, Steel Shelving, Lockers, Reinforcing and Industrial Mesh, Mine Ventilating Pipe, etc.

Write for full information and prices

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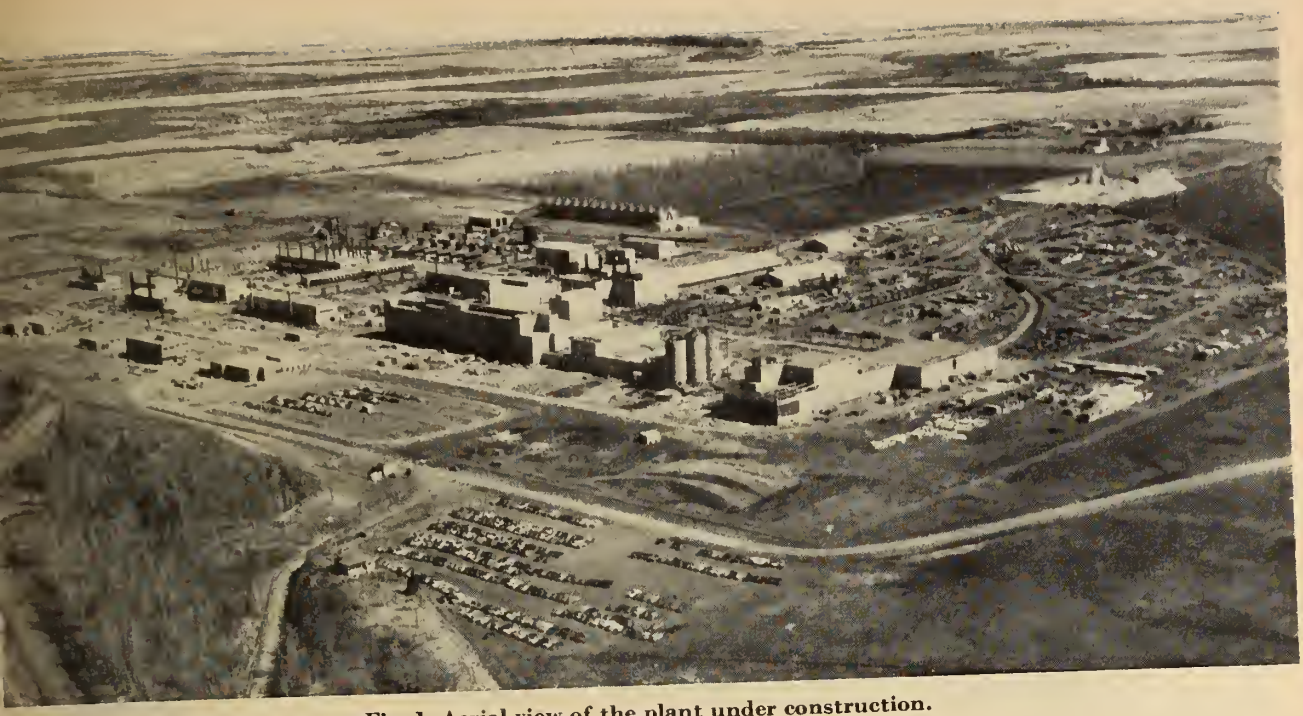

Fig. 1. Aerial view of the plant under construction.

Economy through Standardization

by

D. R. Keck

Plant Engineer,
Canadian Chemical Company Limited, Edmonton, Alberta.

A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 20, 1953.

Briefly outlining the various manufacturing operations at the Canadian Chemical Company's new Edmonton plant, this paper describes the lengths to which standardization has been applied to the refinery type equipment in the Petrochemical Area, for distillation towers, tanks, heat exchangers, pumps, instruments and piping. The resulting savings are enumerated. At the same time the author lists some of the dangers that may result from too much standardization.

Most of you have probably heard of the plant which the Canadian Chemical Company is constructing at Edmonton, Alberta. This plant will manufacture organic chemicals from petroleum and cellulose acetate from petroleum and wood pulp, which is manufactured at the Company's plant at Prince Rupert, B.C., and will do the spinning of cellulose acetate into yarn. In the design of its Edmonton Plant the Company has endeavoured to standardize the design of as much equipment as possible. However, before discussing the standardization of equipment, it would probably be helpful to review what is being attempted with the equipment, in order to give a better idea of the type of equipment used and the materials being handled.

The plant is divided into three sections, the Petrochemical Area, the Cellulose Acetate Area, and the Yarn Area. (Fig. 1.) Feed stock to the petrochemical plant will be from two sources, liquefied butane and propane from gasoline plants, and recovered gases from Edmonton refineries. A hydrogen sulfide removal unit is required to remove this component from the refinery gas streams before the propane and butane can be fed to the oxidation unit.

The oxidation unit, operating under carefully controlled conditions, uses air as the source of oxygen to produce the following recoverable chemicals: formaldehyde, acetaldehyde, propionaldehyde, acrolein (the unsaturated form of propionaldehyde), propylene oxide, methanol, acetone and mixtures of heavier aldehydes, oxides, alcohols and ketones. Two chemical streams leave the oxidation unit, one primarily formaldehyde, the other containing the remainder of the oxidation products.

The formaldehyde-containing stream is pumped to a separate unit, where it is purified to 37 per cent formalin solution for sales or transferred to another unit for conversion to pentaerythritol. The main chemical stream from the oxidation unit is

Fig. 2. Aerial view of the Petrochemical Section.

fed to the products purification unit, which is the largest unit in the Petrochemical Area, containing about twenty-five towers and extractors.

By the employment of straight distillation, azcotropic distillation, extractive distillation, and liquid-liquid extraction, the products of the complex feed mixture are separated into pure products or mixtures of products, which are further purified in a separate specialties unit.

One of the larger streams from products purification, acetaldehyde, is either sold on the market or converted to acetic acid by oxidation with air in the acetic acid unit. The conversion of acetaldehyde to acetic acid is a relatively simple reaction, but extensive distillation and extraction equipment is required to produce a pure acid product at a high recovery efficiency.

Chemicals produced will be shipped by rail or truck. Liquid products will be handled either in drums or tank cars, while solid products will for the main part be shipped in bags. Due to the remote location of the plant with respect to some of the larger markets, considerable storage facilities have been provided to permit steady operation of the plant, should delays in tank car movements to or from outside points cause erratic shipping rates.

From the foregoing brief discussion of the Petrochemical Area one can see that refinery type equipment such as distillation towers, tanks, heat exchangers, pumps, instruments and piping is primarily required. The Cellulose Acetate and Yarn Areas, on the other hand, are primarily solids handling, and require a much smaller percentage of refinery type equipment. For this reason the standardization program to be discussed applies primarily to the Petrochemical Area of the Plant.

Standardization of Layout and Buildings

The first standardization applied to the Petrochemical Area was the block layout system. This provides a three hundred foot square block for each unit, with a one hundred foot roadway and pipe lane clearance between blocks. The block system was adopted to provide room for expansion of various sections of the plant without interferences. (Fig. 2).

All told, there are eight blocks in the Petrochemical Area. The product purification unit could not be installed in this size block, making it necessary to assign a three hundred foot by seven hundred foot area to this unit. Generally the longitudinal axis of the buildings is in the centre of the block, the building being located closer to the south end of the block to permit extension if desired at a later date. Location of the buildings in this manner within the block will permit the removal of any item of major equipment from the block, without interference from other units or utilities equipment.

The second item of standardization in the Petrochemical Area is the design of the buildings. The buildings are forty-eight feet wide and thirty-two feet high at the eave, with the second floor elevation sixteen feet above the first floor. Standard fifteen foot bays were selected to hold virtually all types of equipment required. Most of the building cross sections are identical with regard to height, width, roof structure, floor loading and equipment layout. By this design the drawing, ordering and fabricating of the structural steel for the buildings was simplified to the maximum extent.

A twenty-four foot shed is provided along one side to house the bottom portions of the fractionating towers and their reboilers. A fifteen

ot shed is provided on the other de of the building to house the nds of the rundown tanks and neir transfer pumps. Thus the perators of the units can carry out heir assignments completely in- oors. The only outdoor work re- uired will be that of transferring f material from storage to tank ars or from storage to other units. Fig. 3).

Overhead vapour lines from the owers will enter the building hrough the walls of the second loor, where heat exchangers are ocated along one side of the second loor. This gives clearance on the other side of the second floor for cleaning the tubes, replacing the tubes or removing the entire heat exchanger. An overhead crane has been provided in the second floor of each building to permit removal of the heat exchangers and other equipment from the building for repairs or replacement.

The first floor of each building contains the fractionating tower pumps, the piping for the unit, the control rooms for operating the units, electrical control rooms, a locker room for employees of that building, a small tool room and a small laboratory. Some of the control rooms are located in the shed area on the same side of the building as the rundown tanks, while some are located within the buildings themselves. Residue lines from the towers flow directly into the pump suctions, with no traps in the lines and the shortest possible distance. This minimizes NPSH difficulties when pumping boiling liquids.

Due to numerous openings in the sides of the Petrochemical buildings, required for the piping to and from towers, it was decided to use a Trafford tile or transite type wall, which can be easily cut. This siding is supplied in standard size sections, which can be easily fitted to the building steel at a low cost. Following the example of some of the other people in the area we are using a sprayed-on asbestos insulation for the Petrochemical buildings.

On the other hand, buildings in the C.A. and Yarn Areas are made with the precast concrete wall slabs, consisting of two inches of concrete, two inches of foamglas and two more inches of concrete, held together with reinforcing and bolted to structural steel framework. Basic differences in type of equipment housed is the reason for different construction.

The ventilating of all buildings presented a serious problem, because of the high freezing point of

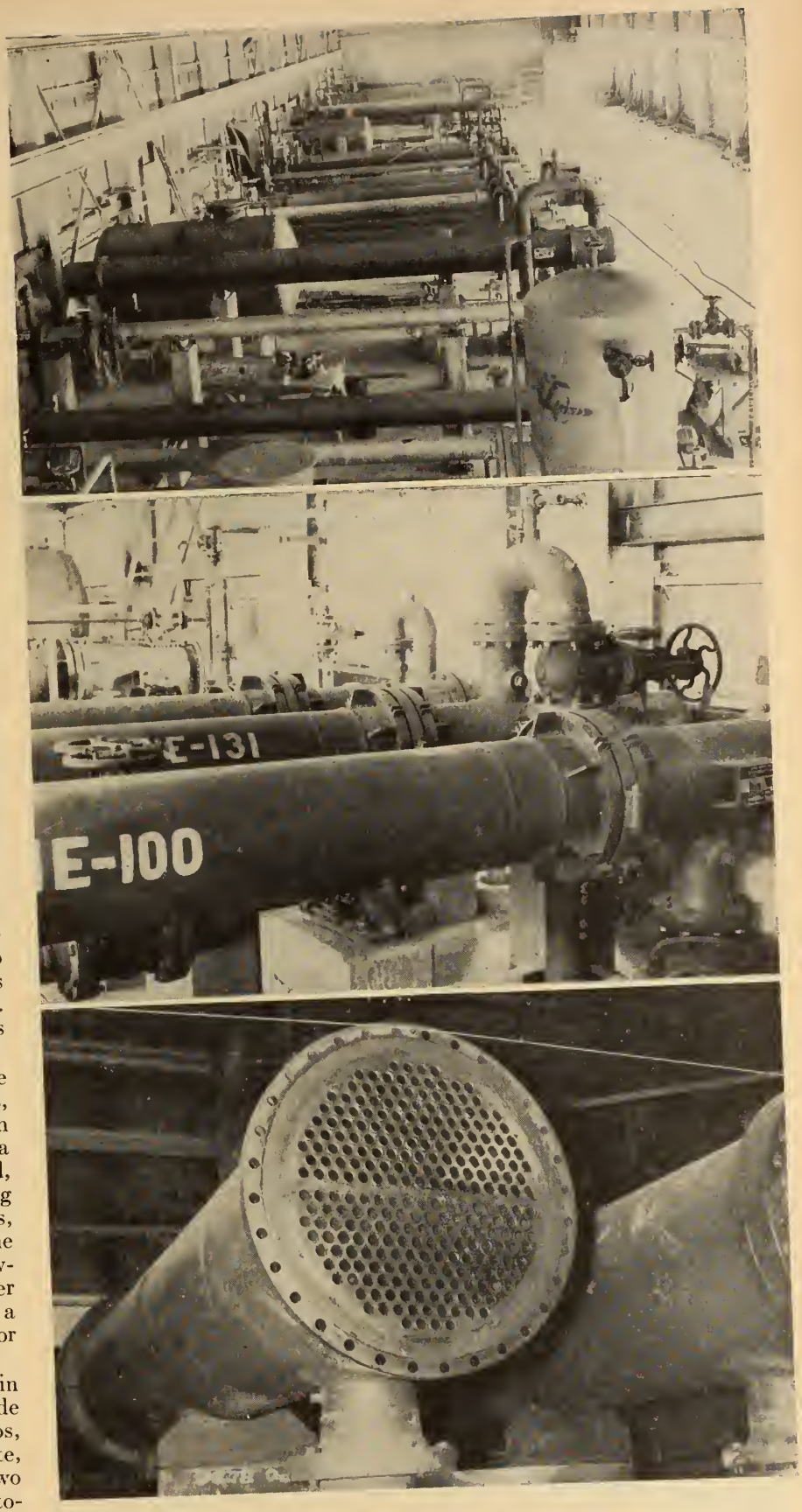

Fig. 3 (top). Typical heat exchanger installation.

Fig. 4 (centre). Illustration of heat exchanger shell expansion joints.

Fig. 5 (bottom). Heat exchanger with standard two-pass tube layout.

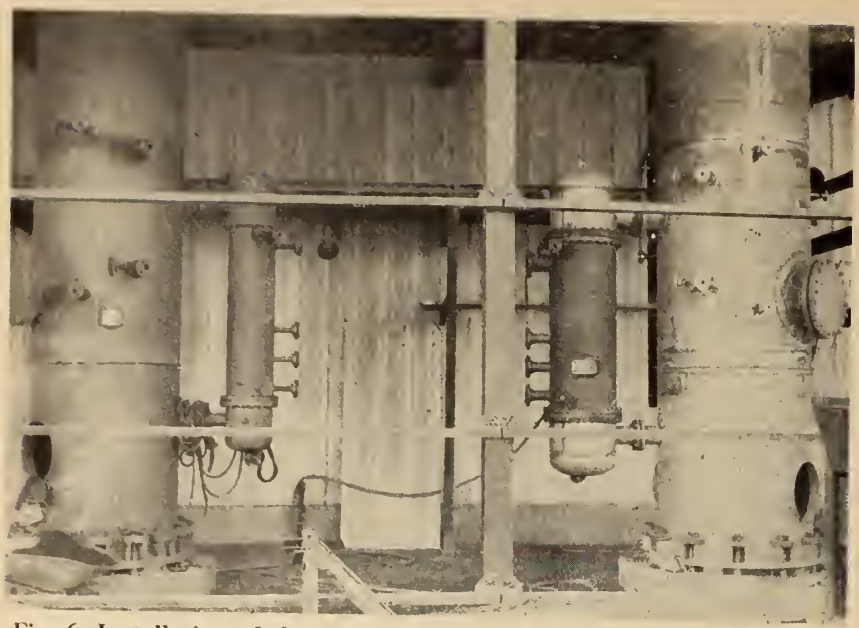

Fig. 6. Installation of thermo syphon reboilers on fractionating towers.

some of our produets and their lachrymatory properties. The eombination of these two items required from five to twelve air changes per hour within the buildings and the maintenanee of a reasonable temperature within the buildings. Control rooms are pressurized with heated, outside air, which eliminates the nccessity for explosion-proof instruments and elcctrical eontrols in these areas. Through the use of transmitters, no chemicals are piped into the control rooms.

Due to the combustible nature of many of the ehemicals, there are no trenches in the floors of the buildings. All serviee piping runs overhead inside the buildings, leaving the sewers and scavenger systems as the only underground piping. The seavenger systems consist of stainless steel underground header systems. From these, any pump leakage or sample bottle washings are colleeted at a number of central points for returning to the process tanks. While this system is quite elaborate, it is soon paid for by the reduction of losses of products, whieh range in value from twenty-five cents a gallon to fifty cents a pound.

Standardization of Storage System

One of the areas of the Petrochemical section of the plant eontains most of the storage tanks. (Fig. 2.) Spherical pressure storage tanks are supplied for butane and propane and some high vapour pressure products. Spheroidal-roofed tanks are provided for low vapour pressure yet volatile products, which must be connected to plant vapour recovery systems. Cylindrieal pressure tanks are used for small volume high vapour pressure products, and ordinary eone-roofed tanks are used for the low boiling materials.

All piping in the tank farm is about three feet above ground on eoncrete sleepers. This permits aecessibility to the piping and eliminates the losses of products due to leaks in underground lines. An unused line can be salvaged economically, or an undersized or corroded line can be readily replaced. Each tank or tanks containing the same product have individual pump houses, whieh greatly reduces the amount of intereonneeting piping in this area. A further advantage of this type of installation is that it is impossible for the pumper to open the valves from the wrong tank into the pump for transferring the material to another point. The tank ear loading raek is adjaeent to the tank farm.

Standardization of Heat Exchangers

One of the most highly standardized items of the plant is heat exchangers. All heat exchanger tubes are one inch O.D., and are either twenty feet long or some equal division of twenty feet, whieh gives 100 per cent utilization of the standard twenty foot tube length The vapour condensers and liquid-liquid exchangers are virtually all twenty feet long. Due to the rigid specifications of our produets no floating tube shcets are used; instead expansion bellows have been installed in the shells of units where appreciable expansion will oecur. (Fig. 4). This stems from the fact that it is impossible to eliminate leaks in the floating tube shects and their gaskets due to unequal expansion of the bolts and head and tube sheet materials.

This unequal expansion results in over- or under-compression of the gasket at some time during the cycle, giving rise to leaks. With the exception of some of the large standardized units, all of the condensers and exchangers are drilled for two-pass flow, although many of these are installed with one-pass heads. (Fig. 5). This design permits changing the number of passes on the tube side by minor changes to the heads, making each tube bundle more readily adaptable to changing conditions.

Thermosyphon reboilers are used throughout the Petrochemical section. (Fig. 6.) By thermosyphon, we mean that the process fluid is circulated through the tubes, the motivating force being the difference in density of the liquid in the tower base and the liquid and vapour passing up through the tubes. Generally speaking, the amount of surface required by thermosyphon type of construction is about one half of that required for the kettle type. A further saving of spaee is effeeted beeause the unit mounts vertically elose to the tower and has a much smaller diameter and tube length.

Very little liquid is retained in the reboiler tubes, sometimes a factor where polymerization might occur with long retention times at elevated temperatures. Experimental work is progressing whieh will ultimately lead to the publieation of our information on these units. The design of the thermosyphon reboilers has been standardized, so that we have 8 in., 12 in., 16 in., 20 in., 24 in., 30 in., and 36 in. diameter bundles with tube lengths of 5 ft. and 6 ft. 8 in. Any reboiler of the same diameter and tube length can be interchanged with any other reboiler of that diameter in the plant.

In future plants it is planned to further standardize the centerline to centerline dimensions of the nozzles, so that there will be only two or three different ones, making it possible, for instance, to replace a 36 in. reboiler with a 24 in. reboiler without making any changes to the tower. Due to the vertieal installation of these units and the faet that the liquid level in the tower is maintained at the top of the tubes, there is available suffieient NPSH for the operation of the bottoms pumps from the fractionating towers.

In a number of instances we have

ound that, due to the low boiling oint of the material on the process ide, the pressure in the steam chest alls below that of the condensate eturn system. To overcome this ondition three condensate drawoffs ave been installed in the shell of all eboilers, to permit blanking off of a ortion of the bottom area, which in urn will raise the condensate pres- ure and bring the unit back under ontrol.

Fractionating Towers and Storage Tanks

About two thirds of the fractionating towers are equipped with sieve trays. Sieve trays differ from bubble trays, in that the bubble caps and risers have been replaced by numerous perforations in the tray to permit passage of the vapours up through the tower. All towers of a given diameter have the same perforating patterns.

If the number of holes required to give stability is different from the number perforated on the tray, those holes not needed are sealed off by the installation of blanking strips across rows of holes. Each tray is perforated to permit the maximum allowable flow for that diameter tower on any of the products which we normally process in our towers. Details of the sieve trays were published in "Industrial & Engineering Chemistry" last year, and those interested have probably already seen the paper.

In order to provide stability to external forces from wind, the towers have been designed with a minimum wall thickness of one quarter inch. The design pressure is then back calculated according to the A.S.M.E. code at a temperature of 400°F. By this method of assigning design pressures, towers are approved for operation at their maximum allowable working pressure, although the actual operating pressure at a given time may be much less. This provides needed flexibility in a plant where the changes in market conditions might require changing the service of the tower several times during its life. In our previous experience, there are some units in which the service of every tower has been changed at least once.

Aside from the storage tanks, which were standardized to a certain extent, most of the in-process storage tanks are 3 ft. by 5 ft, 5 ft. by 8 ft., 6 ft. by 30 ft. or 8 ft. by 30 ft. The latter two are used for product rundown tanks while the others are overhead receivers and surge tanks. Although some price advantage was obtained by standardizing on these sizes, a further saving could have been effected by purchasing standard LPG storage tanks from small manufacturers, who manufacture them on a production line basis at a cost of about fifteen cents per pound. In the future the LPG tanks will probably be used, which normally come in two sizes, five hundred and one thousand imperial gallons, in place of our 3 ft. by 5 ft. and 5 ft. by 8 ft. tanks.

Standardization of Pumps

The selection of centrifugal pumps was made by comparing equivalent pumps from several manufacturers, then selecting two manufacturers to supply the main group of pumps, (Fig. 7), one, the cast iron and steel, the other the stainless steel pumps. Instead of selecting the most efficient pump for each of the individual services, several sizes of pumps were selected and the one coming closest to the requirements for each service taken. By this method the number of different sizes of pumps was reduced by about two thirds, and a saving of about $50.00 per pump realized in the original purchase price.

In addition, by eliminating a number of sizes of pumps there is considerable saving in spare parts investment and warehouse space for maintaining the pumps. Of course, the efficiency of pumping was sometimes affected adversely. With the low flow rates and heads required

Fig. 7. Illustration of standardization of pumps.

in most instances, however, the difference of a small percentage efficiency is not to be considered, because it amounts to so little in the overall plant power load.

Most pumps are electric motor driven, with a motor being supplied which would carry the pump throughout its entire operating range with the impeller size being used. Turbine drives are being provided in two instances; one, to utilize the power from the considerable volume of high pressure vent gas and second, to keep the liquids flowing in the event of a power failure, where the failure of the pump would result in the loss of control of the reaction or serious losses of materials.

Most pumps are supplied with mechanical seals, which are interchangeable from one type of pump to another. Less than one half dozen seals are being used in the plant on the standardized group of pumps. Only maximum diameter impellers will be stocked and the plant machine shop will trim them to the required diameters immediately prior to installation. All pumps are mounted for the largest motor which that pump can utilize with its maximum diameter impeller. This will permit the changing of service of the pump without remounting the entire pump and motor unit.

Three horsepower minimum electric motors are used to ensure the operation of the pump if the packing were to become too tight or the maximum flow suddenly be required from the pump. A number of vertical pumps have been selected for the tank farm due to their low NPSH characteristics which permitted keeping the tanks close to the ground. In one instance, there was not sufficient area to install horizontal pumps and the vertical pumps were used. (Fig. 8.)

Standardization of Instruments

Instruments for the Petrochemical section were bought in bulk and given standard classification numbers, so that they can be withdrawn from stores according to classification rather than special requirements. Discussions have been had with numerous companies concerning the use of specialized instruments for various applications, such as boiler control, centrifugal compressor controls and so on. Virtually all of the instrument engineers feel that the use of standard refinery and chemical plant process instrumentation for boilers, compressors and so forth, results in better instrumentation for these units, as well as a cheaper cost.

That the ordinary refinery type instruments can be used for boiler control was demonstrated to us recently in a new plant at Pampa, Texas, where the same instruments are used in the boiler plant and centrifugal compressor plant as were used throughout the processing units. A saving of about 50 per cent can be effected by the adoption of process instrumentation. However, in addition to the objections from boiler house operators who are not familiar with them, the process instrumentation companies themselves are hesitant about supplying the boiler instrumentation engineering, which is often desired by the customer. They are, however, eager to supply instruments to suit the customer's instrumentation design.

Standardization of Piping

Before any piping drawings were made considerable time was spent in setting up standards by which all piping drawings could be made. Various services were given classifications, which specified the type of piping, flanges, fittings, bolts, gaskets and valves for that classification. Thus, if a line was classification "A" and one wished to install a valve he would look under Classification "A" to see which valves were acceptable. There he would find V-49 is the gate valve used for that service.

By referring to another table he would find that V-49 is a 316 stainless steel, flanged, 150# double wedge gate valve. In preparing the drawings and bills of material the only reference required, therefore, is the notation V-49. Listed under V-49 in the specifications is a number of manufacturers of that type of valve in the order of their preference. If the company is not listed, the Purchasing Department would not consider their valve without approval from our engineers.

A number of valves were eliminated because they were not built according to standard face to face dimensions. Others were eliminated because of previous unsuccessful experiences with them, and still others because no experience existed with them. Further standardization was effected by the preparation of standard drawings for motor valve installation, steam traps, flow transmitters and other installations which would be repeated numerous times during the construction. (Fig. 9.)

The Company has two very stringent specifications. The first — one that is probably not often encountered, is that no flowing line, whose failure would shut down the operating unit, contains any screwed connections. If a portion of the line can be cut off or by-passed, then screwed connections can be used down stream of block valves. In lieu of screwed connections socket weld fittings and schedule 80 pipe for 1½ in. and smaller carbon steel lines have been adopted. Block

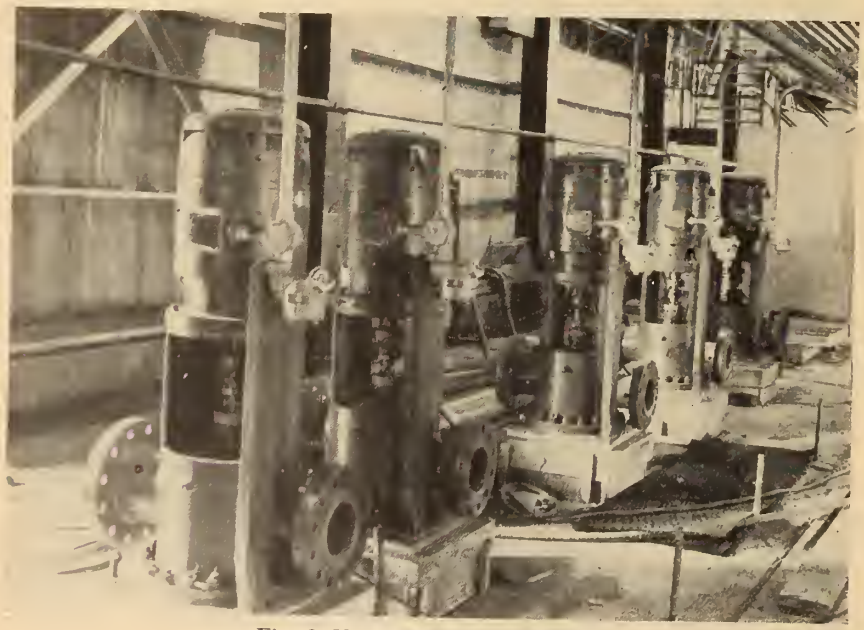

Fig. 8. Vertical process pumps.

lves of these sizes are 600# carbon eel, flanged or welded. This might em to be going a little far, but hen one has experienced repeated iit shut-downs due to the failure threaded connections, the justi-ation becomes apparent.

The second, common to most ants, is that every turn in a run of ipe must be accompanied by a hange of elevation. To effect this stem two north-south elevations, 6 inches apart, were selected, with wo east-west elevations, 18 inches bove each of the north-south ele-ations being added. The reason for his is that vacant pipe lanes can be sed for future new lines without aving to jump over all the pipes hat might have turned across the ane.

Although considerable time was pent in preparing the piping stand-ards, it was more than made up when the time came to prepare approximately six hundred piping drawings with any semblance of standardization of materials in them. By referring to the mechanical flow sheet, which noted the line size and classification, no further informa-tion was required by the piping draftsmen and layout men to pre-pare the drawings and take off the materials for that line. With this type of standardization, bulk orders were issued to cover the piping for the entire Petrochemical Area sever-al months before the drawings were actually ready for the take-off. Even with these precautionary measures, the delivery of stainless piping and fittings has been a serious bottle-neck in the construction of the plant.

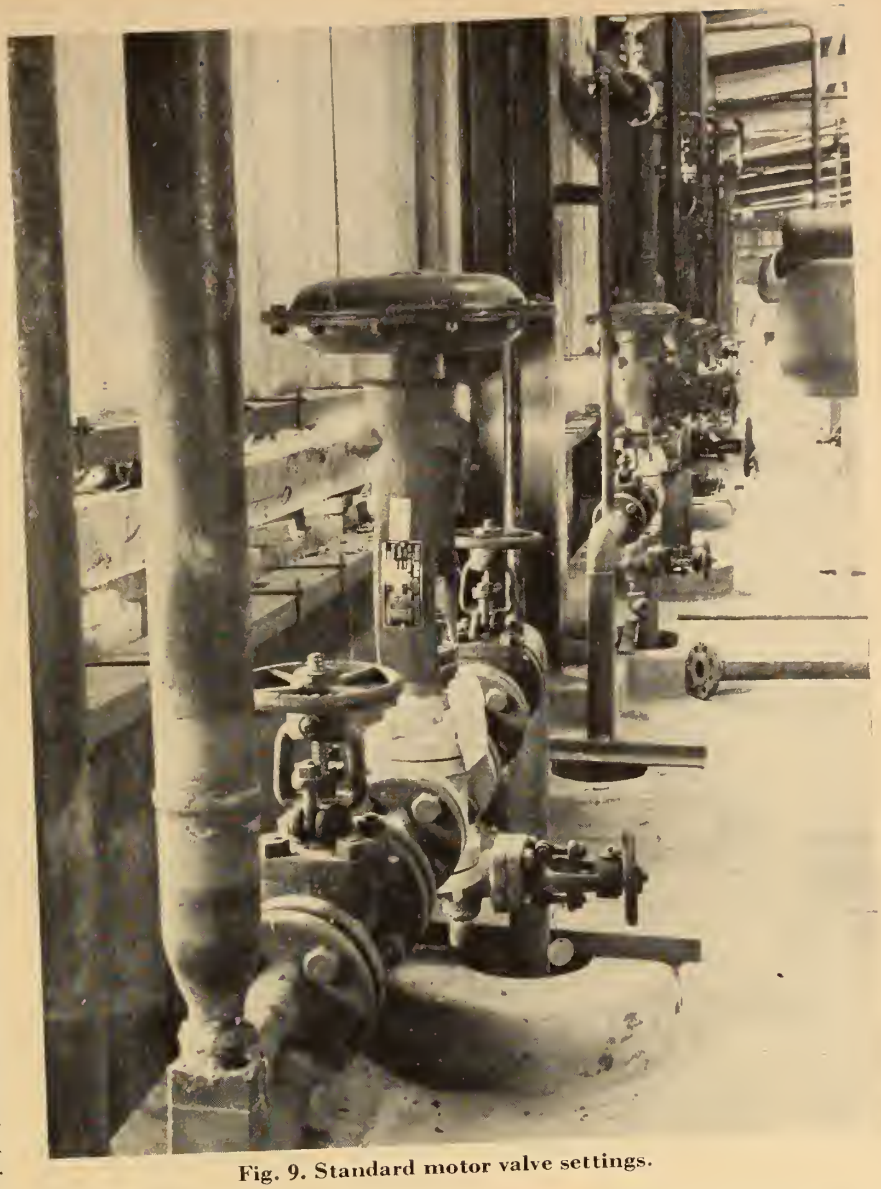

Fig. 9. Standard motor valve settings.

Advantages and Dangers

The foregoing gives a brief de-scription of some of the ways in which the design and construction of the plant has been standardized. It is believed that this program has resulted in:

1. Savings in engineering due to ease of preparing and checking drawings.
2. Savings by facilitating bulk orders.
3. Savings in training of installation and maintenance crews on differ-ent makes of equipment.
4. Savings in the reduction of the number of spare parts required.
5. Savings in the training of oper-ators and the resulting better operations from simplified and standardized equipment.
6. Increased versatility and flexi-bility of equipment, which is very important in the chemical business, due to the ever-changing requirements of the chemical market.
7. A more attractive plant.

At the same time that the Com-pany is attempting to standardize plants, there are certain dangers arising from too much standardiza-tion. Some of these dangers are:

1. Failure to keep up with the pro-gress of new developments. The steam locomotive is a good ex-ample of lack of progress, due to over standardization. Another good example is the plumbing code, which is outdated many years according to modern plant piping practices.
2. Unless care is taken, too many safety factors will creep into standardized equipment, result-ing in overdesign which can destroy the economic advantage of standardization.
3. By retaining old standards, ad-vantages of new equipment and methods are sometimes not taken.
4. If standardization is overstressed, the initiative in younger engi-neers is killed and eventually the engineering group of the Com-pany becomes stagnant.

In the foregoing discussion, an attempt has been made to bring out some of the factors considered in the design of the Petrochemical portion of the Canadian Chemical Plant at Edmonton. It is believed that a good job of standardization has been done and that the Company will have one of the better operating plants of the country. However, the work is not done, for efforts must continue to improve the plant and use any worthwhile new ideas, whether they conform to the Com-pany's standards or not, in an effort to produce more, new, and better chemicals at lower and lower costs. √

Industrial Radioactivity

A New Tool for the Engineer

by

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A paper presented before the Montreal Branch of The Engineering Institute of Canada, October 23, 1952.

Atomic energy has provided engineers with new and delicate measuring devices. The beta-ray gauge is applied to measurement and control of weight per unit of area in the production of sheet metals, paper and other materials. The gamma camera competes with X-ray for cheaper, faster welding inspection. Other instruments are developed for examining pulp digesters, refinery piping and chemical plant inspection. The author predicts many new uses for radiation engineering.

On August 6th, 1945, a fateful event occurred in the city of Hiroshima in Japan. There is no need to elaborate on what that event was, nor to dwell on the oft repeated statements about the Atomic Era introduced to the peoples of the world by this catastrophic event. The bombing of Hiroshima and Nagasaki proved beyond question the dramatic power of atomic energy. These events publicized on an extremely wide basis the results of some very noteworthy developments in the scientific field. Such a dramatic exhibition of a fundamental scientific discovery has in some ways misrepresented the significance of Atomic Energy.

Firstly, atomic energy and military power became synonymous in the mind of the average citizen. Secondly, the peaceful application of this atomic energy has been intimately linked with the development of a new source of power. This is, naturally, an exciting idea, and holds tremendous possibilities for future technology. This new source of power, however, is not just around the corner. It is in less dramatic fields where atomic energy through its by-products, radioactive isotopes, is experiencing its first peacetime applications. It is with these applications and their significance to engineers that this paper is concerned.

Curiously enough perhaps, it is not for the purpose of great force or great power, but in the field of fine and delicate measurements that atomic energy is receiving its first widespread applications. It has opened up to the measurement engineer a new tool, which can accomplish many extraordinary feats in terms of measurement, examination and control. Before considering these techniques in detail, let us digress to describe the materials of this work—the radioactive isotopes—and where they come from. With the exception of a relatively small group of natural radioactive elements such as radium, the origin of these materials is the nuclear reactor or nuclear furnace.

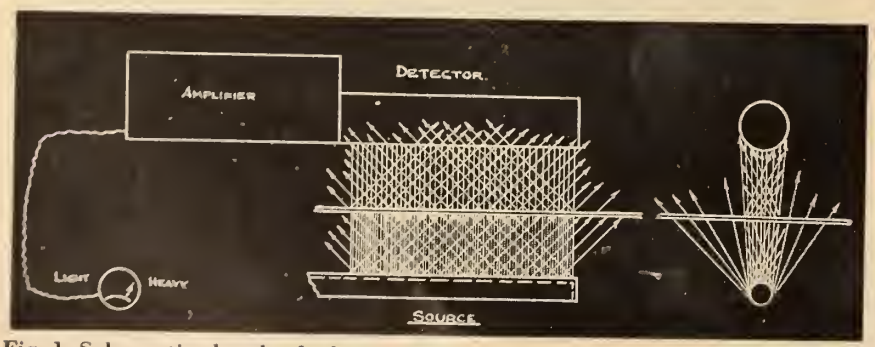

Fig. 1. Schematic sketch of a beta-ray gauge showing the partial transmission of beta-rays by a sheet.

Comparison of Pile and Furnace

A useful analogy may be drawn between the atomic pile and an ordinary coal furnace. The coal of the furnace is replaced by uranium as the fuel of a reactor. The mechanism of combustion is exchanged for the process of nuclear fission. The combining medium, which is the oxygen in the furnace, becomes the neutrons in a reactor. The neutron, which is a basic constituent of all matter, only appears in a free state as a result of a nuclear reaction, and the nuclear reactor is characterized by dense flux of these elusive particles.

The insulation which reduces the heat escape from the furnace is matched by a neutron reflector, which reduces neutron escape from

e reactor. The ash which is the sidue of the furnace becomes the utonium and the fission products the case of the reactor. Here, of urse, the analogy is a bit weak, ice producing plutonium has been, date, the main purpose of operat- g reactors.

The process of preparing radio- tive isotopes is one of simply ooking in the nuclear reactor. A ormal element, such as Fe, Ni, Cl, o, etc., is put in the pile and a rocess called neutron capture takes lace. Some of the nuclei of this lement grab hold of a neutron rom the flux of free neutrons in he reactor. The addition of this eutron creates a new form, viz., new isotope, of the element con- erned and in most cases an isotope vhich is radioactive.

A radioactive isotope is merely an element that has got itself into an uncomfortable state by picking up this neutron. The result is that it seeks to return again to a com- fortable state, and it does this by a proeess called 'beta decay'. This decay process involves in general the emission of two kinds of radia- tion—beta rays and gamma rays. It is the properties of these radia- tions that provide the basis for most of the practical applications.

Radioactive isotopes are also pro- duced as a by-product of the opera- tion of a reactor—the fission pro- ducts mentioned above. The process of nuclear fission is one of the splitting up of the uranium nucleus. This process provides the energy which runs the reactor and the tremendously concentrated energy of the atom bomb. However, it so happens that, when the uranium splits up, the elements formed by the fragments are in a very uncom- fortable state. They have the wrong number of neutrons. Consequently, we have here another source of radioactive isotopes, possibly the most important source from an economic and industrial view-point.

Basis is Penetration of Materials

To return to the beta and gamma rays emitted by these isotopes, what are their properties that make them of interest to us ? They cannot be seen or felt, and they produce a virtually undetectable heating ef- fect. They can, however, produce physiological effects, they can pro- duce chemical and physical change and, most important, at least at pres- ent, they can penetrate materials.

It is this ability to penetrate materials that is the basis for the new measurement and examination techniques referred to at the begin- ning of this article. The beta rays are tiny particles of matter—electrons which can penetrate only a small thickness of material, say up to ¼ in. of paper board, whereas the gamma rays which are similar to x-rays can penetrate up to 12 in. of steel.

The potential applications of radioactive isotopes is of such wide scope that this article will be con- fined, in the main, to those which are already of significance to the engineer. Only brief mention will be made of the lesser developed appli- cations and the future possibilities. Perhaps, the best known among these new techniques is the use of the beta-ray gauge for the measure- ment and automatic control of the weight per unit area (or thickness if the material is of uniform density) of sheet material as it is made by rolling, extruding, calendering or pressing.

This gauge, which we call the Betameter, is actually a weighing machine that makes no contact with the material being measured and, like a weighing scale, is independent of any property of the material being measured other than its weight. It can be rubber or paper, aluminium or glass; it can be hard or soft, thick or thin. The beta gauge will weigh it, and will perform this function continuously and ac- curately on the finest of sheet material running at high speeds on a mill. A slight exception to this rule occurs for materials of high atomic number, where the beta- meter gives a somewhat larger indication than the balance.

The Beta Ray Gauge

The principle of the beta ray gauge is simple indeed. A radio- active isotope is chosen which, contrary to the general rule, emits beta rays but no gamma rays, for example: Thallium 204, Strontium 90 or Promethium 147. As illus- trated in Fig. 1, a source of this material is placed below the sheet and a detector of the radiations is placed above it. The detector is merely a method for converting the radiations to an electrical current— from there on it is handled by nor- mal electronic methods. Usually the result is displayed on a pen recorder.

The paper absorbs a certain per cent of the radiations. Any increase or decrease in the paper weight causes a corresponding decrease or increase in the radiation reaching the detector, and consequently the indication on the pen recorder. Many refinements enter into the design of a specific instrument, such as the sensitivity and stability, the range of operation, the indepen- dence with respect to temperature, pressure and line voltage, the inde- pendence with respect to position of the sheet in the source-detector gap, and the effect of the decay of the radioactive source. These are too detailed for analysis here. Figure 2 shows a betameter head installed on a paper machine.

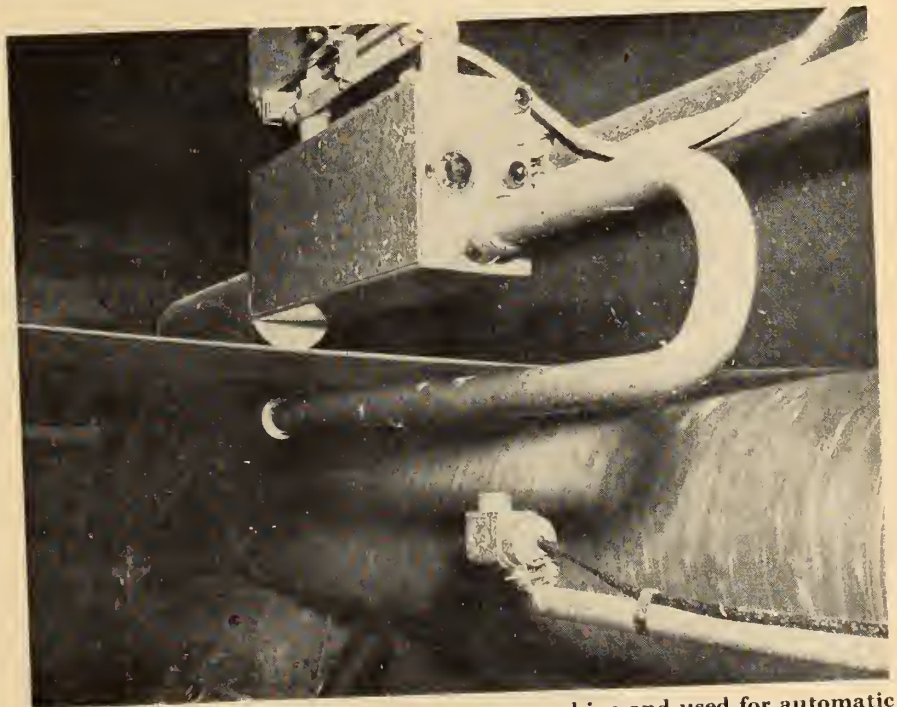

Fig. 2. Betameter head installed on a paper machine and used for automatic control operation.

Fig. 3. Pipe line camera in use on line.

What is the importance of such a measurement to the engineer ? With an accurate and continuous measurement, the product may be held to closer tolerances. This, of course, is very significant as a basic step in quality control, but is generally of more significance in terms of direct savings in mill operations. Elimination of off-weight sheet is the first source of material saving. Closer control, however, will generally allow a reduction in the mean weight of a sheet.

For example, consider a rubber sheet being produced at a mean weight of 200 grams per square meter, with a high and low level tolerance of ±5 per cent. If the tolerance band can be narrowed to ±3 per cent, then no real sacrifice in quality is made by reducing the average weight to 196 gms/square inch. This 2 per cent saving in material over a year's operation, may easily result in many thousands of dollars. Two per cent material saving on a large paper machine would, for example, amount to about $100,000 per year.

The full advantage of such a measurement may be obtained only if the measurement can be used for automatic control of the operation. Although betameters are at present operating in paper, rubber, plastic and steel mills, only in paper mills have the automatic control operations been attempted. This, however, has proved most successful. One mill has now been operating with automatic control for more than a year. This automatic control of a fourdinier machine is an entirely Canadian development, and only recently were the first similar controls (again using betameters) started in the United States.

A betameter offers a still further advantage in mill operations. As a continuous direct monitor of the product, it is very sensitive to change or faults in the process. In many cases these are spotted on the betameter record, and they can be identified and corrected before they develop to such a seriousness as to cause lost production time.

The Gamma Camera

Equally prominent to the beta gauge as a use of radioactive isotopes is the new development in industrial radiography. The products of the nuclear reactor are offering substantial competition to the x-ray machine for the purpose of x-ray examination of welded seams and castings. Particularly for welding inspection, new techniques have been developed using these isotopes that border on the spectacular. High quality welding inspection can be provided in many cases at much lower cost, and in many other cases where it has been a practical impossibility in the past.

One noteworthy example is the inspection of pipeline welding. In the spring and summer of 1952, the first complete contract on pipeline radiography using isotopes was carried out. This contract was on the Imperial Oil Sarnia Products Line, London to Toronto section. In comparison with similar pipeline work with an x-ray machine, the isotope method had the following advantages: 50 shots per day (extended to 70 in the latter part of the operation) were made, as compared to an average of 36 with the x-ray method; each shot covered at least 180° of the circumference, as compared to an effective coverage of approximately 90° with x-ray.

Thus, in its first trial in pipeline inspection, the isotope method performed more than 2½ times the amount of work, and to at least as high a quality for the same cost. Still under development is the internal shooting technique which will bring about a further improvement in the inspection and lowering of costs. Figure 3 shows Isotope Products special pipeline gamma camera in use on the line.

Another example is the inspection of oil storage tanks, or similar vessels. These are examined both in the ordinary way, seam by seam, and by an entirely new "one-shot" technique. Even with the piecemeal method, the isotope radiography has a very substantial advantage over x-rays. The complete portability of the gamma camera allows a speed-up in the work, which by actual comparison on large (150,000 barrel) oil storage tanks was more than a factor of four. The gamma camera is hardly a camera in the strict sense, as it is the source holding device (mainly of lead) with a lid as a shutter. It is, however, used for taking the pictures, and it is a more descriptive name than many others used.

The "one-shot" technique is something quite new. It was carried out first on a Horton Sphere for Polymer Corporation in Sarnia. Every welded seam on the sphere (more than 2,000 feet in all) was covered with a film strip. Each film length was sealed in a light-tight, water-tight envelope, successive envelopes were joined into strips by a white (to reflect the sun's heat) plastic backing, and the strips were firmly

ped to the vessel shell over the elds. An intense radioactive source iridium 192 was dropped as a umb bob to the centre of the sphere. The exposure required about six- en hours and the film was removed, ocessed and examined under the nventional film viewer. The quali- of the welding of the whole essel was revealed by a single xposure. The tiniest buried cracks ere disclosed for repair before ey could develop into large and ngerous cracks. Subsequently, this chnique has been used not only r other spheres but for storage nks as well even with tank iameters up to 150 feet.

With oil storage tanks, in most ases complete radiography is car- ied out only on the bottom half, here the forces are greater and the elding more difficult due to the hicker plate. When a whole tank s done separate exposures are used or the top and bottom halves, to void excessive angles in the vertical lane. Figure 4 shows a horton- sphere with most of the film strips n place for shooting.

The versatility of the isotope method in radiography, and the complete portability of the gamma camera for both tank and pipe work, invite a revaluation of the merits of radiographic inspection. Already this service is being sup- plied for general chemical plant construction work. The engineer must re-examine his practices on the inspection of welded vessels. To inspect or not to inspect might be an easy decision where no radio- graphy was required in the speci- fications, and the cost of such inspection was ten to fifteen per cent of the cost of the vessel.

However, when the cost lies in the one to two per cent range, the economics are heavily balanced in favour of thorough welding inspec- tion. A single seam with 80 per cent penetration along most of the weld (not an uncommon occurrence), may reduce the strength of the whole vessel to 80 per cent of the designed value. Either that vessel is operating under a potentially hazardous condition, or 20 per cent too much steel was bought in the first place. Since twenty per cent of the steel costs much more than the two per cent for adequate inspection, the case for radiography has a sound economic basis.

Many Potential Applications

Other instruments have been developed and applied, using radio- active rays as the basic measuring element. Among these are the

Fig. 4. Horton sphere nearly ready for irradiation. Most of the film strips are in place in the welded seams.

gammagage and the penetron for the measurement of wall thickness of tanks and pipes. Though con- siderably different in design, these two instruments follow the same principles: either the absorption of gamma radiation (the transmission method) or the scattering of gamma radiation (the reflection method).

With the gammagage, the trans- mission method is used primarily for tanks, and the reflection method for pipes, whereas with the penetron the situation is reversed. A growing demand is being felt for the use of this instrument in the examination of pulp digesters, refinery piping and general chemical plant inspection.

Another type of radioactive in- strument is the liquid level gauge. The two outstanding examples of this type are the levelometer and the gagetron. Again, both trans- mission and reflection methods are used. To date, the cost of these installations has restricted their use to such applications as pressure autoclaves and the like, where measurement of the liquid level is difficult or impossible by normal means.

The use of radioactive tracers in industrial research, in process con- trol and in leak testing is the sub- ject for a paper in itself. Whereas these techniques are not widespread, to date each case is a story by itself and space does not permit an exhaustive study here.

For the future we may expect the development of many new gauges and techniques. In addition, there is a new field to be exploited, namely radiation engineering. In this field may be classed the large scale uses of radioactivity such as pasteuriza- tion and sterilization, catalytic action in chemical reactions, grain insect control and rodent control in sewage systems. Some of these such as sterilization are already active research fields, while others are practically untouched.

The outstanding difference be- tween these applications and ones mentioned previously is the quan- tity of radioactivity required. Up to 500,000 curies are required for com- mercial applications, whereas the largest single source of radioactivity in use hitherto are the co-called cobalt "bombs" for cancer therapy, where up to 2,000 curies are in use. However, only a few years ago, one curie was considered a large radioactive source.

Moreover, such quantities of radioactivity now exist, and exist as a waste product wherever nuclear reactors are operated. This waste product is the fission product radio- activity mentioned at the beginning of the paper. These fission products are now used in small quantities, but the engineering of the purifica- tion and handling of large quantities must precede the large scale appli- cations. ✓

The Atmospheric Corrosion

A paper presented before the 67th Annual General and Professional Meeting of the Engineering Institute of Canada, Halifax, N.S., May, 1953.

Introduction

This paper deals with the atmospheric corrosion of the metals commonly used in building—aluminium, copper, lead, steel, zinc and galvanized steel. The prevention of corrosion by painting or by proper design are not covered here. It is based largely on the work reported by Committees A-5 and B-3 of the American Society for Testing Materials (A.S.T.M.), by the Corrosion Committee of the British Iron and Steel Research Association and to some extent on the results of our own atmospheric exposure program, but as we have only just got underway these last are of limited duration. A review of A.S.T.M. test work is given in the appendix.

The corrosion of metals is of vital interest to engineers since it is one of industry's most costly losses. An estimate of the yearly cost of rusting of steel throughout the world was made by Hadfield(1) in 1922 at $3 billion. A similar estimate by Vernon(2) for the cost of rusting of steel in the United Kingdom alone was about $600 million. In 1951 Uhlig(3) set corrosion costs in the United States alone at $5½ billion dollars a year. He also estimated the annual savings possible through a five-year program of research, development and education at just under $1 billion a year.

The most widely accepted definition of the term "corrosion" is (4) "destruction of a metal by chemical or electrochemical reaction with its environment". The definition includes both the metal and the environment, hence "corrosion resistance" is not a fundamental property of metal, as is specific gravity, etc., but depends also on the environment. For example, steel corrodes in seawater about 10 times as rapidly as aluminium, so that one might say that steel has poor corrosion resistance and aluminium good behaviour, but an aluminium tank for a caustic soda solution would disappear in a few minutes, while a steel tank would last indefinitely. Hence when talking about corrosion resistance the environment must always be specified. A medium can be found to corrode any so-called "corrosion resistant" alloy.

The criteria used to evaluate the severity of corrosion depend on the use to which the metal is put, and may vary widely. A corrosion rate that may be tolerated for one purpose may be completely unacceptable for another. The most common criteria are perforation, loss of strength, impairment of appearance, or contamination of the product in contact with the metal. With a hot water tank or in a pipe, resistance to perforation is the important feature: a load bearing steel pile may be perforated without material loss of its bearing strength, but in this case resistance to mechanical failure is important. With metal window frames and store fronts impairment of appearance is the important feature. In the food and chemical industries the product may suffer objectional contamination, due to corrosion of the process equipment, even at very low corrosion rates that which would otherwise be quite tolerable.

In dealing with the atmospheric corrosion of metals the most suitable corrosion rate unit is the rate of thinning expressed as mils per year (m.p.y.). This is usually calculated from the weight loss of a measured panel, assuming uniform

Table I — Relative Corrosivity of Atmospheres Towards Open-Hearth Iron Specimens
2 x 4 x ⅛ in. specimens

Location	Atmosphere	Grams wt. loss in one year	m.p.y.	Relative Corrosivity
Khartoum, Egypt	Tropical (dry)	0.16	0.07	1
Abisko, North Sweden	Rural, sub-polar	0.46	0.20	3
Singapore, Malaya	Tropical marine	1.36	0.61	9
Daytona Beach, Fla.	Rural	1.62	0.72	11
State College, Pa.	Rural	3.75	1.7	25
South College, Pa.	Semi-rural	4.27	1.9	29
Miraflores, Canal Zone (Pacific side)	Tropical marine	4.50	2.0	31
Kure Beach, N.C. (800 ft. from ocean)	Marine	5.75	2.6	38
Sandy Hook, N.J	Marine, semi-indust.	7.34	3.3	50
Kearny, N.J.	Industrial marine	7.75	3.5	52
Vandergrift, Pa.	Industrial	8.34	3.7	56
Pittsburgh, Pa.	Industrial	9.65	4.3	65
Frodingham, England	Industrial	14.81	6.6	100
Daytona Beach, Fla.	Marine	20.43	9.1	138
Kure Beach, N.C. (80 ft. from ocean)	Marine	70.49	31.5	475

# of Architectural Metals

by

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Sheet metal has long been used in architectural practice for roofing, flashing and cornices, but the architect of today also uses it freely in his walls. The subject of the atmospheric corrosion of metals is therefore more than ever a live topic. Mr. Godard has done those interested a service by bringing together data from many scattered sources and by adding to them some of his own in this paper, presented at the Halifax annual meeting. Not the least of its value resides in the appendix and the bibliography.

inning. It permits comparison of ifferent metals free from confusion ue to differences in density. With ost metals the rate of atmospheric orrosion slows with time, so that he most reliable rate value is that etermined over the longest period.

The Severity of Atmospheric Corrosion

The severity of atmospheric corosion, i.e., the corrosivity of an atnosphere, varies greatly from place o place. In general, the most mportant factors that affect it are the extent of industrial pollution, the proximity to the sea, the amount and frequency of rainfall, the amount and direction of wind, the amount of fog, the humidity, the amount of sun and the average temperature. An interesting project was undertaken by Hudson(5), who exposed 2 by 4 by ⅛ in. panels of open hearth iron sheet at 20 locations throughout the world. He found Frodingham, England, the most corrosive, assigned it a corrosion rate of 100, and rated the others as a percentage of the corrosion there. His results, as presented by LaQue(6), are shown in Table I.

In atmospheric corrosion test work it is common to consider four classes of atmosphere — rural, marine, industrial and industrial-marine.

Atmospheric corrosion in rural areas is not a great problem. Galvanized steel barn roofs that have lasted from 25 to 40 years before perforation developed, are quite common. The ordinary galvanized roof in this country has a zinc coating of only about 1.5 oz./sq. ft.* (zinc coating is 1.27 mils thick), yet rust does not appear for some 15 years or so, and perforation much later.

Corrosion is more rapid in marine atmospheres, but there is no such thing as a typical "marine" atmosphere. The most corrosive marine atmosphere is that encountered on board ship. Ashore, the worst place is on a pier or on the beach and the severity decreases rapidly with distance back from the shore. Some figures on this have been published by LaQue(7), who exposed metal panels 80 feet and 800 feet from the open Atlantic Ocean at Kure Beach, N.C. For mild steel the ratio of increased corrosion on the beach was 3 : 1, and for zinc 5 : 1. For 24ST aluminium alloy** the ratio was 3 : 1(8). With Hudson's ingot iron the ratio was 12.5 to 1 (see Table I).

Similar differences between marine atmospheres from the paper by Dix and Mears(9) are seen in Table II which is based on tensile losses after 10 years.

Earlier it was stated that in discussing the corrosion resistance of a metal it is necessary to specify the environment. These results indicate that the converse is also true—in talking about the corrosivity of an atmosphere one must specify the metal and even the alloy. La Jolla is about four times as corrosive to 2S as Key West, 27 times as corrosive to 3S, and 59 times as corrosive to 17ST. Thus Hudson's scale of corrosivity applies only to his low-carbon open-hearth iron and not to other metals. This point can be illustrated further with some figures from our own work, as shown in Table III.

These are based on the weight losses of 6 x 8 in. panels exposed

*Galvanized coatings are expressed in ounces of zinc per square foot of surface, both sides included in the case of sheet.

**Contains 4.4% Cu, 1.5% Mg, 0.6% Mn.

Table II — Relative Corrosivity of Three Marine Atmospheres to Aluminium Alloys

Marine location	Relative corrosion rate		
	2S*	3S*	17ST*
Key West, Fla.	1	1	1
Sandy Hook, N.J.	2	1	11
La Jolla, Calif.	4	27	59

*2S contains min. 99.0% Al; 3S contains 1.25% Mn; 17ST contains 4% Cu, 0.6% Mg, 0.6% Mn.

for two years. The story behind the missing lead value for Durban is interesting. The local price of lead made our specimens fair game for scrap hunters. They even took the lead from a lead-aluminium riveted bimetallic sample and left the aluminium portion behind!

Industrial atmospheres are generally more corrosive than marine atmospheres on shore. The most common contaminant in industrial atmospheres, and that making city atmospheres corrosive, is SO_2 from coal. Hudson[10] has shown that, in 16 industrial locations, the rates of corrosion of steel and zinc are in almost perfect correlation with the SO_2 content of the atmosphere.

The accumulation of dust and soot on metals in a polluted atmosphere is a contributing factor, since it provides a moist poultice that traps the SO_2 on the metal surface and makes possible the corrosion reaction.

With the growth of cities and the concentration of industries, the extent of industrial pollution has been steadily increasing. This means, of course, that corrosion rates are also increasing, and it is likely that performance over the next century will be poorer than over the past century.

The most corrosive atmospheres are found in coastal cities and industrial plants. On Hudson's scale for ingot iron, the corrosivity of the atmosphere at the magnesium plant at Freeport, Texas, on the Gulf coast is about 500[11]. The plant is located about a half-mile from the sea, where the marine atmospheric rating should be 50 or less.

The corrosivity of an industrial-marine site is shown by our own results in which the Halifax dock area is compared to down-town Montreal, which has a heavy industrial atmosphere. (Table IV.)

Table IV — Relative Corrosivity of Montreal and Halifax Atmospheres

(Based on two-year exposure of 6 x 8 x 0.060 in. panels)

	Montreal	Halifax
Aluminium	1.0	1.8
Zinc	1.0	1.8

Galvanic Corrosion in the Atmosphere

The galvanic corrosion of dissimilar metal couples is practically negligible in inland rural atmospheres, is pronounced in marine atmospheres and is worst on board ship. A marine atmosphere may be arbitrarily defined as that along the sea coast for a distance of two to three miles inland, depending on prevailing wind and topography. The severity of galvanic corrosion decreases rapidly with the distance from the shore. The difference between 80 feet from the water's edge and 800 feet is several fold, as has been shown at the Kure Beach, N.C., corrosion testing station. In industrial atmospheres galvanic corrosion is less marked.

In predicting which metal of a pair will corrode it is common practice to use the sea water galvanic series of LaQue[12] from which the relative positions of the metals here considered are:

Zinc (anodic end)
Aluminium
Steel
Lead
Copper (cathodic end)

In rural atmospheres all these metals may be coupled safely with the exception that zinc or aluminium should not be coupled with copper, although even in this case the corrosion rate is small. In industrial atmospheres the same may be said, although there will be small galvanic corrosion rates. In marine atmospheres the rates may become appreciable, depending on the salinity and moisture content of the atmosphere. However, aluminium may be safely coupled to zinc, steel to lead, and lead to copper; other couples usually lead to appreciable galvanic corrosion.

Atmospheric Corrosion of Aluminium

Commercial aluminium ingot produced in Canada averages about 99.6 per cent Al, the principal impurities being iron and silicon. The commercial alloys of aluminium usually contain one or more of the following elements: copper, chromium, magnesium, manganese, silicon and zinc. Super-purity aluminium (>99.99 per cent Al) has the best corrosion resistance obtainable in this metal. In general, chromium, magnesium and manganese improve the corrosion behaviour of aluminium, silicon has little effect, and zinc and copper are detrimental.

Alclad alloys are available in sheet and wire form. These have a core of high strength alloy covered with a layer of another alloy of better corrosion resistance. This is chosen to give cathodic protection to the core at scratches and cut edges. Clad alloys are more resistant to perforation than unclad alloys.

As a group, the aluminium alloys are highly resistant to atmospheric corrosion. The shape of the corrosion rate curve for aluminium alloys is shown in Fig. 1. Initially (in six months to a year) the rate is fairly rapid (perhaps 2-4 m.p.y.), after which it slows markedly. In a number of marine and industrial locations the rate of penetration has been found to be about 0.03-0.11 m.p.y. In a few especially severe locations somewhat higher rates have been encountered. The

Fig. 1. Shape of atmospheric corrosion curve for aluminium.

Table III — Relative Corrosivity of Three Atmospheres

Location	Metal			
	Al	Cu	Pb	Zn
Kingston, Ont.	1.0	1.0	1.0	1.0
Cape Beale, B.C.	0.5	1.8	2.4	3.0
Durban, S. Africa	5.0	3.8	—	5.3

pe of the initial portion of the ve and its height depend on the oy and the location, but after this e curves are remarkably similar all aluminium alloys.

In rural atmospheres there is no preciable corrosion of aluminium er very long periods—rates are in e order of 0.001 m.p.y.—and uctural aluminium has an almost definite life. It can be safely pre-cted that light gauge (0.019 in.) rn roofs will last well over 100 ars. Even thinner sheet will last long while if requirements of echanical and structural strength rmit its use.

In marine atmospheres aluminium hibits good corrosion behaviour d is performing well on ship perstructures and in small boat nstruction.

In industrial atmospheres alu-inium has good corrosion resist-nce, although the acid condition roduced by the sulphur content of oal does produce some corrosion nd gradual loss of strength over ng periods.

Quantitative results on the atmos-heric weathering of aluminium are available for some 30 to 40 locations n many parts of the world, covering wide variety of atmospheric con-litions. Some of the test stations re:

Location	*Type of Atmosphere*
Phoenix, Ariz.	Desert
State College, Pa.	Rural
Key West, Fla.	Marine
Kure Beach, N.C. . .	Marine
La Jolla, Calif.	Marine
Pitcairn Island	Marine
Durban, S. Africa	Marine
Pittsburgh, Pa.	Industrial
New York, N.Y. . .	Industrial
Montreal, Que.	Industrial

The 10-year results obtained by A.S.T.M. Committee B-3(9) are given in Table V.

These show that, in general, industrial atmospheres are more corrosive to aluminium than marine atmospheres, while rural atmospheres have little effect. These results and many others have not yet dispelled a commonly held notion that aluminium corrodes rapidly in marine atmospheres. Actually it resists such atmospheres well. It must be admitted that improper installation which encourages galvanic corrosion or crevice corrosion may lead to unexpectedly high rates of corrosion at local areas, but these are well understood and easily avoided. However, proper installa-

Fig. 2. Aluminium tropical houses.

Fig. 3. Aluminium sheathed building.

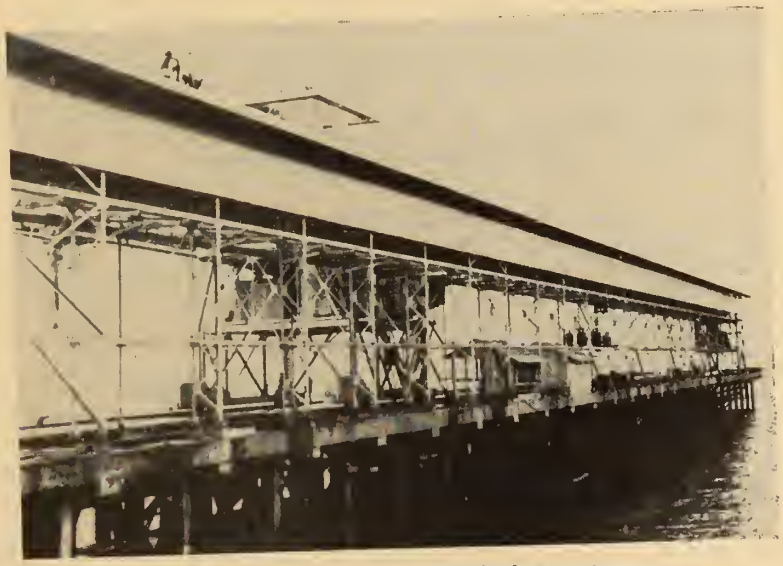

Fig. 4. Aluminium sheathed dock structure.

tion is required for all the metals discussed in this paper.

The marine performance of aluminium can be illustrated by some pictures of buildings erected in 1949-50 on Kassa Island off French Guinea. Kassa Island is about 10° north of the equator, and five miles off the coast of French Guinea, West Africa. Figures 2, 3 and 4 show some of the installations there. A 1953 inspection report indicates these to be in excellent condition.

As case histories, the following may be cited:

1884—The cap piece on the Washington Monument was cast in commercially pure aluminium. When examined in 1934, 50 years later, abrasion with light emery revealed the cap to be in excellent condition and the original inscriptions could be easily read([13]).

1890—Aluminium door knobs, hinges and facings were installed on the exterior of a private home in Atlanta, Georgia. When examined, in 1944, 54 years later, they were still in service and in good condition([14]).

1893—The statue of Eros in Piccadilly Circus, London, was cast in aluminium. The last recorded examination was in 1947, 54 years later([15]). In March, 1953, it was cleaned for the Coronation. Despite the severe industrial atmosphere, it remains in good condition.

1896—A cornice of commercially pure aluminium (0.032 in. sheet) was installed on the Canada Life Building in downtown Montreal. It was finally removed in 1948, 52 years later, during the renovation of the building, and some extensive corrosion at localized areas was found. The remainder of the sheet was in fair condition([16]).

1897—A cupola of the Church of St. James in Rome, Italy, was roofed in 1897 with commercially pure aluminium. When examined in 1937 and 1949, the latter after 52 years, it was found to be in excellent condition and good for at least another 100 years([17]).

1898—An aluminium roof of 0.028 in. sheet was placed on a house in Steckborn, Switzerland. When inspected in 1931, 33 years later, it was in excellent condition. Some galvanized sheeting installed at the same time had been completely destroyed.

Table V — A.S.T.M. Ten-Year Weathering Results for Aluminium
(9 x 12 x 0.035 in. panels of 2S alloy)

Location	Wt. loss (grams)	Calculated m.p.y.	Per cent tensile loss
Rural:			
Phoenix, Ariz.	0.01	0.000	1.7
State College, Pa.	0.12	0.001	+0.1
Marine:			
Sandy Hook, N.J.	0.22	0.002	3.1
Key West, Fla.	0.35	0.004	1.7
La Jolla, Calif.	2.7	0.028	14.1
Industrial:			
Altoona, Pa.	2.4	0.025	7.0
New York, N.Y.	3.0	0.031	6.3

Table VI — Aluminium Laboratories Limited, Two-Year Weathering Results for Aluminium
(6 x 8 x 0.064 in. panels of 2S sheet)

Location	Wt. loss (grams)	m.p.y.
Rural:		
Kingston, Ontario	0.08	0.010
Marine:		
Cape Beale, B.C.	0.04	0.005
Kure Beach, N.C.	0.24	0.028
Durban, S. Africa	0.40	0.046
Industrial:		
Vancouver, B.C.	0.21	0.024
Toronto, Ont.	0.28	0.033
Montreal, Que.	0.35	0.041
Industrial—Marine:		
Halifax, N.S.	0.61	0.071

Atmospheric Corrosion of Copper

Electrolytic tough pitch-copper containing 99.95 per cent Cu is the grade most widely used in North America. There is also a variety of commercial coppers and modified forms of electrolytic copper of industrial significance. Fire-refined coppers are characterized by the presence of minor impurities, notably arsenic and silver. Lake coppers are formed by adding arsenic or silver in small amounts.

Copper has been extensively employed for roofing buildings in Scandinavia and Eastern Europe since the 13th century. Its large scale use in England began about 1830 and its widespread use in this country as a roofing material for churches and public buildings is familiar to all.

A number of papers have been published on the atmospheric corrosion resistance of copper. Vernon ([18]) concluded that the common impurities in copper are without measurable influence on the early stages of tarnish and patina formation, with the exception of arsenic, which causes a more rapid darkening of the surface and loss of reflectivity. Hudson([19]) exposed a series of wires for five years at South Kensington, England. Tracy, Thompson, and Freeman ([20]) have published 10-year results for sheet and wire in a number of atmospheres. They exposed strips of copper sheet (5/8 by 8 by 0.050 in.) machined to tensile specimens weighing about 30 grams, in a horizontal position. The 10-year weight losses are shown in Table VII.

Table VII — Ten-Year Weathering Results or Copper Strips
(5/8 x 8 x 0.050 in.)

Atmosphere	Wt. loss, grams	M.p.y.
Rural	0.26	0.020
Marine	0.47	0.032
Industrial	0.60	0.040

Tensile strength losses over the 10-year period were of the order of 2 to 4 per cent. Differences in resistance to atmospheric corrosion of the several types of copper tested were

Table VIII — A.S.T.M. Ten-Year Weathering Results for Copper
(9 x 12 x 0.035 in. panels)

Location	Type of atmosphere	m.p.y.	Per cent loss tensile strength
Phoenix, Ariz.	Desert	0.005	1
State College, Pa.	Rural	0.023	4
Sandy Hook, N.J.	Marine	0.026	3
Key West, Fla.	Marine	0.020	2
La Jolla, Calif.	Marine	0.052	10
Altoona, Pa.	Industrial	0.046	7
New York, N.Y.	Industrial	0.047	6

mall and had little practical significance.

Tracy[9] has reported the 10-ear results of A.S.T.M. Committee 3-3. These tests involved 9 by 12 y 0.035 in. sheet panels exposed ertically. The rates of corrosion vere calculated from the 10-year veight losses for tough-pitch copper, s shown in Table VIII.

Some interesting examples of old opper roofs in England and Europe ave been described[21], e.g., Roskilde Cathedral, Denmark (1300); Gripsholm Castle, Sweden (1573); the Chapel Royal, Windsor, England (1540). Tracy[22] has described the 1837 copper roof on Christ Church in Philadelphia. After 113 years the maximum thinning was found to correspond to a corrosion rate of 0.062 m.p.y., in fair agreement with the A.S.T.M. test results. His original paper gave a longer life, but this has since been found to be an error[23].

Atmospheric Corrosion of Iron and Steel

As the variations in the forms and alloys of iron and steel are numerous, this paper will be restricted mainly to mild steel, which represents by far the highest proportion of structural steel produced today, although a few variations will be mentioned.

Mild steel is a slag-free low-carbon (0.1 to 0.2 per cent) soft iron alloy, containing some manganese and traces of phosphorus, silicon and sulphur. Two common grades are:

	C	Mn	Si	P*	S*
SAE 1010	0.10	0.45	0.15	0.04	0.05
SAE 1020	0.20	0.45	0.15	0.04	0.05

*Max. values

Ingot iron is a very high purity iron (0.02 per cent C, 0.03 per cent Mn). Despite its purity, ingot iron has somewhat inferior atmospheric corrosion resistance to mild steel. Wrought iron, or "malleable iron" as it is sometimes called, contains dispersed particles of slag. The performance of wrought iron varies with its type. Hudson[5] found that the British wrought irons have atmospheric corrosion resistance superior to mild steel (roughly 75 per cent of their corrosion rate).

Low-alloy steels (<10 per cent added ingredients) exist in large number and will be mentioned only briefly. For a thorough treatment on the effect of composition on corrosion performance see French and LaQue[24]. High alloy steels are equally numerous and are beyond the scope of this paper.

An official British publication[25] gives the average corrosion rates for mild steel to be:

Atmosphere	*m.p.y.*
Rural	1.5
Marine	2.0
Industrial	5.0

In Table I the rates for ingot iron were shown to vary from 0.07 to 31.5 m.p.y. depending on location.

Pilling and Wesley[26], in work on the influence of nickel, found the following ingot iron corrosion rates:

Atmosphere	*m.p.y.*
Rural	0.91
Marine	6.7
Industrial	6.7

In 1911-1915 Buck[27,28] demonstrated the greatly increased corrosion resistance of mild steel in an industrial atmosphere resulting from the addition of small amounts (0.1-0.3 per cent) copper; he studied the range from 0.01 to 2.0 per cent. This was followed up by A.S.T.M. Committee A-5 in a series of exposures beginning in 1916 and continuing to date, studying the effects of copper and other elements.

Larrabee[29] has presented information on the corrosion of various

Table IX — Atmospheric Corrosion Rates for Steel
(Kearny, N.J. — Industrial atmosphere)

Alloy	Per cent Cu	m.p.y.	Calculation period
Bessemer steel (mild)	0.008	8.9	1st year
Mech. puddled iron	0.01	1.0	2-4 years
Open-hearth steel	0.04	0.36	4-8 years
Open-hearth steel	0.25	0.20	4-8 years
3.2% Ni steel	—	0.11	2-8 years

Table X — Influence of Copper on Corrosion of Steel

Location	Atmosphere	m.p.y.		Calculation period, yrs.	
		0.003% Cu	0.20% Cu	Low Cu	High Cu
South Bend, Pa.	Semi-rural	1.2	0.48	0-5	0-5
Kure Beach, N.C.	Marine	6.6	0.81	1.5-3.5	1.5-3.5
Kearny, N.J.	Industrial	6.5	0.56	0-2	1-3

Table XI — Influence of Nickel on Corrosion of Steel

Alloy	Composition			Years to Perforation			
	% C	% Cu	% Ni	Rural	Marine	Indust.	Heavy Indust.
Ingot iron	0.04	—	—	11.0	1.5	1.5	1.5
Cu-steel	0.07	0.17	—	14.5	1.5	3.0	2.1
2% Ni-Cu	0.07	0.61	1.39	14.5	>5	4	3.2
6% Ni-Cu	0.03	1.8	4.2	14.5	5	8	>14.5

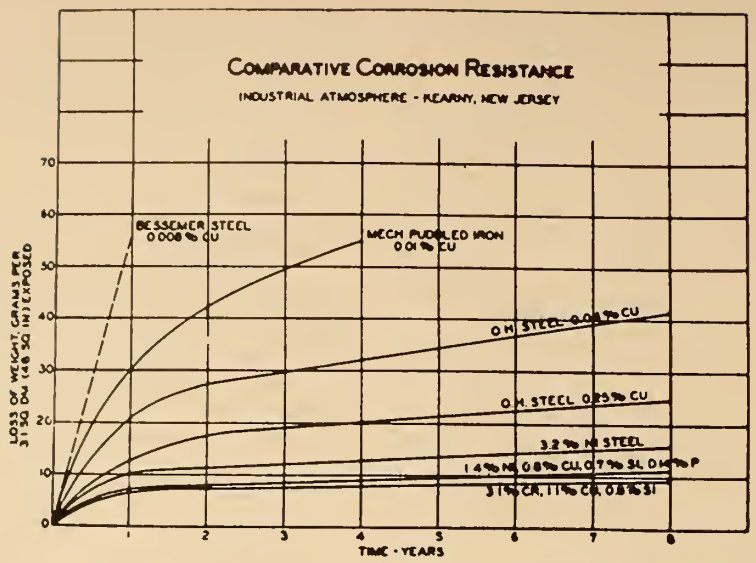

Fig. 5. Comparative corrosion resistance.

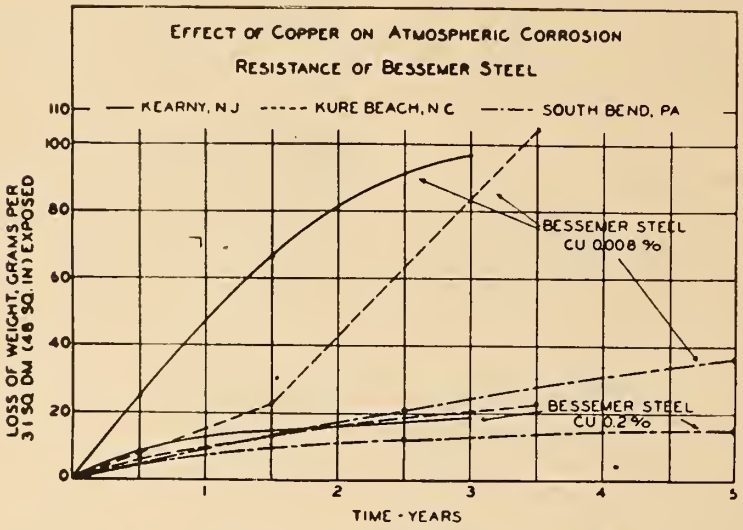

Fig. 6. Effect of copper on atmospheric corrosion resistance of Bessemer steel.

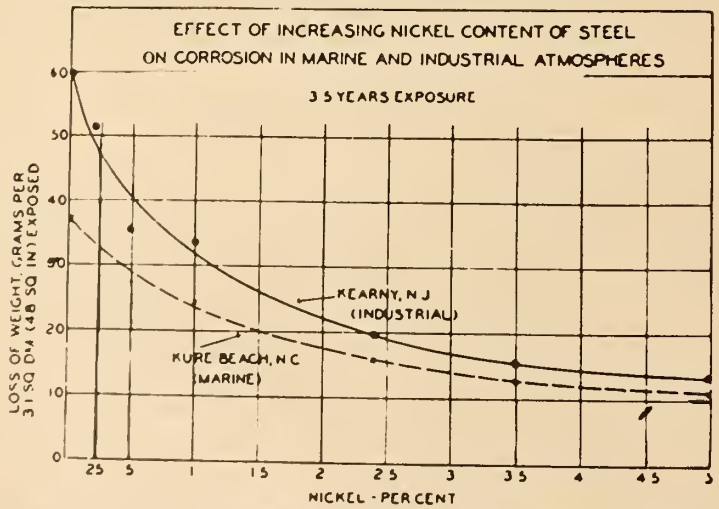

Fig. 7. Effect of increasing nickel content of steel on corrosion in marine and industrial atmospheres.

steels in an industrial atmosphere at Kearny, N.J. His results are shown in Fig. 5.

The corrosion rates taken from the slopes of these curves are shown in Table IX.

The effect of copper on the weathering of steel at three locations has been studied by Larrabee, and is shown in Fig. 6.

The corrosion rates computed from the graphs are shown in Table X.

Pilling and Wesley[26] showed that nickel has a strong beneficial effect, increasing over the range of 2 to 10 per cent. Their results for 0.020 in. sheet are shown in Table XI.

Figure 7 shows the influence of nickel on the corrosion resistance of steel in both industrial and marine atmospheres.

Small amounts of phosphorus (0.01-0.3 per cent) also improve the performance of a 0.5 per cent Cu steel, although it is usually kept below 0.05 per cent for other reasons[30].

Numerous investigations have established that the rust on some steels is more protective than that on others; indeed, the major influence of compositional changes in the steel appears to be in developing a more compact and adherent protective rust film. The denser, more protective rust films are darker in colour and finer in texture. LaQue[31] has stated that for these more protective rust films to develop there must be an opportunity for the rust films to dry, at least occasionally, long enough to enable the desired changes to develop.

The most notable example of the resistance of iron to atmospheric corrosion is the famous Indian iron pillar of Qutab, near Delhi, which has been described by Singh[32] and others. This is a tapered iron pillar 21 feet high, 19 inches in diameter at the base and 12 inches at the top. The composition is 0.08 per cent carbon, 0.11 per cent phosphorus, 0.05 per cent silicon, and no manganese or sulphur. The pillar is generally believed to have been erected about 400 A.D. It has survived 1,500 years without rusting and the original inscriptions are as clear today as when erected. This excellent behaviour is attributed rather to a dry climate than any specially resistant quality of the ancient iron.

An equally surprising report of opposite nature is the statement by Larson[33] that a 14-gauge (0.080 in.) steel sheet in the south west Pacific area rusted through in 24 hours (14,600 m.p.y.).

Table XII — A.S.T.M. Ten-Year Weathering Results for Lead

(9 x 12 x 0.035 in. panels)

Location	Atmosphere	m.p.y.
Phoenix, Ariz.	Desert	0.009
State College, Pa.	Rural	0.019
Key West, Fla.	Marine	0.022
La Jolla, Calif.	Marine	0.016
New York, N.Y.	Industrial	0.017
Altoona, Pa.	Industrial	0.027

Atmospheric Corrosion of Lead

Commercial purity lead is about 99.9 per cent pure, the largest impurity being a trace of copper. This is used for roofs and gutters. Pb-4 Cu alloy coating on copper has been used extensively in the United States. Hot-dipped lead coatings on steel may contain up to 2.5 per cent tin (A.S.T.M. A267-46T). A Pb-6 Sb alloy is frequently used where additional strength is required.

Lead was perhaps the first metal to be employed architecturally, being cast into sheets thousands of years ago. The first application was probably between stone building blocks used in the construction of ancient temples and residences, some of which are intact today. According to Hiers[9] the Pantheon in Rome, with its 144-foot diameter dome, has been roofed with lead for almost 2,000 years. Information on the building in the Encyclopedia Britannica throws some doubt on the age of the lead covering, but it is probably several hundred years old.

Lead was used extensively for roofing churches, especially in the late fourteenth and in the fifteenth centuries. Many examples of medieval lead roofs exist today[34] although most have since been recast and relaid. The lead roof on St. Paul's Cathedral was laid in 1700. A few lead roofs are still in existence that have not been recast for 400 years, but it is rare to find examples dating before 1750.

Lead is considered by many to be the most corrosion resistant architectural metal and to be unaffected by sulphur dioxide in industrial atmospheres, or by sea atmospheres. The normal expectation of life for a newly laid roof of recast lead is at least 200 years[34]. As with other metals, the lasting quality of lead roofs is dependent on proper methods of fixing.

Despite this opinion, it will be seen that lead does possess an appreciable atmospheric corrosion rate, larger, in fact, than aluminium in rural atmospheres. It would appear that the recognized durability of lead is due in part to the fact that it is invariably used in thick sheets, while other metals, which are stronger and do not creep, are used in relatively thin sheets.

Hiers[9] has reported on A.S.T.M. Committee B-3 ten-year exposure tests with lead sheet panels, 9 x 12 x 0.035 in. and these results are presented in Table XII.

Lead coatings for steel have been proposed as an alternative to galvanizing. Compton[35], basing his opinion on A.S.T.M. tests[36], concludes that for pole line hardware, lead coatings are generally adequate and are superior to zinc. In general, pin-hole rusting occurs very early, but in most cases there is a tendency to self-healing with little or no spreading.

Atmospheric Corrosion of Zinc and Galvanized Steel

The impurities in commercial zinc are lead, iron and cadmium. The A.S.T.M. recognizes six grades of slab zinc, varying from 98.3 per cent (1.6 per cent lead)—"Prime Western"—to 99.99 per cent pure "Special High Grade". Zinc is also available in sheet alloys containing about 1 per cent copper, with or without supplementary additions of magnesium, chromium, etc.

Zinc coatings range in purity through the entire series of A.S.T.M. grades and are of four types: hot-dipped, electroplated, sherardized and sprayed. Electrodeposited zinc is generally very pure. The hot-dip galvanized coatings sometimes contain added tin or aluminium and always contain iron. These do not materially affect corrosion resistance but antimony and copper are objectionable[37]. In general, a given thickness of zinc, however applied, gives roughly the same protection to the coated steel.

The extensive use of zinc coatings on steel is largely because of its much better atmospheric corrosion behaviour than steel and because of the protection afforded the steel at scratches and edges where the zinc corrodes galvanically, hence the term "galvanized steel". Low cost and case of application are also important.

Zinc corrodes uniformly and without appreciable pitting. The rate of corrosion depends on the frequency and duration of moisture contact, the extent of industrial pollution or salinity, and the rate of drying. The worst conditions involve frequent wetting of the metal with dews and fogs, in an industrial atmosphere where the

Table XIII — A.S.T.M. Ten-Year Results for Zinc

(9 x 12 x 0.035 in. panels)

Location	Atmosphere	m.p.y.		
		P.W.	H.G.	S.H.G.
Phoenix, Ariz.	Desert	0.010	0.007	0.005
State College, Pa.	Rural	0.042	0.034	0.036
Sandy Hook, N.J.	Marine	0.055	0.056	0.054
Key West, Fla.	Marine	0.021	0.018	0.015
La Jolla, Calif.	Marine	0.068	0.063	0.048
New York, N.Y.	Industrial	0.19	0.20	0.19
Altoona, Pa.	Industrial	0.19	0.19	0.17

P.W. = Prime Western (98.9 per cent Zn)
H.G. = High Grade (99.93 per cent Zn)
S.H.G. = Special High Grade (99.99 per cent Zn)

Table XIV — Additional Ten-Year Results for Zinc

Location	Atmosphere	m.p.y.		
		H.G.	B.S.	H.G.-Cu
Hanover, N.M.	Rural	0.008	0.009	0.014
Key West, Fla.	Marine	0.14	0.14	0.26
Montauk, Pt., N.Y.	Marine	0.12	0.13	0.16
Palmerton, Pa.	Semi-indust.	0.055	0.058	0.052
New York, N.Y.	Industrial	0.28	0.27	0.23
Pittsburgh, Pa.	Industrial	0.18	0.17	0.15

H.G. = High Grade
B.S. = Brass Special
H.G.-Cu = High Grade —1.0 per cent Cu

Table XV — Rusting of Galvanized Steel

Galvanized Coating		Years to 50% Rust	
Oz./sq. ft.	Mils	Altoona, Pa.	Brunot Is., Pa.
0.75	0.64	2.2	2.9
1.25	1.06	3.3	4.3
1.50	1.27	3.8	5.2
2.00	1.69	5.4	7.5
2.50	2.12	7.4	8.9

Table XVI — Rusting of Galvanized Steel
Average Years to Initial Rust

Location	Atmosphere	Coating Thickness				
		oz./sq. ft.	0.75	1.25	1.50	2.00	2.50
		mils:	0.64	1.06	1.27	1.69	2.12
State College, Pa.	Rural		10.6	14.7	16.7	>17	>17
Sandy Hook, N.J.	Marine		4.8	6.8	7.6	10.0	12.0
Altoona, Pa.	Industrial		2.0	2.4	3.0	3.8	4.5
Brunot Is., Pa.	Industrial		2.2	3.2	3.5	4.6	5.5

Table XVII — Expected Life of Galvanized Steel

Location	Atmosphere	Corrosion rate Fe/Zn ratio	Calculated life of 0.75 oz./sq. ft. coatings* (1.27 mils) in years
GREAT BRITAIN			
Calshot	Marine	20.1	9
Llanwrtyd Wells	Semi-rural	19.0	10
Motherwell	Industrial	21.0	7
Sheffield	Industrial	7.5	2
Woolwich	Industrial	26.4	8
Derby	Industrial	17.8	4
Frodingham	Industrial	20.7	3
Sheffield University	Semi-indust.	19.4	6
ABROAD			
Abisko, Sweden	Rural	9.8	58
Apapa, Nigeria	Tropical marine	23.9	30
Aro, Nigeria	Tropical inland	8.5	20
Basrah, Iraq	Dry, sub-trop.	14.3	29
Congella, S. Africa	Marine	20.4	8
Khartoum, Egypt	Rural	3.6	63
Singapore, Malaya	Tropical marine	16.8	36
Berlin-Dahlem, Germany	Industrial	19.3	12
Sandy Hook, N.J.	Marine	30.6	12
State College, Pa.	Rural	30.9	36
Pittsburgh, Pa.	Industrial	15.1	4

* English practice is to give the zinc coating weight in oz./sq. ft. on one side of the sheet, as opposed to North American practice in which the coating weight value applies to both sides of the sheet. Thus, for a given coating weight an English coating will be twice as thick as an American one.

condensed moisture is distinctly acid. In such cases, the acid prevents the formation of the partially protective basic corrosion product that normally develops. Rainfall tends to be beneficial by washing away chlorides and acid dust particles. Shelter tends to be beneficial[38].

It was not until the early 19th century that good sheets of zinc were rolled by a process developed in Belgium. As an experiment, the Church of St. Barthelmy in Liege was roofed with zinc in 1811 and the Cathedral of St. Paul in 1812. Zinc later became one of the most popular roofing materials in western Europe. In England its use gradually declined after 1914 and it is not currently in favour for long-term roofing, the estimate being made that even if 0.080 in. thick, a life of only 40 to 50 years can be expected[34].

In contrast to this Pourbaix[39] has described a zinc roof at Neufchatel, Belgium, as being in good condition after 103 years. The A.S.T.M. Committee B-3[9] 10-year atmospheric exposure results at seven locations are shown in Table XIII.

Anderson and Reinhard[38] have reported some additional 10-year results, as shown in Table XIV.

Galvanized Steel

If steel were covered with a perfectly uniform coating of zinc, and if all parts were exposed to the same corrosive influence, at one stage the zinc coating would suddenly disappear from the entire surface, after which the steel would corrode at its normal rate. In practice this never happens and the development of rusting follows a curve of the shape given in Fig. 8.

As the points of initial and complete rusting are difficult to determine in exposure tests, it is common to plot such curves from data recorded at different times and take the midpoint—the development of 50% rusting—as the criterion of performance of zinc coatings.

On hot-dip galvanized products there is a Zn-Fe alloy layer at the interface between the steel and the zinc. When this is exposed a yellowish corrosion product appears which may be mistaken for rust. This layer is considered to be as protective as the zinc itself. Only when this in turn has corroded does the reddish-brown steel rust appear.

Typical curves are shown in Fig. 9 taken from the reports of A.S.T.M. Committee A-5[40].

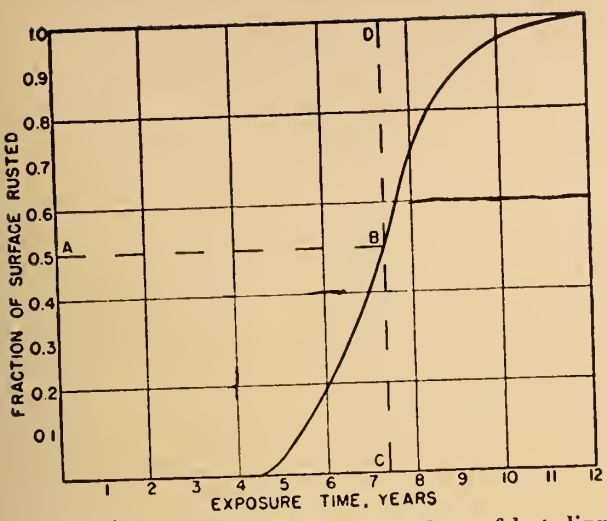

Fig. 8. Typical curve for the rate of failure of hot-dipped sheet subjected to outdoor exposure.

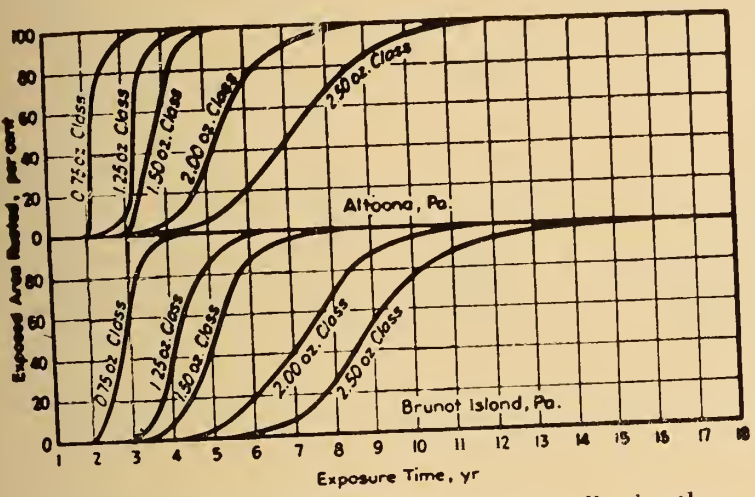

Fig. 9. Life of zinc coatings on iron and steel indicating the progressive development of rust.

The influence of the thickness of zinc on the life of the coating is shown in Table XV which has been prepared from Fig. 9.

Committee A-5 (VIII) results have also been reported on the basis of average life to initial rusting.

Hudson[5] has also published some similar interesting figures for galvanized steel in Great Britain and elsewhere; these are presented in Table XVII.

An official British publication[25] gives the average corrosion rates of zinc coatings on steel to be:

Atmosphere	*m.p.y.*
Rural	0.1
Marine	0.2
Industrial	0.6

These are appreciably higher than the American results obtained for zinc.

Relative Corrosion Rates

It is of interest to compare the relative atmospheric corrosion rates of the five metals under discussion. As explained earlier, test results for different metals can be compared with accuracy only if they have been obtained at the same place during the same time period. Fortunately, some of the A.S.T.M. Committee B-3 data fulfill these conditions, and some of our own results are also available, though of limited duration (two years only) at this time.

A.S.T.M. 10-year results, based on weight loss calculated to penetration rates, are shown in Table XVIII.

This table is based on the assumption that corrosion is by uniform surface attack and thus by general thinning, which is true for copper, lead and zinc, but not for aluminium, which suffers pitting but no general thinning. The rates shown for aluminium are thus too low except in rural atmospheres where pitting is negligible. The best rate values for aluminium in marine and industrial atmospheres are those of Walton, Nock and Sprowls[41] determined over a period of 20 years. In the first year or two the rate may be several m.p.y., but it then slows to a steady rate.

Our own weight loss data for a two-year period, calculated as m.p.y. are shown in Table XX.

Comparing these rates to those reported by A.S.T.M., it is seen that our marine stations (Cape Beale, Kure Beach, Durban) were more corrosive to the metals. This is probably because the corrosion rates for all metals are higher in the early periods of exposure.

It is of interest to carry the comparison further and attempt calculation of the relative cost of corrosion for the different metals. As costs vary with form, computations will be limited to roofing sheet. It should be emphasized that the cost figures are at best only a rough approximation; it is hoped only to show their order. The metal prices are based on April, 1953, quotations for 1,000-pound lots in the Montreal area. Prices will vary with gauge. For the cost unit, $/1,000 sq. ft./year has been chosen arbitrarily. This is calculated from the cost per square foot, the gauge, and the corrosion rate as follows:

$$\$/1{,}000 \text{ sq. ft./yr.} = \frac{(1{,}000)\ (\$/\text{sq. ft.})}{(\text{mils thickness})} \times (\text{Corrosion rate in m.p.y.})$$

The results are shown in Table XXI.

The galvanized steel values were calculated assuming uniform removal of the zinc, followed by rusting of the steel. Such uniform corrosion does not generally occur, but the assumption should nevertheless give a figure of the right order, although more favourable than nature allows.

In rural atmospheres it is seen

that the annual cost is by far the lowest with aluminium. In marine atmospheres the cost figures for lead and copper are less than those for galvanized steel; using the rate figure of 0.11 m.p.y.([41]), aluminium is about equivalent to copper. In tropical marine atmospheres, if the Georgetown rate figure of 0.03 m.p.y.([41]) is assumed, aluminium is similar to lead (0.14 vs. 0.24). In industrial atmospheres lead shows the lowest annual cost with aluminium next, even if a higher rate than 0.08 m.p.y. is assumed.

Conclusion

An attempt has been made to provide an introduction to the subject of the atmospheric corrosion of metals and to provide a comparison of the corrosion rates of the more common architectural metals. This paper is admittedly incomplete, but it is hoped that it will provide an entry to the literature for those desiring more complete information.

Table XVIII — A.S.T.M. Ten-Year Atmospheric Corrosion Rates

Location	Atmosphere	Corrosion rates in m.p.y.			
		Al*	Cu	Pb	Zn**
Phoenix, Ariz.	Desert	0.000	0.005	0.009	0.010
State College, Pa.	Rural	0.001	0.023	0.019	0.042
Key West, Fla.	Marine	0.004	0.020	0.022	0.021
Sandy Hook, N.J.	Marine	0.008	0.026	—	0.055
La Jolla, Cal.	Marine	0.028	0.052	0.016	0.068
New York, N.Y.	Industrial	0.031	0.047	0.017	0.19
Altoona, Pa.	Industrial	0.025	0.046	0.027	0.19

* 2S alloy (commercial 99.2 per cent Al)
** Prime Western Zinc (98.9 per cent Zn)

Table XIX — Corrosion Rates of Aluminium

Walton, Nock and Sprowls ([41])

Location	Atmosphere	m.p.y.
Pt. Judith, R.I.	Marine	0.11
Georgetown, British Guiana	Marine	0.03
New Kensington, Pa.	Industrial	0.08

Appendix

Review of Atmospheric Corrosion Test Work by A.S.T.M.([42])

Committee A-5 (Corrosion of Iron and Steel) was formed in 1906. In 1909 A-5 (then designated "U") reported on 12 samples of galvanized wire with different coating thicknesses exposed at Pittsburgh, Pa. A final report was given in 1911.

In 1915 a program was begun to test the effect of steel composition (influence of copper) on performance, specimens being exposed at Fort Sheridan, Ill., Pittsburgh, Pa., and Annapolis, Md. The 1946 report of A-5 presents the cumulative results.

In 1920 a more extensive test program was planned and by 1926 five test sites were established, at:

State College, Pa.	Rural
Sandy Hook, N.J.	Marine
Key West, Fla.	Marine
Altoona, Pa.	Industrial
Brunot Island, (Pittsburgh), Pa.	Industrial

Corrugated sheets, both bare and with various weights of zinc coatings were exposed. Reports of this work appeared in 1934, 1935, 1936, 1938, 1942, 1944 and 1946.

In 1928 A-5 began tests at the same five sites on steel products coated as follows:

Hot-dipped	zinc
Electrodeposited	zinc
Sherardized	zinc
Electrodeposited	cadmium
Hot-dipped	aluminium
Hot-dipped	lead

Two-, four- and six-year results were reported in 1931, 1933 and 1935 respectively. In 1936 a brief report was made correlating this work with other corrosion studies by A-5. In 1938 a further report was presented. Numerous specimens

Table XX — Two-Year Relative Atmospheric Corrosion Rates

(6 x 8 in. x 0.064 in. 2S panels)

Location	Atmosphere	m.p.y.			
		Al	Cu	Pb	Zn
Kingston, Ont.	Rural	0.009	0.026	0.022	0.037
Cape Beale, B.C.	Marine	0.005	0.046	0.054	0.111
Kure Beach, N.C.	Marine	0.028	0.060	0.034	0.130
Vancouver, B.C.	Mild industrial	0.024	—	—	0.061
Toronto, Ont.	Industrial	0.033	—	—	0.159
Montreal, Que.	Severe indust.	0.041	—	—	0.167
Durban, S. Africa	Severe marine	0.046	0.099	—	0.196*
Halifax, N.S.	Indust. marine	0.071	—	—	0.298

Table XXI — Relative Cost of Atmospheric Corrosion of Metal Roofing

Metal	Thickness	$/sq.ft.*	Corrosion Rate (m.p.y.†)			Cost of Corrosion $/1,000 sq. ft./year		
			Rural	Marine	Indust'l	Rural	Marine	Indust'l
Aluminium	0.032	0.150	0.001	0.11	0.08	0.005	0.52	0.37
Copper	0.032	0.975	0.023	0.023	0.045	0.70	0.70	1.37
Lead	0.085	1.000	0.019	0.020	0.022	0.22	0.24	0.26
Steel	0.018	0.073	1.5	2.0	5.0	6.1	8.1	20.2
Galvanized Steel (1.5 oz./sq. ft.)	0.022	0.127	0.042§	0.038§	0.190§	2.9	2.9	11.9

* in 1,000 pound lots
† from 10-year A.S.T.M. results except for Al, Fe
§ Rate for zinc

ere remounted and are reported on 1943, 1944 and 1946. Additional ardware tests were being planned 1946.

Extensive tests on unfabricated ire, barbed wire, wire strand, farm eld fencing and chain-link fencing ere started in 1936 at 11 locations:

Ames, Iowa	Rural
Manhattan, Kan.	Rural
Ithaca, N.Y.	Rural
College Station, Tex.	Rural
Davis, Cal.	Rural
State College, Pa.	Rural
Lafayette, Ind.	Rural
Sandy Hook, N.J.	Marine
Brunot Island, Pa.	Industrial
Bridgeport, Conn.	Industrial-marine

The materials tested were uncoated vire and fencing (copper-bearing and copper-free), zinc-coated wire and fencing, alloy steel wire and fencing, lead-coated wire and fencing.

The program was outlined in the 1937 committee report. The two-, four-, six,- eight- and 10-year results were reported in 1939, 1943, 1945 and 1947.

Committee B-3, Corrosion of Nonferrous Metals and Alloys, was organized in 1922 and in 1931 began an extensive atmospheric test program at nine sites:

Phoenix, Ariz.	Desert
State College, Pa.	Rural
Sandy Hook, N.J.	Marine
Key West, Fla.	Marine
La Jolla, Cal.	Marine
Pittsburgh, Pa.	Industrial
Altoona, Pa.	Industrial
Rochester, N.Y.	Industrial
New York, N.Y.	Industrial

Specimens of zinc, nickel, monel, copper, lead, tin and aluminium were exposed. The 10-year results were reported in a symposium in 1946(9). The 20-year results are now being prepared and should soon be available.

Committee B-3 also started a number of galvanic-couple exposure tests in 1931. The final results were published by Sub-Committee VIII in 1939.

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The Coronation Review

On June 15 off Spithead, England, one of history's greatest assemblages of ships sailed past Her Majesty Queen Elizabeth in the traditional Coronation Review.

Proudly taking their stations in this array were six ships of the Royal Canadian Navy, a cross-section of Canada's relatively small but expanding sea forces.

Canada's Coronation squadron was headed by the aircraft carrier *Magnificent*. The cruisers *Ontario* and *Quebec* were on hand. The destroyer *Sioux*, tested in the Korean war, was there. The frigates *Swansea* and *La Hulloise* represented Canada's World War II naval construction effort that helped turn the tide in the Battle of the Atlantic.

Our country's peacetime skills were on view, too, in the Department of Transport's new icebreaker *D'Iberville*, designed and built in Canada, and which in time of war could be used for defence purposes.

Canada's contingent may not have loomed large, numerically, in the armada of 200 ships. It served as a reminder however that as our country moves up the scale of world powers she takes her place beside Britain and other freedom-loving countries whose naval forces stand as a barrier against world enslavement.

Mr. C. K. McLeod, M.E.I.C., president of the Navy League of Canada, was present at the review.

From newsletter of Canadian Shipbuilding and Ship Repairing Association.

The Schluchseewerk Project

by

Kurt A. Scholz

Chief of Civil Engineering Design,
The Rankin Co. Ltd.,
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Our recent immigrant engineers have brought many skills and much experience to Canada. This paper is a sample of both and is particularly timely because, although we have as yet made no attempt to store off-peak power in the form of water available for the generation of peak power, the matter is a live one and is receiving considerable study in more than one quarter. Particularly noteworthy are the author's description of a prestressed concrete tunnel lining and his analysis of a penstock failure.

The writer was from 1947 to 1951 civil design engineer with the consulting engineers for the Schluchseewerk-project, the Elektrizitaets Actien Gesellschaft, formerly W. Lahmeyer & Co., at Frankfurt-on-Main in Germany. In that capacity he worked on the last phases of the Witznau and Waldshut stages and of the proposed Wutach diversion of the Schluchsee project.

The information for this paper came from various publications about the project and the Rheinisch-Westfaelisches Elektrizitaetswerk A.G. and from personal notes. The explanation of the penstock failure at the Waldshut plant in the autumn of 1951 is the writer's personal opinion and is not based on official investigations, which were not available up to the time he emigrated from Germany.

Idea and Purpose

In 1952, after 24 years of construction, Europe's largest hydroelectric development with pumped storage peak loads was completed. This project is located in the Schluchsee-Upper Rhine district in the southwestern corner of Germany.

The Schluchsee development has an important place in the West-German grid owned and operated by the Rheinisch-Westfaelisches Elektrizitaetswerk A.G. (RWE). It cooperates with the steam power plants in the Lower-Rhine and Ruhr regions and various run-of-river plants on the 220 kv. transmission lines. The present voltage of 220 kv. will eventually be stepped up to 400 kv. The diagrammatic layout and the proposed extension of this grid may be seen in Fig. 1. The grid has connections to Austria, Switzerland, France, Belgium, and

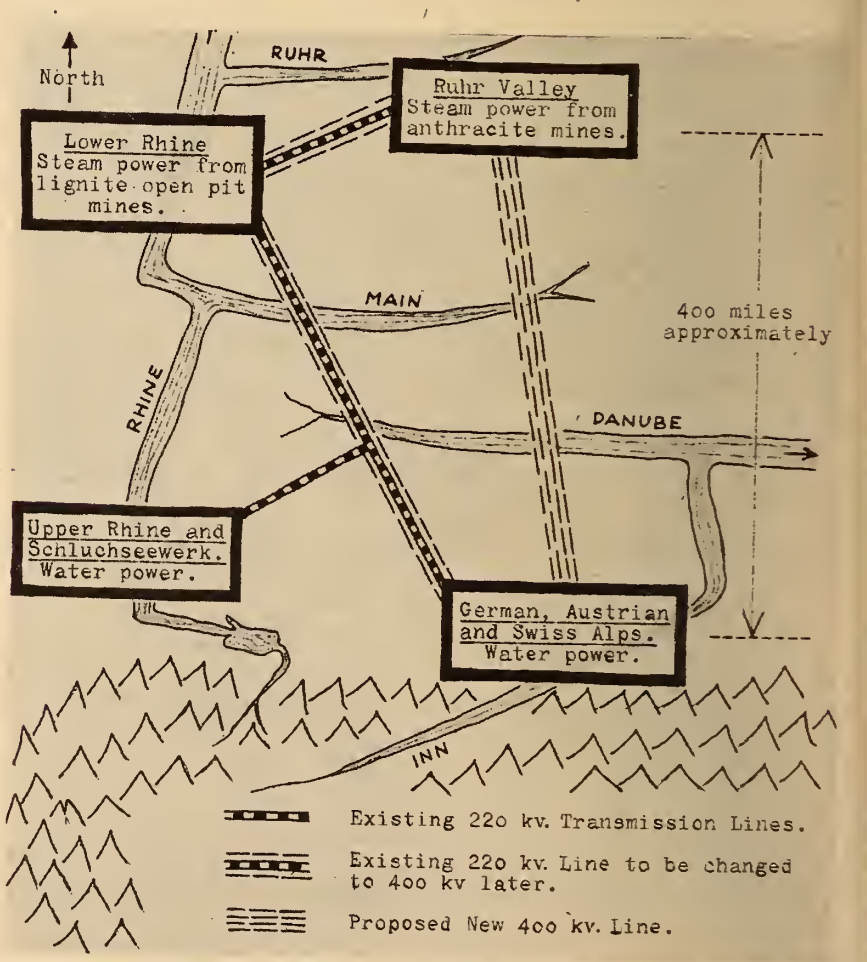


Fig. 1. Existing 220-kv. grid and proposed 400-kv. ring of the Rheinisch-Westfaelisches Elektrizitaetswerk A.G. (RWE)

ıe Netherlands and later will have ne to Italy. The length of the xisting main transmission line is omparable to that of the Ontario lydro-Electric Power Commission rom the Ottawa river development o the steam generating station at Windsor.

The general scheme of the RWE grid is as follows: The run-of-river plants are operated continuously at their highest capacity. The steam power plants are run at full load in succession according to their economy. The peaks of load are carried by peak load hydro plants, which are more suitable for this purpose than steam plants because they can be switched in more rapidly without losses. During the time of low power consumption, the electricity from steam and run-of-river plants is used to pump water from the lower to the higher reservoirs of the pumped storage plants as a reserve capacity, to apply on the peak load or to take care of sudden breakdowns in the grid.

The Schluchseewerk development is the largest one of its kind in the RWE-system. During off-peak night hours and on week-ends, water is pumped from the Rhine river to the Schluchsee headwater reservoir. During on-peak day hours, water is shunted back through the hydro-electric generating units to the tailwater of the Rhine river again. The reservoirs are also large enough to store some of the summer run-off for the bigger winter demand.

General Description of the Project

The drainage area of the Schluchseewerk development is 122 sq. miles. An average annual precipitation of 70 in. is recorded within the watershed. The gross head of 2,030 ft. between the Schluchsee headwater reservoir and tailwater in the Rhine river, which is the headwater for the Albbruck-Dogern run-of-river plant, is divided into three stages as follows:

Plant 1—Haeusern

(Built from 1929-1932)

The original water level of the Schluchsee lake is raised 95 ft. by a gravity dam, to provide a usable storage capacity of 88,000 acre-ft. The original ½-mi. length of the Schluchsee ("narrow lake") is increased by 4 miles. Run-off from other watersheds is brought to the lake by tunnels, pipe lines and canals.

An intake with racks and gate lets the water from the reservoir into a 13-ft. circular concrete lined tunnel 4 miles long. A surge tank of 33 ft. diameter is cut in rock where the tunnel changes over to two steel penstocks of 10 ft., decreasing to 8 ft., diameter. The pipes run from the controlhouse to the powerhouse down a steep hillside.

The powerhouse is built on solid bedrock in the Schwarza valley and has four vertical-shaft units. Each unit consists of generator, turbine, hydraulic clutch-coupling and pump. The Schwarza dam provides a tailwater pond of 1,060 acre-ft. usable storage capacity, with 36-ft. normal drawdown. This reservoir is also the headwater for the second plant.

Plant II—Witznau

(Built 1938-1950)

Simultaneously with the completion of the Haeusern plant, the temporary Eichholz plant (two 35,000 kva. units) was built at the end of a two-mile tunnel downstream in the Schwarza valley. It produced power for 10 years, until the tunnel to the Witznau plant was completed and the first unit there was put into operation.

The Alb dam and free-flow tunnel increase the run-off area for the Schwarza reservoir (Haeusern), adding 1,800 acre-ft. of usable pondage.

The Mettma dam provides a second headwater reservoir of 1,380 acre-ft. usable storage capacity. The water surfaces of the Schwarza and Mettma reservoirs are at nearly the same elevation as they are interconnected. Differences in elevation of the two surfaces are due to different friction losses of the tunnels. The Schwarza and Mettma tunnels meet in a 16-ft. circular tunnel. A vertical surge tank, 40 ft. in diameter, is excavated in rock just beyond the junction of the tunnels.

The Witznau powerhouse is combined with a gravity dam. Tailwater goes into storage in the pond upstream of the dam. The Witznau reservoir has a usable storage capa-

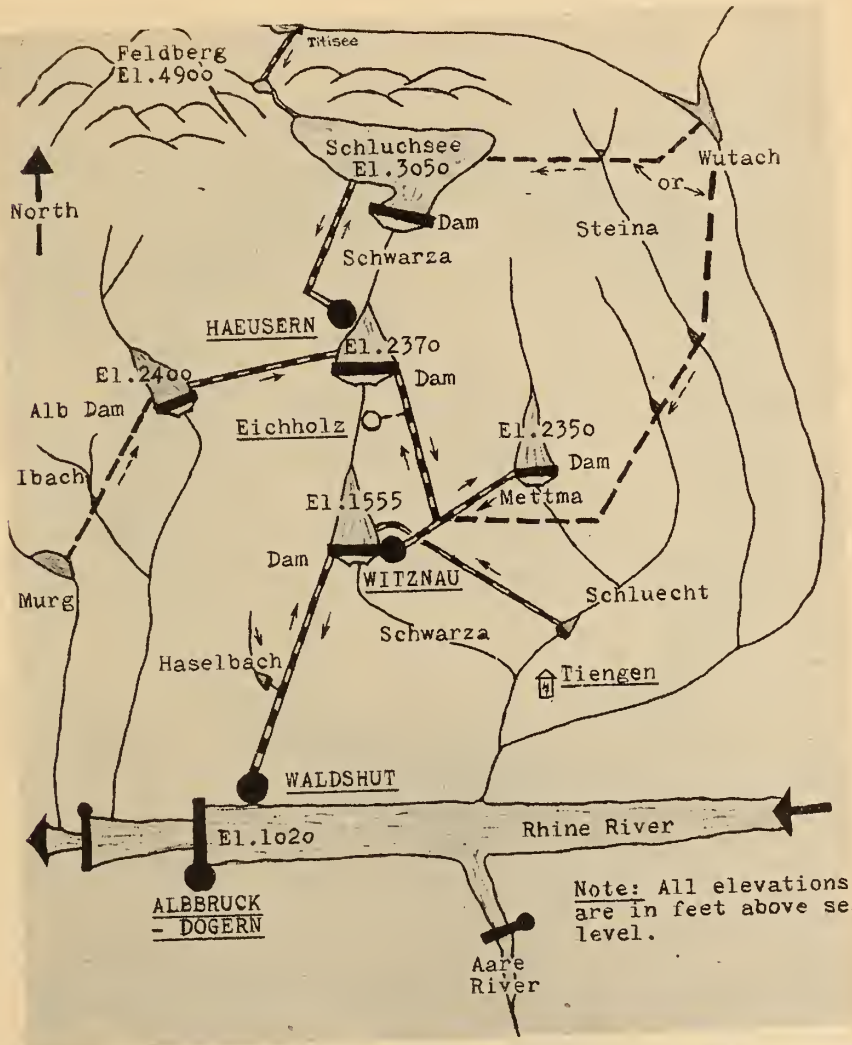


Fig. 2. Diagrammatic plan of the existing Schluchseewerk development and the proposed diversions.

city of 1,060 acre-ft. with 60 ft. normal drawdown.

Plant III—Waldshut

(Built 1942-1952)

The drainage area of the Witznau reservoir is increased by a weir in the Schluecht river which diverts Schlnecht water through a 1-mile tunnel to the Witznau pond.

A high-pressure intake at Witznau with racks and gate releases the water into a 20-ft. circular tunnel 6 mi. long. This tunnel delivers water from the Witznau reservoir to the Rhine valley. A vertical shaft collects the diversion of the Haselbach river. The surge tank is again excavated in rock, 46 ft. in diameter and 520 ft. high. A control-house is built at the end of the tunnel. There a steel-Y splits the 20-ft. pipe into two 13-ft. pipes which run to the powerhouse. The powerhouse is erected on solid bedrock parallel to the bank of the Rhine river.

The tailwater pond for the Waldshut plant is also headwater for the Albbruck-Dogern base load plant in the Rhine river. This plant has 30-ft. head, the turbines discharge 37,500 c.f.s. and the capacity of the three generators is 75,000 kw. The average annual energy output is about half a billion kw. hr.

A diversion to the Alb reservoir from the Murg and Ibach rivers is planned to the west and a diversion of the Wutach and Steina rivers to the Witznau plant, or eventually for pumping to the Schluchsee headwater reservoir is proposed to the east.

Figure 2 shows the relative locations of the various dams, reservoirs, tunnels and power plants.

Structure, Machinery and Equipment

All the dams are solid concrete gravity dams. The foundations are keyed one-twentieth of the total height of the dam and saw-toothed into sound rock to prevent sliding. A 40-ft. deep cut-off wall is built upstream. A grout curtain injected under 120 lb. per sq. in. pressure fills all cracks in the rock underneath making a nearly watertight contact between dam concrete and rock. Contraction joints with metal water stops between the wall sections are provided at approximately 40-ft. centres. Inspection shafts at each joint are connected by an inspection gallery near the foundations. Horizontal drainage pipe galleries are located 10 ft. apart. All dams have spillways with crest gates and high-pressure outlets for the release of water. The upstream faces of the dams are protected by cement plaster and heavy bituminous coatings. A cement containing a high percentage of blast furnace slag and low in lime content was used for the concrete, because the water of the Schluchsee drainage area is somewhat acid. Dams finished and in operation are listed in Table 3.

Two small diversion weirs are already built. The Schluecht weir and intake structure impound the water for that diversion through a free-flow tunnel. The Haselbach weir and intake are at the beginning of the 1,600-ft. concrete pipe line which brings the water to the Haselbach shaft. Here it drops down 160 ft. to the Waldshut pressure tunnel.

All the pressure tunnels are circular. The maximum water velocities in the tunnels are between 15 and 20 f.p.s. The tunnels were excavated in solid rock where possible. The minimum concrete lining was 10 in. thick. The rock around the whole circumference was grouted 6 to 10 ft. deep. A gunite coating was applied to the concrete lining, where timber forms were used. This finish could be omitted if smooth steel forms were used. Small check valves were set in the concrete which allow the exterior water in the rock to flow in when the tunnel is emptied, but prevent the outflow of water from the pressure tunnel. The drainage pipes were filled with concrete after construction.

Steel lining is used at the ends of the tunnels where the pressure is high and the rock cover over the tunnel is inadequate. The steel plates were riveted at the Haeusern and Witznau plants, but welded at the Waldshut plant. Here automatic electrically melt-welded seams fixed the ½ to 1½ in. thick panels of sheet together to form 40-ft. sections. These shells were then connected by hand welding when in place in the bore. The joints were all checked by X-raying. The space between the steel shell and the rock was filled with concrete and grouted under a pressure of 30 lb. per sq. in. Where steel lining is used, the drain-

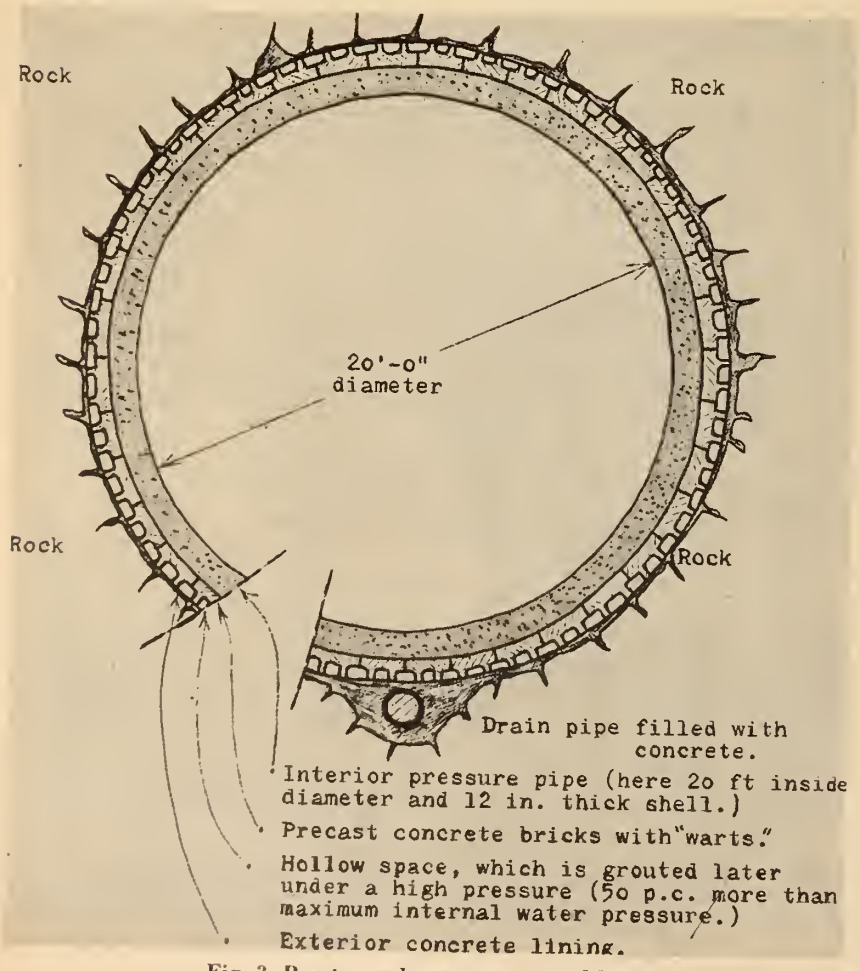


Fig. 3. Prestressed concrete tunnel lining.

age pipes remain open and are controlled by valves at their ends. The pipes are drained when the tunnels are emptied to decrease the external pressure on the steel shell.

A prestressed concrete lining was applied to quarter-mile section of the Waldshut tunnel, between the normal concrete lining and the steel lining (see Fig. 3). The construction method works as follows. At first a circular tunnel is driven in rock and faired up with concrete. Then pre-cast concrete bricks with "warts" are built up against this lining, so as to leave an empty space between the bricks and it. A 12-in. thick shell is then poured against the pre-cast bricks. When the interior shell is set, the hollow space between bricks and exterior lining is grouted under a pressure of 255 lb. per sq. in. Thus the external pressure applied to the 12-in. lining becomes 50 per cent higher than the bursting stress from internal water pressure. Therefore the interior lining is always under compression and is water-tight. Controls with special instruments showed that the applied pressure temporarily decreased to about 70 per cent of its initial value but increased again later to the former average compressive stress of 4,300 lb. per sq. in. in the extreme interior fibres.

The total excavation of the Waldshut tunnel was about half a million cu. yd. The concrete lining for this tunnel was estimated at 20,000 cu. yd., but 57,000 cu. yd. concrete were required to fill up holes in the rock, caused by decay and disintegration during wartime, when the construction was stopped.

The surge tanks of the Haeusern and Witznau plants are vertical risers over the tunnels excavated in rock with an overflow, a surface chamber and a superstructure. The capacity of the Haeusern riser alone is not sufficient to provide the water reserve for the time necessary to put the water in the tunnel in motion when the turbines are opened. Therefore additional chambers were excavated at the base of the surge tank. No such chambers are required at the Witznau and Waldshut shafts. The Waldshut surge tank is a simple vertical riser with a protecting roof structure at its top. The 48-ft.-long access shaft from the tunnel at the base of the surge tank is lined with a 20-ft. circular steel insert. The prestressing method used in the pressure tunnel was applied to a section of this surge tank, where it passed through a layer of gypsum. A special acid-resistant cement was used for the

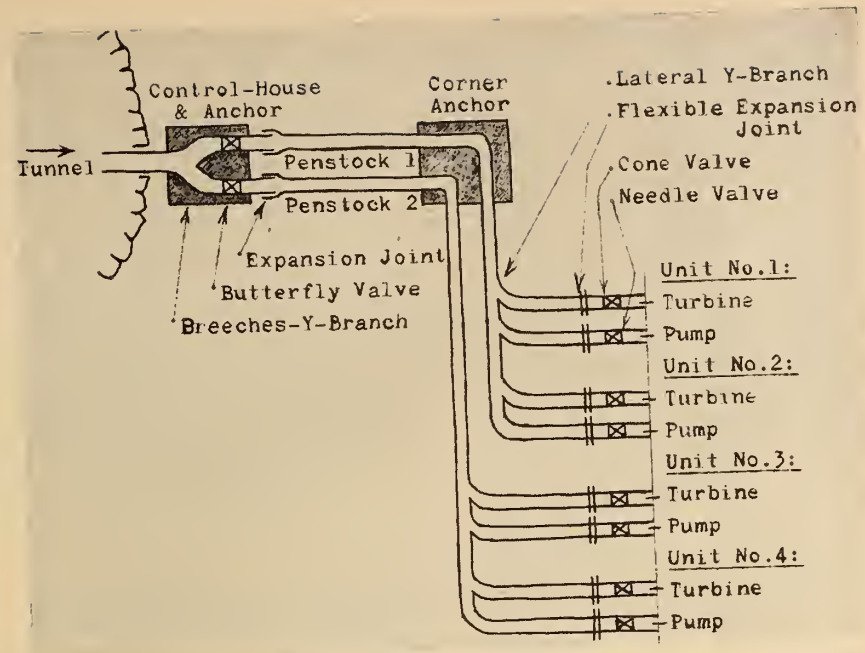


Fig. 4. Typical penstock layout.

Table 1—Data on the Plants of the Schluchseewerk Project

	Haeusern	Witznau	Waldshut
Number and type of units	4 vertical	4 vertical	4 horizontal
Headpond HWL and LWL	3,050-2,955	2,370-2,334	1,555-1,495
Tailpond, HWL and LWL	2,370-2,334	1,555-1,495	1,020 (+or−2 ft
Tunnel and penstock length	4 miles	6 miles	6 miles
Gross head	680 ft.	815 ft.	535 ft.
Turbine rating, hp. and head	48,500 630	74,000 710	59,000 470
" " cfs. and r.p.m.	780 333.3	1,050 333.3	1,240 250
Generator rating, kva. and p.f.	32,000 .7	55,000 .8	44,000 .9
Pumps rating, cfs.	325	325	325
Motor kw. required	20,000	32,000	18,000
Kw. hr./year, natural runoff	41 million	140 million	106 million
" " pumped storage	99 million	110 million	54 million
" " total	140 million	250 million	160 million
" " future total (after completion)	140 million	380 million	230 million

Table 2—Main Reservoirs

	Usable acre-ft.	Max. acres	Length miles	HWL & LWL	Drawd'n ft.
Schluchsee	88,000	1,270	4.6	3,050-2,955	95
Alb	1,800	60	1.1	2,400-2,370	30
Schwarza (Haeusern)	1,060	37	0.6	2,370-2,334	36
Mettma	1,380	32	1.1	2,350-2,310	40
Witznau	1,060	35	1.0	1,555-1,495	60

Table 3—Dams Finished and in Operation

	Height ft.	Length ft.	Concrete cu. yds.
Schluchsee	200	820	157,000
Schwarza	150	520	56,000
Mettma	150	430	50,000
Alb	90	500	33,000
Witznau	160	380	82,000 (including power-house substructure)

grouting as a precaution against chemical damage. Hard-burned bricks with mortar of the same special cement were used for the exterior lining.

The steel linings in the final sections of the tunnels change over to independent steel pipes and then branch with large breeches-Y's into two penstocks. These Y's are so designed as to cause a minimum of hydraulic losses and therefore they are built without interior ties. A semi-elliptical longitudinal exterior center piece and four transverse exterior ring-girders were used for stiffening. Only the central longitudinal joints were riveted; all the others were hand-welded in place. All welded seams were X-rayed. The omission of ties at the Waldshut Y reduced hydraulic losses by nearly two-thirds, but the weight of the Y was increased from 160 tons to about 250 tons. Every inch of head loss means about 25 kw. less output of the Waldshut plant, therefore the increase of weight is justified in consideration of the gained head.

The penstocks are furnished with automatically controlled butterfly valves and expansion joints at the upper ends and are fixed by heavy reinforced concrete anchors (see Fig. 4). Between anchors the pipes are supported by ring girders. Having passed the corner anchor near the powerhouse, the two penstocks divide into four pipes each serving the turbines and pumps of two units. Here tensile interior members are used for all lateral Y's to reduce their weight. Cone valves are used for turbines control and needle valves for the pumps. Special expansion joints, reducing the bending moments due to fixing, are constructed at the points where the pipes enter the powerhouse substructure. They provide a certain amount of flexibility and work like a hinge when lateral forces from pipe expansion or contraction, etc., are applied. Most of the pipe lines have riveted joints, but some are welded. Special fittings at the Haeusern plant are steel castings, and at the Witznau and Waldshut plants are welded constructions of steel plate. Special care was given to the rust protection of the pipes. They were sand blasted, then dried with an air blast before the first coating is applied. Up to four protective asphalt and bituminous coatings were brushed or sprayed on.

The powerhouses contain four units each. A two-stage pump, a hydraulic clutch coupling, a Francis turbine and a generator (synchronous motor), respectively, rotate around vertical shafts at the Haeusern and Witznau plants, and on horizontal ones at the Waldshut plant (see Figs. 5 and 6). It is not desirable that the turbine turn the pumpwheel when idling, thereby wasting power. Therefore a clutch is put between the pump and the turbine. This clutch is out while the turbine is moving the generator and is in when the generator is acting as a motor. Before clutch is engaged, a small impulse turbine brings the pump to the same rotation speed as the generator-motor. This arrangement has the advantage of cutting down the time of change-over between generating and pumping to a minimum by keeping the machinery in rotation. Only three minutes are required for this change-over.

The generators of the Haeusern plant are rated at 32,000 kva. each, 10,500 volts, three-phase, 50 cycle and 0.7 power factor. They work as synchronous motors for the pumps with 22,000 kw. max. each and 0.7 power factor. The rotation speed is 333⅓ r.p.m. The main and pilot exciters are mounted on the generators and direct connected. Water for the cooling system is pumped from the Schwarza reservoir. The Francis turbines have a maximum discharge of 780 c.f.s. and are rated at 48,500 hp. each. They have pressure regulators with bypasses. The two-stage pumps have a maximum discharge of 325 c.f.s. Cone valves are provided at the penstock side and sliding gates at the conduits to the reservoir for the turbines and the pumps. The machinery is operated automatically from the switchboards in the control room and hand operating is possible for emergencies. Only 1½ min. are required to bring a unit to full load from rest. A CO_2 system is installed for fire protection. Line and tie air-break facilities control the transformers and the 110,000-volt transmission lines. A tertiary winding on the transformers may be used to supply local loads. An independent 740-h.p. unit at the Haeusern plant feeds the auxiliary system for all three plants of the development. Telephone communication over the high-tension transmission lines by high-frequency is provided. The operation of the Witznau and Waldshut plants is directed from the Haeusern control room.

The layout for the machinery of

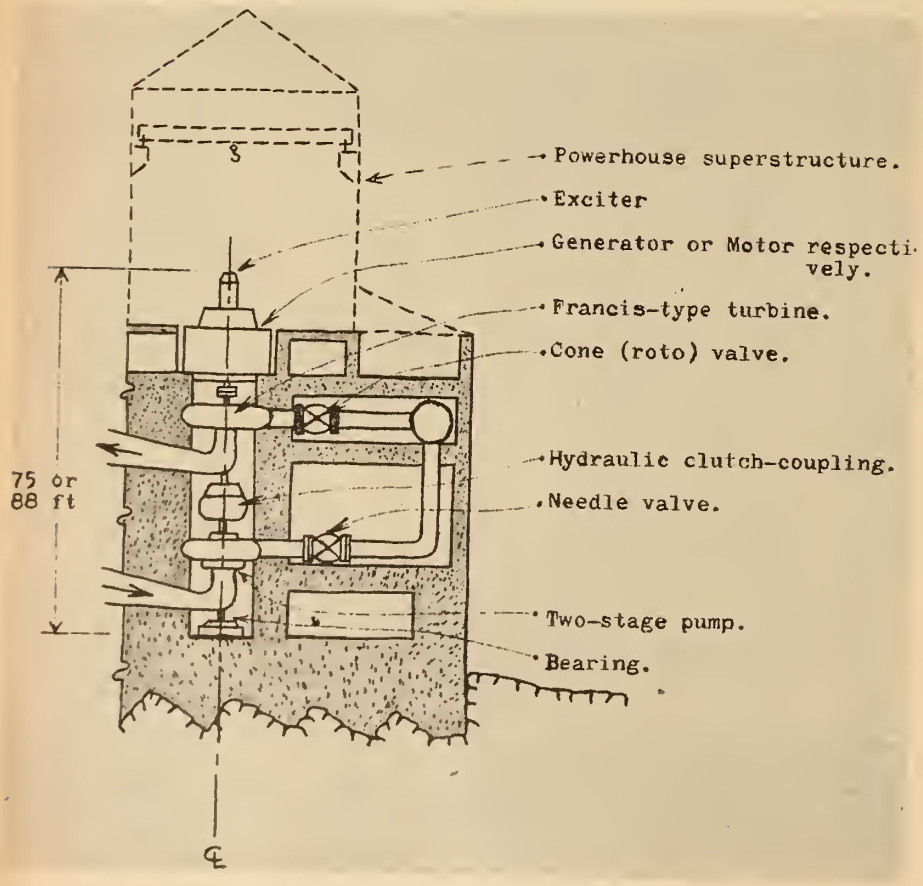


Fig. 5. Typical vertical-shaft unit.

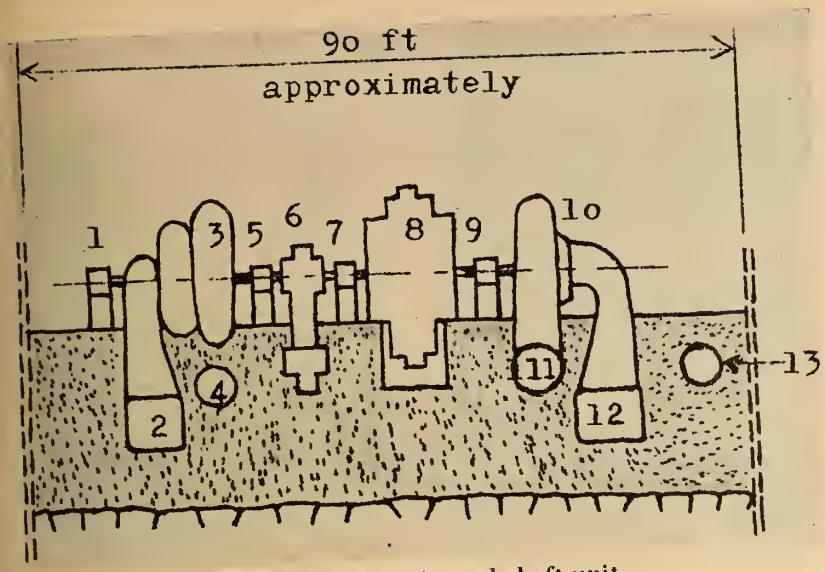


Fig. 6. Typical horizontal-shaft unit.

1—Bearing. 2—Suction conduit to pump. 3—Two-stage pump. 4—Outlet from pump to penstock (needle valve). 5—Bearing. 6—Hydraulic clutch-coupling. 7—Bearing. 8—Generator or motor respectively. 9—Bearing. 10—Francis-type turbine. 11—Inlet from penstock to turbine (cone valve). 12—Draft tube from turbine to the Rhine river. 13—Bypass of the pressure regulator.

the Witznau plant differs little from that of the Haeusern plant, but the rating is higher. Each generator is rated at 55,000 kva., 10,500 volts, three-phase, 50 cycle and 0.8 power factor. Working as a motor, it consumes 32,000 kw. with 0.8 power factor. The speed is 333⅓ r.p.m. The cooling water is at present pumped from the reservoir, but later will be diverted from the Schluecht tunnel. This change will avoid an expensive filtration plant when the silty Rhine water is pumped into the reservoir. The rating of the turbines is 74,000 hp. at 710 ft. head and 1,050 c.f.s. discharge. The two-stage pumps have approximately the same discharge as the Haeusern pumps. The penstocks are controlled by cone valves at the turbines and by needle valves at the pumps. The conduits to the reservoir have only one set of emergency stop logs, as the spiral casings are not drained by pumps, but are unwatered by compressed air. The plant is automatically operated from the control room. The transformers and the switchyard are located on the dam.

The Waldshut plant has four horizontal-shaft units. The generators are rated at 44,000 kva. each, 10,500 volts, three-phase, 50 cycle and 0.8 power factor. The speed is 250 r.p.m. Acting as motors for the pumps, they use 18,000 kw. with 0.8 power factor. The main and pilot exciters are located immediately beside the rotors. The generators are cooled by forced air, which heats from 92°F. to 131°F. 1,160 c.f.s. of cold air is required. Cooling water keeps the temperature of oil in the bearings below 122°F. The water heats from 68°F. to 79°F. The cooling water is obtained from groundwater wells or from a filtration plant which can clarify 10 c.f.s. of Rhine water. The Francis turbines are rated at 59,000 hp. at 470 ft. head and 1,240 c.f.s. discharge. The pumps require 18,000 kw. each to pump 325 c.f.s. The water in the spiral casings can be removed by compressed air. The pipes to the turbines are controlled by cone valves and needle valves are installed at the pumps. Sliding gates keep Rhine water out of the draft tubes and intakes if necessary. The racks at the pump intakes are cleaned by a mechanical machine. Two electrically operated 140-ton cranes serve the generating station. For loads in excess of the capacity of one crane, an equalizer beam combines the lifting capacity of both. All machinery is automatically operated from the control room. Transformers and switchyard are arranged similar to those of the two previous plants.

110-kv. high-tension lines transmit half of the power output to the regional power company, the Badenwerk A.G., and the other half is

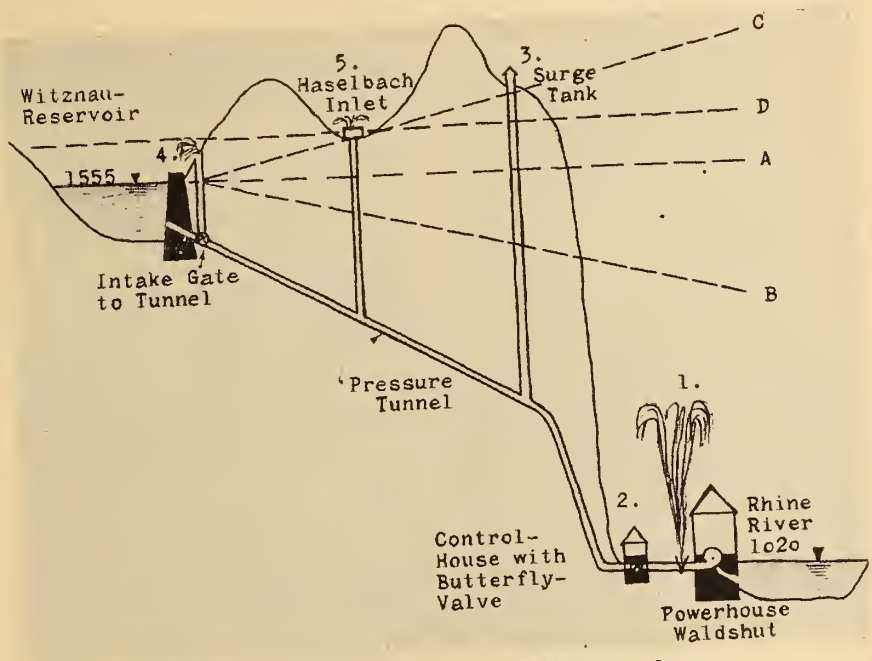


Fig. 7. Penstock failure at the Waldshut plant.

Line A—Reservoir level, plant not operating. Line B—Hydraulic gradient, plant in operation. 1—Lateral Y-branch cracks. 2—Automatically controlled butterfly valve in controlhouse closes. 3—Water in the surge tank swings up. Line C. 4—Intake gate from the Witznau reservoir to the tunnel is closed. Water surface in the tunnel tends to become level. Line D. 5—Water pressure destroys the superstructure at the Haselbach inlet.

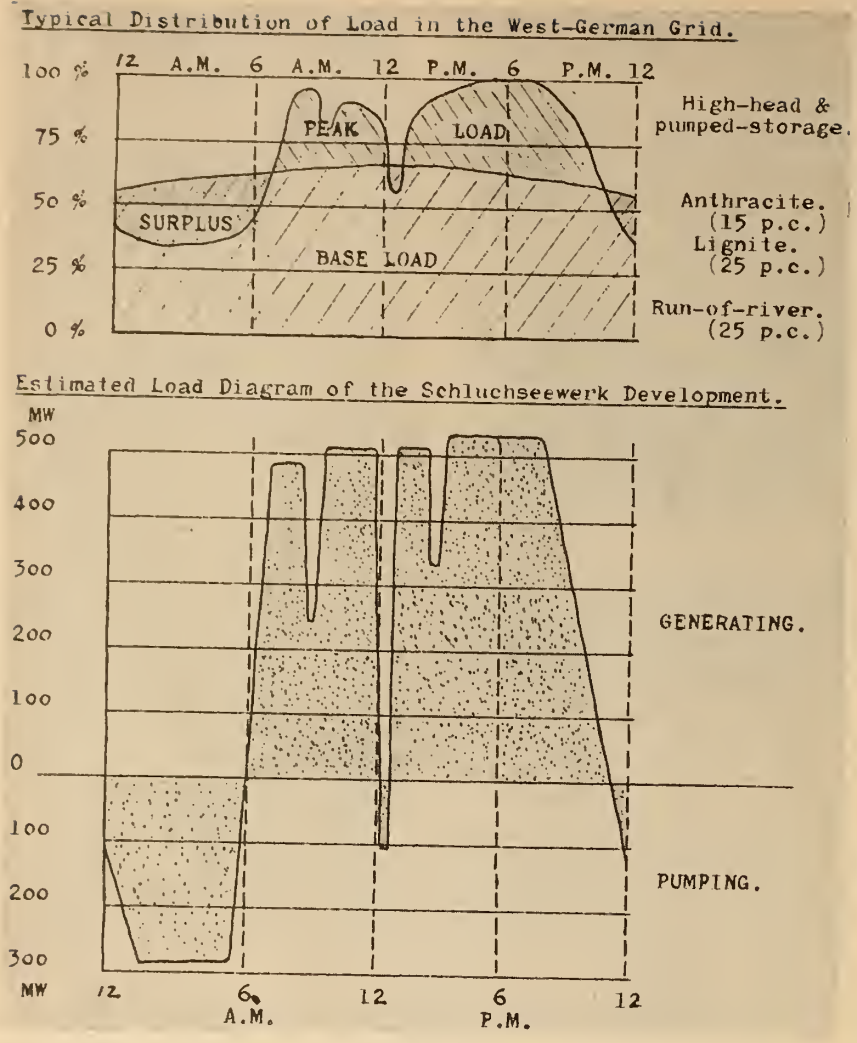


Fig. 8.

transmitted to the Tiengen substation of the RWE. There transformers step up the voltage to 220 kv. for the RWE-grid. The surplus power which is used for pumping is transmitted the same way but in the opposite direction.

Penstock Failure at the Waldshut Plant

In the autumn of 1951 the first unit of the Waldshut plant was already in operation and several test runs were being made to check the second and third units. Suddenly a crack occurred at a lateral Y-special and the pipe burst. A fountain approximately 60 ft. high, which seriously damaged the powerhouse structure and the piping gallery basement, was reported by observers.

The butterfly valve in the control house, which closes automatically when the velocity of the water is twice the normal, shut down promptly and the flow of water was stopped, so further damage at the powerhouse was prevented. It was suspected that internal stresses in the material near the welded joints, together with the water hammer set up during the testing period, were the cause of the rupture. The heat treatment after the welding, a slow cooling of the joints and the adjacent areas has to be carefully observed to relieve internal stresses. The proper heat treatment of the field welded joints, where the pipe burst, was obviously difficult and perhaps inadequate.

The water in the tunnel, still in motion, started rising in the surge tank. In the meantime, the operator of the Witznau plant was ordered to close the intake gate at the reservoir in case the butterfly valve in the control house should not work. Unfortunately, this gate was closed just at the moment when the pressure wave in the surge tank reached its peak. The closed gate prevented the water, now swinging down again, from flowing back into the Witznau reservoir. The continuous body of water tended to produce a level upper surface and poured out from the tunnel access to the gate, nearly drowning the operator.

During the testing period special registering instruments were installed at various places and observers were posted at the structures. The observer at the Haselbach superstructure reported that the reinforced concrete slab and the heavy steel cover had been damaged. The Haselbach inlet is built in a former shaft used for construction purposes. It is located upstream from the surge tank and closer to the Witznau reservoir. The design was based on the assumption that the pressure wave, having its peak in the surge tank would decrease proportionately to zero at the tunnel intake from the Witznau reservoir. Though closing of the valves in the control house or at the powerhouse was considered in this assumption, closing of the intake gate during operation of the plant was not taken in account. Figure 7 shows what is believed to have happened.

It is suggested that intake gates of tunnels should not be used for emergency closing if they are not especially designed for that purpose. Preferably, two butterfly valves in the control house, one for normal operation and one for emergencies, should be installed. This arrangement has been provided at the Haeusern plant. But if the intake gates are required for emergency closing, the effects mentioned above should be considered by the designer and all intermediate intakes between the surge tank and the headwater reservoir must be located high enough.

Power and Costs

A maximum capacity of 407,000 kw. (524,000 kva.) is installed in the 12 units of the Schluchseewerk development and the aggregate consumption for pumping is 280,000 kw.

The natural runoff of the watershed gives an average annual energy output of 287 million kwh. at the present stage of completion.

This figure is increased if the output gained by pumped storage is included. This energy is estimated to be about 260 million kwh. per year. Thus the total average annual energy output of the existing plants will be 550 million kwh.

After completion of the eastern diversions (Wutach and Steina) and the western diversions (Murg and

(*Continued on page 865*)

Nova Scotia

by

HIS WORSHIP R. A. DONAHOE
Mayor of Halifax, N.S.

An address delivered at dinner, May 19, during the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, N.S.

The dictionary defines a peninsula as "a piece of land almost surrounded by water and connected to the mainland as by a narrow neck called an isthmus". Nova Scotia is a peninsula. It is connected to the mainland by the Isthmus of Chignecto, and jutting out into the Atlantic Ocean, it is thereby the point on the Atlantic seaboard nearest to Europe.

The school geography, in describing Nova Scotia, tells us that at one time it was part of the ocean floor and at still another time was covered by glaciers, and the topography of the province reflects both periods.

But land is land and water is water wherever found, and except insofar as its position has affected its development, we are not concerned for my present purpose with the physical aspects of Nova Scotia.

That Nova Scotia is beautiful none can deny. That its bluffs and headlands, its beaches and coastline, its meadows and orchards form vistas of beauty to charm the eye of the beholder whether he be native or visitor is a self-evident fact. But tonight I hope to discuss with you the question of what kind of a place Nova Scotia really is, what kind of people Nova Scotians really are and what has gone to make them what they are. To begin with, Nova Scotia is the scene of the first permanent white settlement in North America at Port Royal, now Annapolis Royal. The story of that first settlement is material for a speech or indeed a book in itself. Picture to yourself those French settlers throwing up rude houses and forts in the midst of a wilderness and then through the long winter months eking out their insufficient rations with the available fish and game; sharing their meals with the Indian chiefs and organizing themselves into the Order of Good Cheer and with pomp and ceremony, songs and stories and a different officer in charge of each function, whiling away the long winter nights and learning to make life pleasant in a new and to them, forbidding land. Think of them as the only white men in a whole continent, hemmed in by towering forests, surrounded by Indians, and who can fail to admire their courage and their bravery.

But on the other side of the Atlantic, not only French eyes were looking westward to this peninsula, and in 1622 when James I was King of England, a grant of what is now part of Quebec, all of New Brunswick and all of Nova Scotia was made to Sir William Alexander and the territory christened Nova Scotia, the Latin form of "New Scotland". The experiment of a Scottish settlement was financed under Charles I by the sale of baronetcies in the territory, and although the colonization efforts failed, the name has survived.

It is interesting to recall that rather than brave the Atlantic to install these baronets, Charles I declared that a little square of ground on Castle Hill in Edinburgh should be declared forever part of Nova Scotia, and on this spot he knighted the baronets of Nova Scotia and until this day, this little peninsula has an extension of itself in Scotland, in the very heart of that country from which, in later years, so many Nova Scotians came. The story of Nova Scotia until 1690 is the story of the slow growth of the French population and of the realization of the New Englander that Acadie, as the French called it, was, while in French hands, a detriment to the development of the New England fisheries and a threat to the peace of the English settlements in New England, and in that year Port Royal was for the first time captured by New Englanders, under William Phipps. Possession of the country passed from hand to hand until with the Treaty of Utrecht in 1713 what is now the mainland of Nova Scotia passed into permanent possession of the English while the island of Cape Breton remained French.

There ensued a period of peace for 30 years, but the French had seized the earliest opportunity in the year 1713 to construct the fortress of Louisburg in Cape Breton. This fort controlled the approaches to the St. Lawrence, gave protection to the French fisheries and served as a French naval base, and was considered so strong that it was called the "Dunkirk of America". It is amazing to recall that more than 200 years ago, Louisburg was a thriving centre of commerce. The French ships coming out for cargoes of fish were laden by their thrifty owners with French products, wines and laces, and other good things far beyond the capacity of Louisburg to absorb. There arose a thriving trade, albeit illegal, with New England and the West Indies and many a New Englander or Englishman in the West Indies drank French wines at low cost because of the existence of Louisburg.

Then in 1745 the town was dramatically captured by New Englanders, under William Pepperell, only to be returned to France a year or two later when peace came.

The French went busily to work to extend and improve the defences of Louisburg, and in 1749 the decision was made to offset the power of the Cape Breton base by the establishment of a military and naval base on the mainland. Halifax was the result of that choice, and the unfolding of the years has demonstrated what a wise choice was made. From Halifax, in 1758, sailed the army with General Wolfe, later the conqueror of Quebec, which suc-

ceeded in capturing Louisburg and went on from there to break the power of France in North America.

To an audience of engineers it may be interesting to recall that Halifax was no come-by-chance development. The site was a selected one, the plans of the new town were drawn before the settlement was begun and the streets were laid off from the very beginning according to an engineer's idea of what a new town should be like. If therefore, any of you would wish to criticize the layout of Halifax in its older sections, or the width of its streets, I feel obliged to remind you that you will be criticizing the work of some who might be called for want of a better term "your spiritual ancestors".

The fall of Louisburg was followed by its destruction, for after its capture, the English Government ordered that "all the fortifications of Louisburg, together with all works, and defences whatever, belonging either to the said place, or to the port, and harbour thereof, be forthwith totally demolished, and razed and all the materials so thoroughly destroyed so that no use may, hereafter, be ever made of the same".

With the fall and destruction of Louisburg, the history of Nova Scotia becomes the story of its settlement and development by the various groups and races which have gone into the making of its present population. The French, of course, were first and the story of their expulsion in 1755 is at once one of the most dramatic and poignant stories in our history. The so-called "neutral" Acadians in the eyes of those in charge in Nova Scotia represented a threat to the English power. These simple habitants were gathered together, placed in transports and dispersed along the Atlantic seaboard as far as Louisiana. The story of the return of some of these evacuees and the epic trek of some hundreds of men, women and children from New York and Boston on foot back to Nova Scotia; the tragedy of finding their old homes and farms occupied by others, and their settlement in Clare, in Chezzetcook, and in the western end of the province near Cape Sable is the best evidence of the courage and tenacity of the Acadians and their love for Nova Scotia.

The first influx of settlers was attracted by the building of Halifax and they were shrewd New Englanders. Merchants, fishermen, tradesmen, professional men flocked to Halifax. Rum, preferably smuggled rum, was sold in abundance until it was said that half the population lived by selling rum to the other half.

Halifax was the capital of an empty province, the French had been expelled, and England's policy was to discourage emigration from the British Isles, so the next flow of settlers were Germans from the Rhine provinces. They settled on the south shore, founded Lunenburg and for years afterwards preserved their language, their customs and their Lutheran religion, and today their descendants form a stable, energetic part of our population with the German names and characteristics still predominating in that section of the Province.

Curiously enough, the Germans who were farmers in this new land turned to the sea, and today are the finest fishermen in the world and make the greatest single contribution to that industry. In the five years from 1760-1765 thousands of New Englanders settled in Nova Scotia, attracted by offers of land grants and hoping for better opportunities than New England afforded. They settled Newport, Falmouth, Morton, Cornwall and Windsor; in Annapolis and in Cumberland. Yarmouth, Barrington, Liverpool and Chester had their beginnings at this time in these places, the settlers being almost exclusively fishermen.

In the central part of the Province a settlement of Ulster Irish was established, and the names of Londonderry and New Dublin mark their arrival to this day.

It may be appropriate to mention at this point that Nova Scotia and particularly Halifax at a somewhat later date became the home of many thousands of those millions of southern Irish who, after the famine of 1849, sought to make their homes in the New World, and these people and their descendants, of whom I am proud to be one, have proven through the years that their contribution to Nova Scotia's history is not to be overshadowed by any other single group.

In the same period, a thousand or two Yorkshiremen, farmers of substance, arrived and settled in Cumberland near where the Isthmus of Chignecto links Nova Scotia to the mainland. Then came the war of Independence, and Nova Scotia received new impetus. Thousands of Loyalists came, in all about 30,000, of whom just over 20,000 remained and settled, thus doubling the then population. Most were English, but many were Scotch, Irish and Dutch, and two thousand negroes were among these settlers. The impact of these new colonists was felt in all the established communities, many new settlements on the Eastern shore in Halifax, in Guysborough, on the Strait of Canso and in Cumberland where Parrsboro was founded, sprang up, but the chief settlement was at Shelburne in the western end of Nova Scotia, and about five hundred found their way into Cape Breton Island.

And then in the years between 1773, when the ship *Hector* landed her cargo of 33 Scottish families at Pictou, and 1800, interrupted briefly by the Revolutionary War, came that flood of Highland Scots who have given to Nova Scotia its Scottish flavour and traditions and made such marked contributions to Nova Scotia's growth, education and development.

The Scots settled Pictou and Antigonish, flowed over into Cape Breton and in the period mentioned, no fewer than 25,000 settled in Cape Breton alone. All Highlanders, bringing their tartans and their pipes, their clannish spirit and their sturdy independence, they were admirably suited to the new land. They were almost equally divided as to religion, being either Presbyterians or Catholics, and they tended to settle in clan formation and according to their religion, and the results of that tendency are still marked in eastern Nova Scotia.

And there in broad outline you have the picture of the people who peopled Nova Scotia. Those are the men and women who established this province. Such are the forces and events which brought them here. From those beginnings have come the Nova Scotians of today, a people who fear God, respect religion, are intensely loyal, politically minded and who know and respect the power and value of education.

Nova Scotia had representative government as early as 1758. It was the first of all the British Colonies beyond the seas to achieve Responsible Government.

It has contributed great men to the political life of Canada. Howe, Sir Charles Tupper, Sir John S. D. Thompson, Sir Robert Borden were all great Nova Scotians to mention only a few. I would not have you believe either that all the great Nova Scotians are dead, but in view of current events and the approach of next Tuesday (Provincial Election Day) it would be invidious for me, at this time, to attempt to list the living greats.

ova Scotia has sent its sons in eir thousands to play a notable rt in the development of the rest Canada. Doctors, lawyers, minisrs and priests, farmers, merchants d engineers have gone out from is province and made their mark Central Canada and in the West. The Nova Scotians have demonrated their love of education. alhousie, Kings, Acadia, St. Fran's Xavier and St. Mary's, St. nne's, and last but not least, Nova cotia Technical College, the finishng school of all engineers, all have layed their part in developing and raining our youth and each has, on s roll of graduates, men who have nade their mark, either at home r abroad.

Since Confederation, a number of orces have worked to deprive Nova Scotia of the same measure of progress that has fortunately visited some other parts of Canada. The decline of the shipbuilding industry, the transference of capital to Central Canada, the falling off of seaborne traffic have all had a cumulative effect far from beneficial to the economic life of this sea-girt province.

But Nova Scotia has not stood still. Cities and towns have grown and flourished. The fishing industry is a source of wealth that gives promise of providing work and income for hardy Nova Scotians for generations yet to come. More scientific use of our coal and other natural resources cannot be long delayed. Agriculture will continue to be a basic feature of our economy. The establishment of local industries utilizing our natural resources is the next logical step in our development, and Nova Scotians will utilize these advantages to the full.

And Nova Scotia has a great asset in its charm and beauty, in its restful quality, and is, I firmly believe, destined to continue to attract tourists in ever-increasing numbers. Drawn by our delightful summers and our glorious autumns, welcomed by our warmhearted, hospitable people, Nova Scotia will continue to offer to the tourist that blend of history and of beauty, of comfort and of ease, which combine to make it an ideal vacation spot.

Those same sturdy, sensible, intelligent and industrious people who carry with them the best characteristics of the racial strains from which their blood is drawn will meet and solve their problems and their difficulties, and Nova Scotia will play its full part so that Canada may grow and prosper as a whole and go on to that great destiny which is undeniably hers. √

THE SCHLUCHSEEWERK PROJECT

(*Continued from page 862*)

Ibach), the total average energy output derived from the 12 installed generating units will be about 750 million kwh. peak load per year.

The final annual output, divided by the installed capacity (750 million kwh./407,000 kw.) gives 1,840 hours of potential utilization at maximum capacity. This figure characterizes the value of the peak load plant.

An interesting factor is the efficiency of the pumped storage plant. About 1.7 to 1.8 kwh. of power is necessary to pump the water which produces 1.0 kwh. power. Thus about 450 million kwh. of dumped energy is converted to 260 million kwh. of annual peak load energy from pumped storage, a most valuable conversion. Figure 8 shows this relation graphically.

Another advantage of the Schluchseewerk development is that the reservoirs can be filled by pumping from the Rhine river during the freshets of the spring and early summer. This stored power potential is available later to answer the winter demand.

The capital investment up to now is estimated at about $50 million (216 million DM.). A large part of the necessary capital was invested by the shareholders, the rest was raised by German and Swiss banks. During the later years funds of the Marshall Plan (E.R.P.) were available.

The cost per kwh. has not yet been announced, but it is presumed that it will be below the German average for equivalent steam power. The capital cost per rated kw. is about $125 (530 DM).

Though the energy output of the Schluschseewerk development is only one per cent of the total power output of the West German Federal Republic (6.5 per cent of her total hydro energy), the installed capacity of this project represents approximately 2 per cent of the kw. total installed capacity with peak load power available at any time.

Future Annual Meetings

of the

Engineering Institute

QUEBEC, QUE.—May 12, 13, 14, 1954
Chateau Frontenac

★

TORONTO, ONT.—May 11, 12, 13, 1955
Royal York Hotel

★

MONTREAL, QUE.—May 22, 23, 24, 1956

Sixty-seventh Annual General Meeting

Convened at Headquarters, Montreal, on January 22, 1952, and adjourned to the Nova Scotian Hotel, Halifax, N.S., May 20, 1953

The Business Meeting

The Sixty-seventh Annual General Meeting of the Engineering Institute of Canada was convened at Headquarters on Thursday, January 22, 1953, at eight o'clock p.m., with President J. B. Stirling in the chair.

The general secretary having read the notice convening the meeting, the minutes of the Sixty-sixth Annual General Meeting, as published on pages 621 to 628 in the June 1952 *Journal*, were taken as read and approved.

Appointment of Scrutineers

On the motion of G. N. Martin, seconded by Henri Gaudefroy, Messrs. A. S. Rutherford, J. A. Freeland, and Gaetan Ducharme were appointed scrutineers to canvass the officers' ballot and report the result.

There being no other formal business, on the motion of R. H. Findlay, seconded by E. D. Gray-Donald, it was resolved that the meeting do adjourn to re-convene in Halifax, Nova Scotia, on Wednesday, May 20, 1953.

The adjourned meeting convened at ten o'clock p.m. at the Nova Scotian Hotel on Wednesday, May 20, 1953, with President J. B. Stirling in the chair.

Retiring President's Address

Dr. Stirling delivered his address, the text of which appears on pages 878-881 of this issue of the *Journal*.

Nominating Committee 1953

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1953 as follows:

Chairman: F. W. Bradshaw, Grandmere, Que

Branch	*Representative*
Prince Edward Island	D. I. D. Rozman
Cape Breton	H. G. McCann, Jr.
Halifax	W. C. Risley
Amherst District	L. F. Kirkpatrick
Moncton	R. T. Sansom
Fredericton	M. W. Black
Saint John	W. M. Brenan
Saguenay	B. L. Davis
Lower St. Lawrence	P. E. Roger Thomas
Quebec	C. H. Boisvert
St. Maurice Valley	A. M. Hubley
Eastern Townships	J. C. Critchley
Montreal	R. B. Wotherspoon
Cornwall	P. H. Nasmyth
Ottawa	A. C. Ross
Kingston	J. W. Brooks
Belleville	F. C. Adsett
Port Hope	A. F. Alexander
Peterborough	A. L. Killaly
Toronto	W. E. Bonn
Hamilton	W. E. Brown
Kitchener	A. J. Girdwood
Niagara Peninsula	C. G. Cline
London	G. E. Humphries
Border Cities	G. W. Lusby
Sarnia	S. V. Antenbring
Sault Ste. Marie	R. A. Campbell
North Eastern Ontario	John E. Lenhoff
Nipissing and Upper Ottawa	J. W. Millar
Sudbury	A. D. Finlayson
Lakehead	A. J. Mikelson
Winnipeg	G. W. Moule
Saskatchewan	W. M. Berry
Lethbridge	A. L. H. Somerville
Edmonton	C. E. Garnett
Calgary	T. M. Parry
Central B.C.	H. R. Hatfield
Kootenay	H. P. Hamilton
Vancouver	S. H. deJong
Vancouver Island	H. D. Dawson

Honorary Memberships

The general secretary reported that the following had been elected to honorary membership in the Institute and that certificates would be presented at the annual banquet or on some appropriate later occasion:

Alexander Joseph Grant, formerly engineer in charge, Welland Ship Canal Office, Department of Railways and Canals, Welland, now of Montreal, Que.

The retiring president Dr. J. B. Stirling (right) explains the job to incoming president Ross L. Dobbin.

Albert Lawrence Killaly, formerly perintending engineer, Trent nal, Department of Transport, terborough, Ont.

Frederick Perry Shearwood, forerly chief engineer now consulting gineer, Dominion Bridge Comny, Montreal, Que.

Arthur Surveyer, B.A.Sc., C.E., .Eng., D.Sc., president, Surveyer, enniger and Chenevert, consulting gineers, Montreal, Que.

Stewart Young, B.A.Sc. (C.E.), rmerly director of community lanning, Province of Saskatchewan, egina Sask.

Awards of Medals and Prizes

The general secretary announced he various awards of the Institute s follows stating that the formal resentation of these would be made t the annual banquet of the Institute on May 22:

Above: At the President's Dinner, six past presidents — from left to right: Messrs. J. A. Vance, L. F. Grant, I. P. Macnab, H. W. McKiel, J. B. Hayes and Alex. J. Grant.

Centre: The Students' Conference. In the centre of the group there is R. F. Shaw who was chairman, and L. F. Grant who aided him. The students are: William R. Tracey, British Columbia; Bruce Alexander, Alberta; B. Yoneda, Saskatchewan; Richard D. Vopni, Manitoba; Peter J. Dalton, Toronto; A. J. G. Morrison, R.M.C.; Calvin J. Partridge, Queen's; Stanley McGurk, McGill; Jean Blouin, Ecole Polytechnique; A. H. Roy, N.S.T.C.; L. A. Coles, New Brunswick.

Below: Council meets in the Senate Room.

Head Table, Wednesday night — left to right, on this and facing page, E. P. Muntz, chairman, technical committee; R. F. McAlpine, chairman, Annual Meeting committee; C. G. R. Armstrong, vice-president; F. H. Sexton, Hon.M.E.I.C.; J. A. Vance, past president; F. W. W. Doane, Hon.M.E.I.C.; H. W. McKiel, past president; Wm. N. Carey, secretary, A.S.C.E.; His Worship R. A. Donahoe, guest speaker; Chairman G. Frank Bennett; President J. B. Stirling; Dr. Lillian

Sir John Kennedy Medal—"As a recognition of outstanding merit in the profession or of noteworthy contributions to the science of engineering or to the benefit of the Institute", to James Alfred Vance, engineer and contractor, Woodstock, Ont.

Julian C. Smith Medals—"For achievement in the development of Canada", to John Edwin Armstrong, C.E., former chief engineer, Canadian Pacific Railway Company, Montreal, Que., and to Marvin Wilbur Maxwell, B.SC. (C.E.), M.E.I.C., former chief of development, Canadian National Railways, Montreal, Que.

Gzowski Medal—"For the best paper on a civil engineering subject", to G. V. Eckenfelder, M.E.I.C., Montreal, for his paper—"Spray Hydro-Electric Power Development".

Duggan Medal and Prize—"For papers dealing with the use of metals for structural or mechanical purposes", to E. A. Allcut, M.E.I.C., Toronto, for his paper "Possibilities of the Heat Pump in Canada" (written jointly with F. C. Hooper).

Leonard Medal—"For papers on mining subjects", to F. E. Patton, M.C.I.M., Noranda, Que., for his paper "Backfilling at Noranda".

Ross Medal—"For papers on electrical engineering subjects", to F. L. Lawton, M.E.I.C., and J. S. Kendrick, M.E.I.C., Montreal, for their paper "Nechako-Kamano-Kitimat Hydro-Electric Power Development and Aluminum Reduction Plant".

Canadian Lumbermen's Association Prize—"For the best paper dealing with lumber, timber or a wood product", to Carson F. Morrison, M.E.I.C., Toronto, for his paper "Glued Laminated Timber".

Prizes to Students and Juniors—"For the best papers presented by Students or Juniors of the Institute in the vice-presidential zones":

John Galbraith Prize (Province of Ontario)—to N. E. Hudak, JR.E.I.C., for his paper "Location of Faults in Power Cables by Fault Generated Surges".

Phelps Johnson Prize (Province of Quebec—English)—to Paul Thibault, S.E.I.C., for his paper "Operation of an Earth to Air Heat Pump".

Ernest Marceau Prize (Province of Quebec—French)—to Leon Tougas, S.E.I.C., for his paper "Structure de Bois pour une Tour de Television Située sur le Mont-Royal".

Left to right: Mrs. W. L. Huber of San Francisco, Mrs. G. D. Anderson, Mrs. J. B. Stirling.

Report of Council, Report of Finance Committee, Financial Statement and Treasurer's Report

On the motion of R. N. Coke, seconded by J. G. Frost, it was resolved that the report of Council, the report of the Finance Committee, the financial statement and the treasurer's report be accepted and approved.

Reports of Committees

On the motion of Carson F. Morrison, seconded by F. C. Morrison, it was resolved that the reports of the following committees be taken as read and accepted: Membership, Board of Examiners, Employment Conditions, Legislation, Library and House, Papers, Admissions, Employment Service, Publication, Prairie Water Problems, Professional Interests, the Young Engineer, report of Field Secretary, Canadian Standards Association, Canadian Chamber of Commerce.

ilbreth, Hon. M.E.I.C.; Dr. A. J. Grant, Hon. M.E.I.C.; O. Nelson Mann, representing the government of Nova Scotia; . F. Grant, past president; J. B. Hayes, past president; I. R. Tait, vice-president; I. P. Macnab, past president; Wynn MacDonald, vice-chairman annual meeting committee.

Branch Reports

On the motion of H. P. Archibald, econded by L. F. Bresolin, it was esolved that the reports of the arious branches be taken as read nd approved.

Amendments to the By-laws

The general secretary referred to the list of the proposed amendments to the by-laws which had been approved by Council and which had been published in the December issue of *The Engineering Journal*. He explained that Council had decided not to proceed with the change in by-law Section 7 until later but that it was desired to get approval for the others at this meeting.

There was a scattered but general discussion referring to different proposals and in some instances suggesting an alternative procedure. One member suggested that as the hour was very late there was inadequate time to discuss the items one by one. He recommended that the meeting should be adjourned and called for another time when proper consideration could be given to the proposals.

Finally it was moved by Mr. Heartz and seconded by Dr. Macnab that the proposals with the exception of Section 7 be now approved for submission to the membership by ballot. An amendment was proposed by Dean Gandefroy and seconded by Mr. Coke that the proposed amendments be approved with the exception of Sections 7 and 55. The amendment was put to the meeting and defeated. The original motion was then voted upon and was carried.

Election of Officers

The general secretary presented the report of the scrutineers appointed to canvass the officers' ballot for the year 1953 as follows:

President:

R. L. Dobbin, Peterborough, Ontario.

Vice-Presidents:

Western Provinces—I. M. Fraser, Saskatoon, Sask.
Province of Ontario—G. R. Henderson, Sarnia, Ont.
Province of Quebec—I. R. Tait, Montreal, Que.

Councillors:

Vancouver Island Branch—
T. A. J. Leach

The general view of the dinner Wednesday evening showing about one-quarter of the assembly.

John R. Kaye, Mr. Robertson, and Professor M. R. Foran.

Messrs. Marshall, H. R. Fee, Ira P. Macnab and S. Sillitoe examine the relief map of Halifax.

The Management Panel. Left to right: J. W. Simpson, managing director of Leetham Simpson Limited, Montreal; F. C. Toombs, associate professor, Institute of Business Administration, University of Toronto; S. M. Finlayson, Chairman, president of Canadian Marconi Limited; Dr. P. J. Nicholson, president of St. Francis Xavier University; N. T. Smith, general manager Nova Scotia Light & Power Co.

Vancouver Branch—J. E. Macdonald
Central B.C. Branch—M. L. Wade
Kootenay Branch—E. Mason
Edmonton Branch—E. L. Smith
Saskatchewan Branch—
G. W. Parkinson
Lakehead Branch—H. M. Olsson
Sudbury Branch—E. R. Eaton
Nipissing and Upper Ottawa—
A. K. Grimmer
N.E. Ontario Branch—N. C. Cowie
Border Cities Branch—J. G. Hoba
Toronto Branch—H. W. Paterson
London Branch—V. A. McKillop
Ottawa Branch—Thomas Foulkes
Kingston Branch—D. L. Rigsby
Belleville Branch—S. Sillitoe
Port Hope Branch—J. M. Jordan
Montreal Branch—Jacques Benoit,
E. D. Gray-Donald, F. L. Lawton
Eastern Townships Branch—G. J. Cote
St. Maurice Valley Branch—
E. E. Copping
Saguenay Branch—H. R. Fee
Lower St. Lawrence Branch—
L. P. Dancose
Saint John Branch—John Reed
Fredericton Branch—H. G. Hughson
Halifax Branch—A. R. Harrington
Amherst District Branch—J. N. Ritchie
P.E.I. Branch—G. J. Hayes
Newfoundland Branch—
Ernest Dickinson
Corner Brook Branch—Eric Hinton

On the motion of Henri Gaudefroy, seconded by R. B. Wotherspoon, it was resolved that the report of the scrutineers be adopted, that the scrutineers be thanked for their services in preparing the report and that the ballot papers be destroyed.

Vote of Thanks to Halifax Branch

On the motion of Gordon W. Ross, seconded by C. G. R. Armstrong, it was unanimously resolved that a hearty vote of thanks be extended to the members and officers of the Halifax Branch in recognition of their hospitality and activity in connection with the sixty-seventh annual general meeting.

Vote of Thanks to Retiring Officers

Past-President H. W. McKiel moved a hearty vote of thanks to the retiring officers. Having had some experience himself, and knowing the amount of work involved, he had much pleasure in expressing the appreciation of the membership for the unusually fine service which had been rendered by the president and the retiring officers during the past year. This was seconded by Past-President James A. Vance and carried with loud applause.

In thanking the group on behalf of the retiring officers, President Stirling stated that the appreciation of the membership means more than anything else to the officers of the Institute.

The meeting adjourned at eleven o'clock p.m.

At the President's Dinner. Colonel E. G. M. Cape, who was librarian of the Institute in 1904-5. Background: Professor I. M. Fraser and W. N. Carey.

Above: At the President's Dinner. Left to right: Messrs. V. A. McKillop, G. F. C. Bennett, G. R. Henderson, B. G. Ballard, I. M. Fraser, I. R. Tait and C. M. Anson.

The Professional Meeting

The 67th Annual Meeting of the Institute now takes its place alongside the others that make up so important a portion of the Institute's history. It had many things about it that were new and different, but it had this in common with them all—it was a success.

The necessity of staging various parts of the program in different buildings—five in all—added considerably to the complexity of arrangements and to the worries of the local committee. To their credit may it be said that all the facilities were excellent and their arrangements to meet the needs of the members were appreciated by everyone.

To the authorities of Dalhousie University must go the first acknowl-

Below: The chairman of the Halifax Branch, G. Frank Bennett and Mrs. Bennett.

The Special Reception Committee. Dr. Alan E. Cameron carries the banner and is aided by G. D. Anderson.

Left to right: P. D. Dalton and Mr. and Mrs. Harvey Doane.

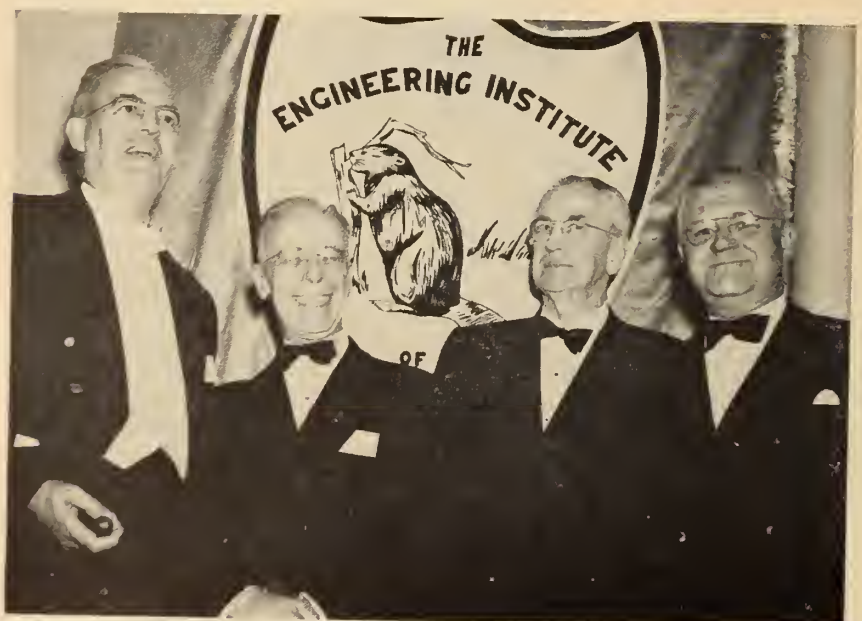
Left to right: Mr. and Mrs. F. C. O'Neill, Mrs. A. F. Chisholm, Robt. T. C. Stewart.

edgment of favours and assistance. They provided the background for the entire professional program. Better facilities have never been available to the Institute. The new Arts and Administration Building was an ideal setting for these meetings and for registration as well. The lecture halls were well equipped, with splendid acoustic properties and adequate accommodation. Both were filled to capacity on several occasions.

The two meetings of Council and the students conference also were well taken care of at the university. Particular mention should be made of the beautiful Senate Chamber where the Council meetings were held. More perfect surroundings for a dignified assembly could not be imagined. Fortunately, both meetings were well attended so that many people had the opportunity to view the room. To Dr. Kerr, the president and to Professor Theakston, the Institute expresses its warm appreciation. To their support and assistance can be attributed a great share of the success of an outstanding meeting.

Another Dalhousie feature was the privilege of using Shirreff Hall to accommodate about 100 out of town members and their wives. Without this space there would have been much confusion and inconvenience, for both hotels between them could take care of only three hundred people. The out of town registration exceeded 450, and the total registration, including the ladies, was 770.

The technical program appeared to be well received. The official count showed that the smallest group for a highly specialized paper was 45, whereas the largest was 265. The total attendance for all technical papers was 2,838.



Four Good Americans (and one good Canadian) all secretaries of American societies. Left to right: W. N. Carey, A.S.C.E., S. L. Tyler, A.I.C.E., H. H. Henline, A.I.E.E., C. E. Davies, A.S.M.E.

"Warmer Upper"

It was the idea of the local committee to inaugurate Muriel's Room on Tuesday night so that visitors and local members could get to know each other before the regular program began. This proved to be a very bright idea. Over 325 crowded into the Nova Scotian Hotel to express their approval.

The President's Dinner

As usual, the retiring president of the Institute held his special dinner on Tuesday night. This is the occasion when he gathers around him those officers who have held office during his year. It is his opportunity to thank them for their support. Seventy such officers gathered at the Halifax Club that evening, including seven past presi-

ats. Without any warning, each st president was called on to eak. The results proved again at the Institute brings to its esidency the outstanding members the profession.

A feature of the program was the esentation of "Half Hours with mous Scientists" to the retiring esident J. B. Stirling. The presen-tion of the book to each president he retires is made possible by a m of money given the Institute the late George Walkem, him-lf president in 1926.

Dinner on Wednesday

A new record was set for attend-nce at the Wednesday evening inner at the Nova Scotian Hotel. he estimate to the hotel was 500 nd the recorded attendance was 92. The fame of Mayor Donahoe s a speaker did much to increase he numbers, but as well, credit for n "assist" must go to a change in he program whereby no lunches were arranged for Wednesday and Friday. Mayor Donahoe thrilled his listeners as few speakers have done previously. His subject, "Nova Scotia", was so well handled, so skillfully delivered that Nova Scotians swelled with pride and others were filled with envy. It was a remarkable lesson in geography, history, histrionics and Canadianism.

The Annual Business Meeting

The routine items of this agenda passed off in the routine way, but there was nothing routine about Dr. Stirling's retiring address. He had an important message to give and he gave it with clarity and emphasis. Seldom if ever has a president made a better address to the members of the Institute. It is published in this issue on page 878. Read it, even though you may have heard it at Halifax.

Thursday Afternoon

There were no technical meetings for Thursday afternoon. Instead, following a well established pattern, there were plant visits and a boat trip. In order to bring everyone to a rendez-vous to start the program, a buffet luncheon was served at the Lord Nelson Hotel, attended by over 400 people.

Plant and field trips were arranged to the Halifax Shipyards, the National Sea Products Ltd. and the Halifax-Dartmouth Bridge. The main group numbering 251 took the boat trip around the harbour. The weather was far from favourable, but everyone reported a very successful afternoon.

In the process of registration. In the group can be seen H. A. Marshall and J. R. Wallace.

Publicity

The local press and radio were exceedingly generous in their handling of the meeting. It is doubtful if local news agencies anywhere ever were more interested and helpful. The newspapers literally had pages of reports and pictures, and the radio stations not only reported the news but as well put on special features. One station (CBH) had a half hour discussion between five members on the subject of Canada's expansion and the engineer's part in it. The discussors were I. P. Macnab, chairman, J. B. Stirling, L. F. Grant, J. J. Hanna of Calgary, and Dean I. M. Fraser of Saskatoon. Another station (CHNS) put on a special program titled "Salute to the Engineering Institute of Canada".

The Banquet

As usual, the banquet Friday night was the feature event. Here again an unusual set of circumstances faced the committee, and were overcome by ingenuity and

The *Journal* advertisers show their literature. In the group are seen Messrs. I. R. Tait, T. Foulkes, Milton Eaton and Miss P. King of the *Journal* staff.

Presentations of honours and medals. Top left: Dr. Grant gets his certificate of honorary membership. Right: A. L. Killaly does the same. Bottom left: M. W. Maxwell receives the Julian C. Smith Medal. Right: James A. Vance receives the Sir John Kennedy Medal from the president. Opposite page top left: F. L. Lawton receives the medal for the best electrical paper of the year, the Ross Medal. Right: F. C. Patton, M.C.I.M., the Leonard Medal, for the best paper on a mining subject. Bottom left: Carson F. Morrison receives the cheque for $100.00 from the Canadian Lumbermen's Association for the best paper on a timber subject. Right: Leon Tougas receives the student prize for the Province of Quebec.

the assistance of the Navy. No hotel had a room large enough to handle the attendance. This had been foreseen more than a year ago, but at that time the only solution seemed to be to hold two separate banquets, one for the ladies and one for the men at the two hotels. However, as the local committee came to grips with the problem, they found a much better solution. They arranged with H.M.C.S. *Stadacona* to have the function at their beautiful gymnasium.

The Navy's co-operation saved the day. They literally "went overboard" to help. Not only did they make the building available, but they did all the catering, much of the decorating, the lighting, the P.A. system and supplied personnel for a great variety of services including "Muriel's Room". It was surely Navy Day with the Institute.

Head Table

The head table for the Institute banquet has been noted always for the distinguished guests around it. This year was no exception. Not only were the guests distinguished but they were numerous. To the glory of Halifax it can be said that never before has so high a percentage of "invitees" accepted Council's invitation. In all there were 86 in the printed list of guests. The company contained certain clearly defined groups representing the State, education, the professions, the armed services, sister societies on the international level, the national level and the provincial level.

The number one head table was set up for 40 people and tables A, B and C were arranged for another 46. The three supplementary tables were arranged in groups to include the senior officers of six provincial associations of professional engineers and their ladies representing Nova Scotia (Mr. and Mrs. G. J. Currie), New Brunswick (Mr. and Mrs. J. M. M. Lamb), Quebec (Mr. and Mrs. R. F. Shaw), Ontario (Col. T. M. Medland), Manitoba (Mr. and Mrs. C. L. Fisher) and Alberta (Mr. and Mrs. J. J. Hanna). The president of the Newfoundland Association also was to be present but fog (not over Newfoundland) grounded the planes so he could not be with his associates. Other guests at this table were G. F. Bennett, chairman of the Halifax Branch, and Mrs. Bennett; Mr. and Mrs. J. A. Russell of the Nova Scotia Mining Society, and Dr. P. L. Pratley.

Another table seated the winners of prizes and awards with their ladies and the third table was designated as "secretaries table". It was graced with the presence of four secretaries of United States sister societies, all from New York: Col. Wm. N. Carey of the Civils and Mrs. Carey, Col. C. E. Davies of the Mechanicals, H. H. Henline of the Electricals, and S. L. Tyler of the Chemicals. Also at this table were two other distinguished Americans—Dr. Lillian M. Gilbreth and her daughter Ernestine, famous for her books about the family. Other secretaries were J. D. Kline of the

va Scotia Association and Mrs. ne and W. J. LeClair of the nadian Lumbermen's Association l Mrs. LeClair.

Practically all guests are identi- l in the accompanying photo- aphs.

The Ball

Immediately on the conclusion of e banquet, the head tables were oved to one side, the orchestra cended the stage and the dancers ok over. The company was aug- ented by the arrival of over two ndred folks who had come for e dance only. "Muriels" set-up as excellent so that her hospitality as comfortably available to all. avy personnel were on hand in oodly numbers to welcome the ests to their quarters and to id in their entertainment. It was a leasant party that showed little gn of breaking up until closing our of 2 a.m.

It can be said that the 67th nnual and General Meeting of he Engineering Institute finished in he proverbial "blaze of glory".

Speeches, Presentations, Prizes and Awards

At the conclusion of the banquet he Institute prizes and awards were presented as reported else- where. The speaker of the evening was Sir Robert Watson-Watt, M.E.I.C. Unfortunately, the P.A. system and the acoustics combined to so muffle and scramble Sir Robert's remarks that not many heard them clearly. It was ironical that with the world's most famous name in the field of electronics at the microphone, an electronics system should behave so badly. Persons outside listening to their radios heard everything clearly and spoke highly of the address. Fortunately, a tape recording was made and presented to the Institute. A transcription is being made and the full text will appear in a later issue of the *Journal*. Nevertheless, it was an unfortunate affair and very embarrassing to the officers of the Institute.

Council Meetings

The last meeting of the old Council was held in the morning of Tuesday, May 19, in the Senate Room of Dalhousie. This was one of the best attended "terminal" meetings ever held. There were 39 present representing 22 branches from Calgary, Alberta to St. John's, Nfld. Dr. J. B. Stirling presided.

The first meeting of the new Council was held in the same beautiful room on the morning of Thursday, May 21. Here again a record attendance was established. There were 44 present, representing 25 branches, R. L. Dobbin presided. The two meetings together represented 27 branches. This is an excellent showing for a meeting held in one of the extremes of the

Extra Photographs

Glossy prints of most of the pictures in this section are available, for $1.00 each, at The Camera Shop, 26 Blowers Street, Halifax, N.S. Payment should be enclosed with order.

Head table at the banquet. Left to right: R. L. Dobbin, president-elect; Mrs. W. W. Porteous; J. N. Flood, president of the Canadian Construction Association; Colonel L. F. Grant, chairman, Engineers Council for Professional Development; Mrs. C. V. Davison; Air Commodore A. D. Ross representing R.C.A.F.; Mrs. A. E. Flynn; Commodore E. P. Tisdall representing the Royal Canadian Navy; Mrs. C. P. Bethune; Dr. J. W. Reid, president, Medical Society of Nova Scotia; Mrs. A. E. Kerr; Dr. Watson Kirkconnell, president, Acadia University; Mrs. A. E. Cameron; Richard A. Donahoe, His Worship the Mayor of Halifax; Mrs. J. L. Ilsley; Walter L. Huber, president, American Society of Civil Engineers; Mrs. J. B. Stirling; Sir Robert Watson-Watt, the speaker; Dr. J. B. Stirling, retiring president and chairman of the banquet. On the chairman's left, top of page, The Honourable Chief Justice J. L. Ilsley; Lady Watson-Watt; Reverend Canon A.

country and was better than the attendance record at most of these meetings held in central Canada. Halifax is certainly a drawing card.

Branch Officers' Conference

This annual event was held on the afternoon of Tuesday, May 19, in the Senate Chamber. The chairman of the Halifax Branch, G. F. C. Bennett, presided and the branch secretary, W. A. Logan, did the secretarial duties. The attendance was 40, representing 23 branches.

Students' Conference

For the eighth year in succession, the Students' Conference was held in conjunction with the annual meeting. They met all day, Tuesday, May 19, at Dalhousie, with R. F.

The secretaries' table.

Stanley Walker, president and vice-councillor, University of Kings College; Mrs. Richard A. Donahoe; Dr. A. E. Kerr, president, Dalhousie University; Mrs. Walter L. Huber; the Right Reverend P. J. Nicholson, president of St. Francis Xavier University; Mrs. A. Stanley Walker; Dr. A. E. Cameron, president, Nova Scotia Technical College; Mrs. Watson Kirkconnell; C. P. Bethune, president, Law Society of Nova Scotia; C. D. Davison, representing Nova Scotia Association of Architects and Royal Architectural Institute of Canada; Mrs. A. D. Ross; Major-General E. C. Plow, representing the Army; Mrs. E. P. Tisdall; Engineer Commodore W. W. Porteous, R.C.N., superintendent, H. M. C. Dockyard, Halifax; Mrs. J. N. Flood; Professor A. E. Flynn, president, Canadian Institute of Mining and Metallurgy.

Shaw presiding for two sessions and Anthony H. Roy of Halifax elected by the students themselves presiding over the third session.

The students—one from each degree granting university — are brought together annually, with the expenses met by the Institute. Through this conference the Institute plans to demonstrate its interest in students and their affairs, and to make certain that it maintains close contact with the coming generations of engineers. The students are very serious about the meeting and cover a great deal of ground at each session. To be selected as a delegate is regarded as one of the biggest prizes offered on each campus.

The Provincial Professional Associations' table plus Dr. P. L. Pratley in the foreground.

Next Year

The 1954 meeting will be at the Chateau Frontenac Hotel, Quebec, on May 12, 13 and 14. Those who attended the meetings there in 1944 and 1949 will need no urging to return, but for the others the *Journal* will offer useful information from time to time, in the hope and expectation that they too will plan to be there to enjoy the 68th Annual Meeting.

Address of the Retiring President

Let's Be Canadian

J. B. Stirling, M.E.I.C.,
Montreal, Que.

Delivered at the 67th Annual General and Professional Meeting of The Engineering Institute of Canada at Halifax, N.S., May, 1953.

It is the custom for the president of the Institute to deliver an address upon the occasion of his retirement. This has become known as the "address of the *retiring* president".

The appropriateness of that adjective may be questioned. In any case, the address is timed to take place after his final meeting of council, after the President's Dinner, and after the business meeting of the Institute, so that he is comparatively free from the possibility of members talking back to him because of any controversial issues he may raise. May it be said that any views expressed in this address are personal and do not necessarily represent Institute policy.

The record in *The Engineering Journal* deals with my activities as president in a somewhat disjointed fashion from month to month but it may be said, in summary, that my 30,000 mile tour this year to all the 48 branches and sections and 16 universities and colleges from Prince Rupert, British Columbia, to St. John's, Newfoundland, as well as two visits to the United States, constituted an unparalleled and never to be repeated opportunity to be of some service to our fellow members and to gain an intimate knowledge of the needs of the members as well as those of the branches—knowledge which I hope may be of some use to my successor as well. If a remark of a personal nature may be permitted, I would like to say that the record would be incomplete if I did not pay tribute to my wife who accompanied me to all the branches—and without whose invaluable assistance my job would have been much more difficult. The recollection of those warm receptions accorded to both of us from coast to coast by all members is something that will be fresh in our memories for all time.

Last year the then President, Dr. Macnab, spoke to you in Vancouver under the title "Canada—my Home" pointing out that there was much to be proud of in our country because of the kind of country he and others have found it to be.

Tonight, I would like to point out that we might also be proud of this country of ours not only because of what it is but because of what we, as engineers, are doing towards its development. Then I would like also to suggest that this pride of country is a very shallow and useless sentiment unless translated into some constructive effort in recognition of the privilege of being a Canadian. Finally, I would like to examine one phase of that effort which we, as engineers, might well exert.

Recent Canadian Achievements

Now just what are some of the outstanding Canadian achievements during recent years ? Here are five of them:—

1. Canada has become the third trading nation and the sixth producing nation of the world;
2. Canada now possesses the strongest currency in the world;
3. Canada has astonished the world by its fiscal policy of—
   (a) balancing its budget or producing a surplus where others have deficits;
   (b) reducing its national debt;
   (c) reducing its taxes;
   (d) carrying its defence program on a "pay-as-you-go" basis (and may it remain that way); (sure, taxes are high, but we, as a people, have asked for it).
4. We are providing, and have been doing so for some years, 6/7ths of our own investment capital—which last year exceeded 5 billion dollars. When one considers the huge foreign investments in oil, iron, aluminum, cellulose, etc., we wonder how this figure can be correct, particularly in the face of the often heard complaint that our resources are being developed by foreigners, and when we learn, for example, that investment in oil development runs about 90 per cent from American sources, but assurance is received from the economic adviser to the Bank of Montreal that these figures are reliable.

The statement last month of the president of the International Bank for Reconstruction and Development is impressive. He said:—

> The World Bank would be unnecessary if there were 60 or 70 nations like Canada; the way in which you have developed your country provides a model which the rest of the world might observe to its own benefit. You have an enormously productive economy, a skill and confidence that inspires you to invest in your own future, a way of doing things that has attracted large amounts of capital. Canada, with $325 million investment in the International Bank is the largest member and one of the most important industrially and financially.

5. Canada, with only one half of one per cent of the world's population, is—
   1st in production of nickel, platinum, asbestos and newsprint;

2nd in gold, aluminum, pulpwood and power;
3rd in silver, zinc and uranium;
4th in copper and lead;
and it may well be said that when present developments and the resulting production are fully geared up there will be other startling figures to announce.

Needless to say, there are many her less spectacular, but equally ıportant, achievements which have l to universal recognition that we ve arrived at a state of substanl nationhood.

It is quite proper and even ıportant that we take stock of our ssets from time to time as I have one just now, so we may not forget ır good fortune, but we must be ıreful not to become smug or oastful lest we become obnoxious ı the eyes of others. We *are* a ealthy country; we *are* an industrious people; we do have a standard f living not excelled by any nation ı the world, but in grateful recognition of it, we must be truly modest nd truly loyal. We must be alert o see that our riches are not dissiated or diverted.

Support of Canadian Institutions

Much of what I am about to say relates to our relations with our good friends in the United States. Some of it is critical—but critical of ourselves more than of our friends. I want to advocate, within limitations, the policy of "Canada for Canadians", but I do not wish to offend those good Americans who have honoured us with their presence at this meeting. I am confident that they will see these situations from our point of view and will agree with me in my observations. One of the great things about being a Canadian is that we have the Americans as our nearest neighbours and our closest friends.

We Canadians manifest our pride of country in various ways. Our men and women generously and voluntarily participate in military service or other secondary services upon which wartime operations depend. Or we may engage in public service in a variety of ways—or we may perform the very important work of giving support to our Canadian institutions—be they professional, trade, charitable or any other form of organization. It is this last evidence of pride of Canadian citizenship, the support of our institutions, with special reference to our own Institute and our profession, about which I would like to devote a few minutes.

During periods of high employment and of huge capital expenditures on construction in a country such as ours, where all forms of man-power, particularly engineers, are at a premium, it is inevitable that there will be attracted to the country people who will tend to close the ranks between the demand and supply. It is a mere platitude to say that all peoples of decent character are welcomed to this country. Some of the things this country possesses in abundance have already been mentioned. Unfortunately, people or population is not one of them, and our governments—federal and most provincial—are to be commended, up until now, for their advanced immigration policies.

As far as we in the engineering profession are concerned it has been recognized for a number of years that a shortage in our professional ranks exists that has at times threatened seriously to curtail construction, research and other activities. Engineers have come to us from other countries and have on the whole been welcomed—as, with few exceptions, they have indicated their intention of becoming Canadian citizens as quickly as the law permits.

There are indications, however, that some engineers are coming to the country who have no intention of becoming Canadian citizens or even permanent residents. In some cases they are sent by companies who employ them and in such a case the individual can hardly be criticized. Some responsibility lies with us in the profession in Canada and some with the foreign company concerned.

Engineers' Responsibility

Our own responsibility lies in the fact that we engineers have taken little trouble to convince foreign companies that we have in Canada men of professional attainments equal to and in some cases greater than those sent here. It is undeniably true that while Canadian engineers have performed some of the greatest engineering works and solved some of the most difficult engineering problems that have been encountered in the history of engineering, we have failed to impress, in sufficient numbers, those who have engineering works to do in Canada. The right of foreign companies to send their own engineers here to carry out their work, in fairness, cannot be disputed. That they should attempt to carry out the work exclusively with foreign engineers would appear to be short-sighted. Equally short-sighted is the practice of foreign consulting engineers attempting to carry out work with junior Canadian staff—as a front.

It is perfectly natural that a foreign company, which is supplying the funds for a project and which has also immediately available skilled staff in whom they have already established confidence, should entrust their work to these men. On the other hand, it does seem common sense that engineers trained in this country—familiar with all special local conditions—can make a greater contribution to a project than can an exclusively foreign staff. The matter of goodwill in this connection is not unimportant.

Conditions in our profession today are very similar to those obtaining in 1928 and 1929. At that time engineers from other countries were coming here in numbers. Many were setting up as consultants and many were representatives of eminently respectable and competent firms in other countries. And in some instances they were not too well known and their expertness went unchallenged. In the intervening years between 1929 and 1953 many, in fact most of them, have left the country. That there will be another influx is not to be doubted and already there is ample evidence that it is now taking place.

Members of the Institute, and I hope our visitors, will not disagree with me when I say that, in general, Canadian work should be carried out by Canadian engineers. You may wonder, then, why I am "preaching to the converted".

Employ Canadians

Well, there is much to be done. If we really believe we should be doing our own engineering work we should move energetically to convince our own Canadian company executives, our own legislators and the executives of foreign companies contemplating capital works in this country that their work can and should be done by Canadian engineers. By this I mean we must proceed with the business of selling our services, not just relying on advertising experts and public relations counsel. We must do it *ourselves* if it is to be effective.

Take, for example, our legislators. Did you read an editorial in *The Engineering Journal*, September, 1952, entitled "Back to Canadian Engineers". It bears right on this subject. It concerns the appointment of a three-man commission to

study the South Saskatchewan River. The responsible minister at Ottawa, and it may be said at once that it was neither of our two engineer ministers—Rt. Hon. C. D. Howe or Hon. R. H. Winters—in reply to a question as to delays in setting up the commission said—according to Hansard and *The Engineering Journal*—

> It has been said that we ought to have a different type of men on the commission. I would just like to say that men are not as easily got at the present time as they were some years ago. Some people wondered why it took us so long to get the commission set up. We tried to get—and when I say 'we' I mean the government did—four of the top-notch engineers in the United States and, one at a time, offered to appoint them. The first of those who were recommended did not find it possible to take it on. Then when that one did not find it possible to do it, he recommended still another one, until we had been in touch with the four of them.
>
> It took some considerable time to give these men the opportunity to determine whether or not they would take the position. Finally they all turned it down. They said they had other work which was taking up all their time, and for that reason they could not take on this work. So eventually we got back to using Canadian engineers, in so far as the power end of it was concerned. So we have two men.

The editor of *The Engineering Journal* fittingly concludes his editorial with the words—

> What an indignity it would have been to have had a commission made up completely of Americans to study the South Saskatchewan River. For goodness sake, let's be sensible, let's be logical, let's be Canadian!

That is what is meant by supporting one of our Canadian institutions—the Canadian engineering profession.

Then take a look at the matter of the St. Lawrence Seaway. You will recall that last year this legislation passed the Canadian parliament without a dissenting vote. For years this great work has been a matter of discussion and negotiation between Canada and the United States. This country with its rapidly expanding commerce has arrived at the stage where the building of the project, according to the Rt. Hon. C. D. Howe, "is necessary without further delay". A small degree of co-operation is required on the part of the United States to enable Canada to proceed with the work, yet it is not forthcoming. Small wonder it is that this lack of co-operation as Mr. Howe says "puzzles us completely".

Mr. Howe made clear to an American audience last month something that does not seem to be clear to most Americans. That is, that the St. Lawrence Seaway is and always has been a Canadian Seaway. "Every improvement," he said, "has been built and paid for by Canada from Lake Erie down." The cost of operating and maintaining the seaway is paid wholly by Canada. Nevertheless, ships of every nation may use the seaway without payment of tolls. An international treaty provides that, if and when tolls on shipping are imposed, they will bear equally on Canadian and foreign flag ships. Canada proposes to pay, on a self-liquidating basis, for improvements in the International Rapids section. "Why then," continued Mr. Howe, "should your country withhold its co-operation and thus delay completion of this vital Canadian transportation outlet? I must confess that I do not know the answer."

The Hon. Mr. Chevrier, our Minister of Transport, said "it is a much less friendly attitude on the part of our good neighbour than could reasonably be expected."

American Influx

While this situation exists concerning the political angle it is interesting to note that engineers and contractors from south of the border are here in numbers anxious to participate in the work.

Thus we have the somewhat incongruous spectacle of our great and good neighbour whom we sincerely admire standing with one hand upraised saying in effect "sorry, gentlemen, we cannot go along with you in this project", and the other hand held out receptively, saying "how about letting us in with you on this work."

In the decisions as to who will carry out this work, I suggest that our Canadian authorities be Canadian in their thinking.

Several instances have come to my attention during the past year where foreign consultants or construction organizations have been engaged for the design and execution of Canadian projects all well within the competence of Canadians. One case is known where a project let to a foreign firm has immediately been sub-let to a Canadian organization which now finds itself working under the instructions and direction of foreign engineers and superintendents, none of whom, as far as could be learned, were familiar with local conditions and some of whom had been discredited by a Canadian employer.

It was not too pleasant reading in the press two weeks ago that our metropolitan city, Montreal, had engaged four foreign engineers as consultants to the city planning department.

Just within the last few days I learned from some British authorities who are about to start a 20 million dollar plant in Canada that they had engaged American engineers to design and construct the project. The *Montreal Gazette*, May 15, reads—

> "Management of the design and construction-engineering, of the plant has been assigned to the firm of H. K. Ferguson Co. of Cleveland and New York. Between 200 and 300 specially trained engineers and draughtsmen will be employed on the engineering phases of the project, which is said to present problems of exceptional complexity." Canadian personnel and materials will be employed wherever possible, the statement said.

Other instances are reliably reported where foreign engineering firms, admittedly specialists in their work, either neglect altogether to engage any engineering assistance in this country or, in some cases, where Canadian engineers are employed only those in the junior category are considered.

Such occurrences as these are giving rise to no small concern among engineers throughout Canada. As indicated previously, one cannot reasonably criticise foreign engineers or their principals for their desire to carry out their works in Canada. And let it be said in justice to some firms of international repute from the United States, Great Britain and France that they have carried out their Canadian enterprises with all Canadian engineers. Clients have reported that their projects have been eminently satisfactory and efficiently executed. But if the trend in the employment of foreign engineers in this Canada is not arrested or reversed, the outlook for maintaining and improving our professional competence in certain fields is discouraging. Again

y I say, there is much to be done the profession in convincing nadian and foreign company ecutives, as well as our own legisors, that Canada can and is xious to supply competent engiering talent. Let's try to convince ese people to be Canadian in eir thinking.

In the words of Mr. Horace iman—president of the Bank of ova Scotia, at the last annual eeting in this City of Halifax—

We cannot expect Americans or anyone else but Canadians to think in terms of Canadian interests.

Support of Canadian Organizations

Something should be said in relaon to support of our Canadian ngineering organizations themelves by the Canadian engineers. Here again we may be accused of reaching to the converted. But, if o, it is with the hope that further onverts may be brought by you nto our own Engineering Institute f Canada — the all-embracing ational voluntary engineering organization of this country.

During the past ten years the nembership has increased at a rate nuch greater than any other time n its history. In the last 16 years it nas increased from 4,000 to 16,000 and our income from $60,000 to over $400,000 per year. But it cannot be said that, in relation to the 27,000 engineers accounted for by our last census figures, plus several thousand unaccounted for in those figures, the membership of our national engineering society is satisfactory. It is appreciated that the vast majority of the engineers in important places in the country are members and warm supporters of and contributors to the Institute's progress, but this Institute needs all engineers in its ranks in order to make its work and its influence fully effective.

It is difficult to understand some of the reasons given for failure to support the national institute, such as, "I feel that I get more good by supporting the A.S.M.E, A.S.C.E., A.I.E.E." or other very excellent American societies. Do these men realize that what they really want are the publications of the American societies and that these can be secured advantageously through membership in this Institute? If it is attendance at meetings of American founder societies they desire, do they not realize that as members of this Institute in most instances they are welcomed to those meetings?

It is undoubtedly true that many engineers in Canada support the Institute because it is Canadian and because they wish to encourage the efforts of our Canadian engineers and because they believe that to preserve our Canadian character we must preserve and expand our Canadian institutions. It is my personal opinion, based on long experience, that the Engineering Institute of Canada can do more for the Canadian engineer than can any society, no matter how good it is, whose headquarters are outside the country. The Institute needs support from the younger engineers and this voluntary support can be secured to the best advantage when the more mature men convince junior engineers that it is a good thing for them and that it is part of their duty as Canadians to support their national body.

What will become of Canadianism if, in place of supporting Canadian organizations, we support foreign ones? The British and American engineering institutions are the best in the world, and hold great advantages for Canadians, but Canadian institutions have something to offer that is invaluable to Canadians and which cannot be secured elsewhere. This applies to the Canadian Institute of Mining & Metallurgy and the Chemical Institute of Canada as well as to the Engineering Institute. Join the other organizations if you will, but first of all make sure you belong to your Canadian society.

Conclusion

Now, what have I been advocating? Let us look back over my remarks. In the first place I recommend that we all do something to bring to the attention of industry and government the indisputable fact that Canadian engineers are best qualified to do the work that is to be done in Canada and, secondly, I urge upon Canadian engineers that they give first thought to joining Canadian organizations. Action on these two proposals should go a long way towards meeting the invasion of our country by foreigners who, with the very best intentions, may well wreck our Canadian economy as far as our profession is concerned.

What I have said is neither profound nor original but it is important. What the members of the Engineering Institute of Canada do about it is important and vitally so for the progress of the profession and the Institute in the years ahead.

Above all—Let's be Canadian.

Visitor to Headquarters

The Institute entertains a distinguished engineer from France, Armand Mayer. Left to right: Ernest Gohier, Mr. Mayer, J. B. Stirling, Arthur Surveyer, and Huet Massue.

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

You and the By-laws

In the month of July all Corporate Members will receive ballots to enable them to vote on proposed changes in the by-laws. They are urged to examine the proposals and record their vote. To do this will require only a short time. It is not too much to ask in the interests of good management and democracy.

The founders of the Institute wisely determined that no by-law could be changed except by the will of the Members. The Council even though it is elected by the members has no authority to do this, but they do urge that the members support the proposals.

The proposals relate to fifteen separate by-laws but none of them is complicated and none should be controversial. All are intended to advance the interests, the activities and the expansion of the Institute. Some are related simply to office routine and are proposed in order to promote efficiency.

All proposals have been approved by the Council of the Institute and by the Annual General Meeting held in Halifax on May 20 this year. Previous to submitting them to Council they had been discussed by the president with almost every branch executive across Canada. At these meetings they were considered in great detail and almost without exception were approved unanimously. The exceptions related to three branches. At two the executive vote was exactly half for and half against. At the third branch the vote was unanimously against every proposal. The broad acceptance of the proposals by the executives encourages Council to believe that the members as well, will give full support to them. It is felt that members will be favourably impressed by the fact that those who have examined the proposals in greatest detail are the ones who represent them on the branch executive and on Council. Their favourable decisions should be helpful to all members when marking their ballots.

Watch for your ballot. Be sure to complete it. Council submits the proposals believing them to be in the best interests of the Institute.

Civil Service Salaries

Salaries never cease to be a topic of interest. For many years the Institute has felt that the low salaries paid by the Federal Civil Service were a menace to all engineers and that consequently every effort should be made to get them up to a better level. Many other services take the federal scale as their guide and usually plot their own scale somewhat lower. That is why a low federal scale is a menace to so many engineers outside the federal service. The Institute's theory is that improvements in the federal scale eventually will affect other employers, at the provincial and municipal level.

Thinking along these lines, a few years ago the Institute urged on the Royal Commission sitting at that time that the maximum salaries of deputy ministers be raised from $10,000 to $15,000 per year. It was known that senior engineers in various branches were barred from increases because such increases would put them beyond deputy ministers, and that inability to raise the level for senior engineers meant that those below there were also denied increases. Recognizing this condition, the Institute adopted the very simple proposal that the ceiling for deputies be raised, thus opening the way for increases all along the line.

Very shortly after the Royal Commission reported, the ceiling for deputies was raised to $15,000 as so urgently pleaded by the Institute. Since then all but two deputies have reached the ceiling and two others have gone beyond to $17,500. (These are the Deputy Minister of Finance and the President of the National Research Council). It now appears as if the ceiling should be raised again, because once more stagnation has set

Cover Picture

Our cover picture shows one of the 50-ton Crane girders for installation at the plant of The Nova Scotia Light and Power Company Limited, Halifax, N.S., being loaded aboard ship in the harbour at Liverpool, England. (See "Steam Generation of Power" by J. W. MacDonald, M.E.I.C., p. 345, *The Engineering Journal*, April 1953.) —*Photo courtesy Wharton Crane & Hoist Co. Ltd.*

with the senior engineers, and consequently with the others below them as well.

The officers of the Professional Institute of the Public Service of Canada have been requesting for some time that further favourable adjustments be made for professional employees, but up to the present moment there seems to have been little encouragement. The latest endeavour has been a letter from Dr. Harold A. Senn, president of the Professional Institute to the Prime Minister in which he pointedly indicated the anomalies between the professional civil servants' remuneration and that offered by private industry.

Dr. Senn's letter appears in the May issue of the Institute's monthly publication "Professional Public Service", but the reply from Mr. St. Laurent is not there due doubtless to the shortness of time. Doubtless it will appear later. In the same number, the leading editorial deals with the issue under the heading "Private Industry Takes Them". As this subject is of such wide interest to members of the Engineering Institute, over 2,000 of them being employed by governments of one kind or another, the editorial is reproduced herewith.

"Private Industry Takes Them"

Dr. John Convey, Director of the Mines Branch and P.I. member, and Dr. Walter A. Bell, Director of the Geological Survey and Institute Medal Winner in 1944, gave some interesting evidence last month before the Commons Committee on Atomic Energy regarding losses of professional personnel in their respective Branches.

Dr. Convey was asked if he had any difficulty getting capable and efficient professional staff and he replied "Yes. Our bargaining power is very limited by the Commission (Civil Service) who sets limits of salary, etc., and also the conditions that they must have so many years of experience. Unfortunately, we are losing quite an appreciable number of key personnel who have been with the Mines Branch for several years after graduation".

"You mean, after a good man has been with you a short time, private industry takes him away?" asked J. W. Murphy (PC, Lambton West).

"That is what happens," Dr. Convey replied.

"For more money?"

"Definitely more money," answered Dr. Convey, "in a few cases for double the salary." (From Atomic Energy Committee proceedings and evidence, March 20, 1953.)

Regarding loss of professional personnel, Dr. Bell's evidence was similar. From the Atomic Energy Committee proceedings and evidence, April 8, 1953, we quote Dr. Bell:

"In closing I would like to mention that one of the greatest difficulties that we have in carrying on our work, both in this division and in other divisions of the Survey, is the difficulty of security-qualified geologists and keeping them on our staff. Within the past 15 months we have lost 14 fully qualified geologists, which is 20 per cent of our total staff of that grade, and they have resigned from the Survey to accept positions which, on the average pay 60 per cent more salary."

Further on in the evidence, Dr. Bell informed the Commons Committee that the above-mentioned 14 geologists were all Ph.D's.; also that some were going into the same line of work, some to metal mining companies, while the oil companies were one of the big competitors. Later, he pointed out that the initial salary of a geologist Ph.D. in the Survey is $4,300 per annum, while industries take these same men at an average salary of $7,500 to start. (Government Senior geologist maximum: $7,200.)

No wonder private industry takes them!

Traffic

The Canadian Transit Association held its forty-eighth annual meeting in Montreal on June 15, 16 and 17. The program would have interested a great many citizens who have no part in arranging mass transportation, but who were simply users or would-be users of the streets. All papers had a popular interest and in particular would they be interesting to engineers. This writer would recommend to anyone that he endeavour to sit in on the meetings of this association that are being held in his bailiwick. As a motorist one has some shocking truths to learn, but the sooner they are learned the more chance there is that the streets will be turned back to the purpose for which they were built — even a thousand years ago — i.e. the movement of people.

H. W. Tate, M.E.I.C., consulting engineer, Toronto Transportation Commission, was the retiring president of the Association. In his presidential address he stated some sinple, but little regarded facts. The writer was eavesdropping on a few sessions including the president's address, but he slunk away with the feeling that all speakers were directing their adverse comments at him, as the typical motorist who drove down town with only 1.78 people in his car, occupying 67½ square feet of street space, whereas if he had had any sense of decency at all he would have been occupying only 5.9 square feet in a street car. Incidentally, it was revealing to learn that a street car rider is supposed to have 5.9 square feet for himself. Apparently the street car companies have not been informed.

Other figures given by Mr. Tate are equally impressive. All joking aside it is evident that some new thinking has to be done by municipalities if they are going to solve their present traffic problems, to say nothing of the future problems, which will be even worse. Mr. Tate said that "76 auto passengers use 850 feet in length of a street lane, whereas 76 street car passengers use 50 feet of a street lane.

All speakers recommended that private passenger car transportation other than through traffic be terminated well outside of the concentrated central business district, and that mass transportation be provided from there to the ultimate destination. Also it was urged that it was only an aggravation of the situation to provide more parking space—on street and off street—in these areas, as was also the building of express ways, through ways, etc., as they only encouraged the private motorist to go down town. The answer seemed to be that to dissolve the down town time-consuming, car-wrecking, nerve-racking tangle, it is necessary to keep the private cars from getting down town. Even to this car owner, it made sense.

Mr. Tate concluded his talk by presenting six points which he thought might be used by the Association "as a chart and compass for our collective efforts through the years ahead". They are—

FIRST: We must strive for

acceptance of the fact that in rush hour traffic, public transit vehicles should have priority. One way to do this may well be to reserve some streets for transit vehicles only. Where possible, too, traffic lights should be controlled so that they will speed up buses and street cars, leaving private cars to take second place.

SECOND: We must oppose resolutely the building of parking lots in already congested downtown areas. There are plenty of good arguments on our side—including the fact that there just isn't room for more cars in the downtown area of any city. We must make these arguments known and convince the public and their elected representatives that the place for new car parks is on the fringe of a city, from where a driver can travel downtown by public transit. As a matter of public policy we must cease regarding downtown areas as places to do "drive in" business.

THIRD: As an industry we must continue to press for the staggering of working hours. By spreading our peak load we can serve the public far more economically than if we are forced—as we are being forced now—to compress the major part of a city's working population into our vehicles within the space of a single hour.

FOURTH: Aside from rush hours, some major shopping thoroughfares should be banned to automobile traffic and left free for pedestrians and transit vehicles only. At present only a small minority of shoppers can possibly park their cars downtown, but these few are enough to slow up a whole city—including the bulk shoppers who rely on public transit to get them in and out of the downtown areas.

FIFTH: There should be no duplicate transit systems operating on the same streets. In most of our Canadian cities this, happily, is one objective we have already achieved, but it must be removed from our list since in some suburban districts duplication is now creating the same waste, which not so long ago led to the present unification of most downtown services.

SIXTH: Our final aim must be to make it clear that downtown parking is expensive and wasteful. And we should insist that motorists who park downtown should pay a proper price for the traffic chaos and delay to others caused by their use of public thoroughfares for vehicle storage. Perhaps higher parking rates on parking meters may be the answer; or perhaps a sales tax on fees charged at privately operated parking lots. Tough though this may seem on the individual, our traffic congestion *can* be eased by stressing in this way the true economy of a public transit ride.

Good luck to the Canadian Transit Association!

The *Journal*...35 Years Ago

The feature of "messages from councillors and branch officers to the membership" continues through this issue. There are messages from George E. Mackie of Moose Jaw, councillor for Saskatchewan; A. E. Doucet of Quebec, councillor for Quebec Branch; Julian C. Smith, was councillor for Montreal and writes a very interesting message dealing with the engineers' contribution to the prosecution of the war. He says "It seems to me that the only question a man should ask himself these days is—Am I doing everything possible to help win the war? I think, taken as a body, the members of our Institute are truthfully answering this question in the affirmative."

There is a message from F. H. Peters of Calgary and one from John Murphy, councillor for Ottawa. Mr. Murphy refers to the change in the Institute's title. He thanks the civil engineering members who so generously supported the proposal to drop the word civil from the title. He says he is particularly appreciative of this because "it was my privilege to start the movement in connection with changing the society's name."

Arthur Surveyer was a councillor for the Montreal Branch and sent in a strong message about the licensing of engineers. He stated "The best way to improve the status of the engineer is to obtain protective legislation in all the provinces. The various provincial bodies should be inter-connected through the Engineering Institute of Canada, in the same way that the medical associations are linked together by the medical council of Canada and the architects' association by the Royal Canadian Institute of Architects."

Other messages come from A. Bowman, chairman of the Halifax Branch; R. W. McIntyre of the Victoria Branch and M. H. Macleod, councillor for the Winnipeg Branch.

There is a four-page article by John Blizard on "Availability of Energy for Power and Heat". This was a paper delivered by the author before the Ottawa Branch.

Another paper running into five pages was "City Light and Power Department, Winnipeg, Manitoba" by J. G. Glassco and E. V. Caton, M.E.I.C. This paper was presented by the authors to the Winnipeg Branch.

Editorial

On the editorial page there is an article headed "Professional Unity". It urges the members to bear in mind that unity and prestige come from the individual efforts of the members of the society. The last paragraph reads this way "Let us all resolve to give some personal service to the profession we represent; to take an active constructive interest in the development of our organization; to contribute, by way of suggestion when sending in items to the *Journal* of personal doings or any other items of interest to the general membership; to become a committee of one to interest others in the Institute who are eligible for admission and on every and all possible occasions to impress those not in the profession what engineers are really accomplishing."

Under the heading of personals there are but few items compared with to-day's *Journal.* However, there is a note that Stanley H. Frame, formerly district hydrometric engineer, Irrigation Branch, The Department of the Interior, Calgary, has been appointed Assistant Engineer, Department of Natural Resources, Canadian Pacific Railway, Brooks, Alberta. Since then and for many years, Mr. Frame has been an active officer of the Vancouver Island Branch.

Also there is a note to the effect that Thomas R. Deacon, M.E.I.C., former mayor of Winnipeg and president of the Manitoba Bridge and Iron Works Limited, has been appointed to the post of Fuel Administrator for Manitoba.

It is interesting to look at the business before Council at that time. The meeting was held under the chairmanship of George A. Mountain who was then president. The minutes say that J. M. R.

Fairbairn "gave a verbal report for the committee appointed by Council to advise the government in connection with changes in the inspection and sales act with particular reference to the weight of the standard sack of cement."

This council meeting also takes note of the fact that the government has sent official word that the name of the society has been changed from the Canadian Society of Civil Engineers to The Engineering Institute of Canada.

Once again we see the beginnings of the Canadian Standards Association. There is a minute to this effect: "It is recommended and approved that the request of the Engineering Standards Committee recently organized under the chairmanship of Sir John Kennedy be granted, that the committee be allowed to make its headquarters in the building of the Institute and that the secretary of the Institute act as secretary of the committee."

Approval is given "to hold a professional meeting of the Institute in Halifax" and also permission is given "to hold a general professional meeting of the province of Ontario in the city of Ottawa some time in 1919."

In the list of people admitted to membership there is the name of Chester B. Hamilton, who even in those early days was "owner of the Hamilton Gear & Machine Company, Toronto". The minutes list the transfer from Student to Junior for Stanley Alexander Neilson "of Westmount, Quebec, resident engineer, Hull Electric Company, Hull, Quebec". Mr. Neilson is now on the staff at McGill University.

Ottawa Branch

As in previous issues, the report from the Ottawa Branch bulks large in the branch news section. This time it deals very largely with the Dominion Topographical Surveys and gives a lot of information which must have been particularly interesting at that time.

From the Ottawa Branch is a reference to discussions or arguments which are taking place between various newspapers in Canada as to the proper place for the location of the national railway headquarters. Apparently each city was urging that it should be their municipality. The report says "Toronto papers point out that the headquarters of the Canadian Northern Railway has always been there and if it were moved, many of its citizens would be thrown out of employment. Furthermore, as public ownership and operation sentiment has not penetrated further east than Central Ontario, the headquarters of the national railways should be somewhere west of Montreal". The report goes on to give Montreal's point of view. "Montreal papers point out that the headquarters of the Canadian Pacific Railway has always been in Montreal and as the headquarters of the Grand Trunk Railways is also in Montreal and as it is probable that this railway will be merged with the Canadian Northern Railway and the Canadian Government railways, it would be in the interest of efficiency and prevent much dislocation and rearrangement if the headquarters of all Canadian railways were established in that city". Later on the report states "surely there can be little doubt about the advisability of locating the headquarters of all Dominion Government railway systems in the capital of the Dominion". The author of this note, who at that time was the associate editor of the Ottawa Branch, subsequently became president of the Institute and it would be interesting to discuss this point with him today.

Another note from the Ottawa Branch reads this way "The recent appointment of J. M. Wardle, formerly highway engineer, Dominion Parks staff, to the position of superintendent of Rocky Mountains' Park, made vacant by the death of S. J. Clarke, is one which will be received with considerable interest and satisfaction by the engineering public". It is only within recent months that Mr. Wardle has retired from the Federal Service and gone into private practice.

There is mention of the International Waterways Work. A note states "R. J. Burley, International Waterways engineer of the Irrigation Branch, Department of the Interior, left Ottawa on June 3 to take charge on behalf of Canada, of the field work in connection with the measuring and apportioning of the waters of the St. Mary and Milk Rivers and their tributaries between Canada and the United States under the provisions of the waterways treaty". A lot of water has gone over the dam and under the bridge and across the International Border since that time, but it was only a few years ago that the issue was finally settled.

Promotion

A half page is devoted to the announcement that J. M. R. Fairbairn, who then was vice-president of the Institute, had been appointed chief engineer of the Canadian Pacific Railway system. The note says that this news "will be received with the heartiest approval by all who know Mr. Fairbairn". Several nice and well-earned things are said about Mr. Fairbairn but the reporter goes on to say "The position as chief engineer of the greatest transportation system in the world represents a proud pinnacle in engineering positions and that it should come to one who is comparatively a young man does him all the greater credit." Dr. Fairbairn held this position for a great many years. He was president of the Institute in 1921. He celebrated his eightieth birthday on June 30.

Four pages are devoted to an abstract of the report of the administrative chairman of the Honorary Advisory Council for Scientific and Industrial Research. This committee was under the chairmanship of Sir George E. Foster, Minister of Trade and Commerce. All this preliminary work was leading up to the creation of the National Research Council. One sentence in the opening paragraph of the abstract says "This report which deals with the measures that have been taken and the plans that are being laid to place Canadian science and industry upon a sure footing must necessarily be of great interest to the Canadian public." The report reveals very elaborate and detailed plans for inaugurating a great variety of useful work.

Reference is made to the passing of two senior members of the Institute. These were Thomas Breen, who was a graduate of Laval University. Mr. Breen died on May 27 at the age of 79 years.

Henry Carre died on July 11 in his 85th year. He was associated for many years with the Canadian Pacific Railway and did much to help in extending the system to the Pacific Coast. He was one of the small group present on the occasion when the last spike was driven, signifying the completion of the road. During the Fenian Raid, he was a member of the militia and proceeded with his company into active service.

It is interesting to think what these men must have known about the early days of the development and of engineering in Canada. They both died in the year 1918 and one was then 79 years of age and the other 85. That certainly puts their beginning well back in the early

history of our profession. What a thing it would be for all of us if we could only know of the things which they encountered and of the conditions of that day.

Trent Valley Canal

There is a half page picture of a group of seven men, sitting on the gunwale of a ship which is tied to a dock. The heading over the picture is "Inspecting the newly opened Trent Valley Canal". In the picture we have from left to right: W. A. Bowden, chief engineer, Department of Railways and Canals; Lieutenant-Colonel Monsarrat, consulting engineer, Department of Railways and Canals; A. T.Phillips, superintending engineer, Rideau Canal; A. L. Killaly, superintendent Trent Canal; D. E. Eason, principal assistant engineer Trent Canal; and A. J. Grant, superintending engineer Trent Canal.

All these gentlemen were members of the Institute but it is particularly interesting to note the presence of Mr. Killaly and Mr. Grant, both of whom were given Honorary Memberships at the Institute's Annual Meeting in Halifax on May 22, 1953. To the credit of both of them it can be said truthfully they didn't look any older in Halifax than they do in this picture which was taken thirty-five years ago.

A whole page is devoted to the program for the forthcoming second general professional meeting which is to be held at Saskatoon on August 8, 9 and 10.

The next issue (August) has in it many interesting papers which were to be read at the general professional meeting to be held at Saskatoon, but these will be referred to in the August issue of the *Journal*.

Advertisers

It is interesting and gratifying to see among the advertisers so many firms that have remained with the *Journal* through all these years. The list includes Pratt & Whitney Co. of Canada Limited, The John Bertram & Sons Co., Limited, Canadian General Electric, Dominion Bridge, Neptune Meter, Canadian Ingersoll-Rand, Canadian Fairbanks-Morse, Dominion Iron & Steel, Dominion Copper Products, Jones Glass Company, E. G. M. Cape Company, T. McAvity & Sons, Canadian Pipe Co., Manitoba Bridge & Iron Works and the Barrett Company. There was one advertisement from the Old Country, advertising electric steel furnaces. The company was Electro-Metals Limited.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, June 26, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:
F. W. Bishop, *St. John's.*
P. R. Brett, *Cornwall.*
L. A. W. Davis, *Montreal.*
C. S. Dutton, *Montreal.*
B. A. Hay, *Toronto.*
B. A. C. Hills, *Montreal.*
W. S. Hosking, *Bathurst.*
L. Ingram, *Pine Falls, Man.*
C. J. Jamieson, *Sarnia.*
J. Jazwinski, *Walkerville.*
G. E. McLellan, *Bathurst.*
M. H. McQueen, *Bellcville.*
O. Martin, *Kingston.*
F. L. Riley, *St. John's.*
J. C. Savage, *Arvida.*
P. S. Sidney-Smith, *Chilliwack.*
R. B. Spence, *Montreal.*
M. Thau, *Montreal.*
K. Tubalkain, *Montreal.*
A. Ubaldini, *Arvida.*
E. D. Van Fossen, *Edmonton.*
H. W. Willcock, *Halifax.*

Juniors:
F. E. Barrett, *Montreal.*
W. S. Bates, *Hamilton.*
C. Bennett, *Ft. William.*
S. T. Bieniada, *Montreal.*
H. Debicki, *Toronto.*
S. Dominik, *Montreal.*
J. D. Lamb, *Sorel.*
R. M. Murley, *Corner Brook.*
F. E. Newbury, *Corner Brook.*
H. H. Otto, *Bathurst.*
P. N. Papafingos, *Nitro.*
I. Potts, *Calgary.*
K. V. Reardon, *Halifax.*
H. Reicher, *Montreal.*
G. M. Rose, *S. Ste. Marie.*
W. A. Schwinghamer, *Humboldt.*
W. A. Thompson, *Port Hope.*
R. D. Wendeborn, *Sydney.*
J. R. S. Wilkie, *Montreal.*
M. Zinn, *Toronto.*

Transferred from the class of Junior to that of Member:
C. H. Bell, *Saskatoon.*
J. M. Childs, *Corner Brook.*
W. B. Christie, *Bath, Eng.*
G. H. Galbraith, *Calgary.*
C. P. Jones, *Vancouver.*
G. W. Kennedy, *Montreal.*
D. H. Paine, *Isle Maligne.*
R. C. Thurbel, *Victoria.*
C. R. Thompson, *Edmonton.*

Transferred from the class of Student to that of Junior:
K. R. Bullock, *Brockville.*
J. W. Nelson, *Kamloops.*

The following Students were admitted:
C. R. Burke, *N.S.T.C.*
G. M. Everhart, *No. Carolina.*
R. J. Mutter, *Univ. of Alberta.*
Q. W. James, *Ft. Erie, Ont.*
J. S. Kennedy, *Queen's.*
D. G. Rogers, *New Brunswick.*
A. Shimbashi, *Univ. of Alberta.*
G. Zachary, *Univ. of Alberta.*

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Members:
W. J. A. Dyne
E. L. Morris
C. N. Rands
C. D. Stewart
S. H. Van Orman

Junior to Member:
M. A. Burns
G. T. Hughes
J. D. Murdoch
I. W. Sanden

SASKATCHEWAN

Members:
D. L. Bishop
K. R. Burns
M. Mowchenko
D. M. West

Junior:
B. L. Walsh

Student:
R. Yoneda

Junior to Member:
W. R. K. Coulthard
R. J. Genereux
H. I. Langley

MANITOBA

Junior to Member:
C. M. Hovey

NEW BRUNSWICK

Member:
J. A. Welsford

NOVA SCOTIA

Members:
C. F. Emms
H. R. Garland

Junior to Member:
D. G. Brown
W. W. Piggott

Student to Member:
H. G. Bowes

QUEBEC

Member:
W. L. Merritt
L. E. Taylor

175 Years of Useful Living

On June 3, 1778 a small newspaper appeared on the streets of Montreal under the title *La Gazette du Commerce et Littéraire*. For 175 years since that time the paper has appeared regularly, in the course of its career turning from a weekly to a daily and from Freneh to English and from its early title to simply *The Gazette*.

This important anniversary was

(*Continued on page 889*)

The President Finishes His Tour of the Branches

Corner Brook. Eric Hinton received the charter from the president while Will Smith looks on.

Amherst. H. A. Morrison is the first chairman.

Below: Two views of the head table. In these pictures can be seen Mr. Morrison, Mr. G. J. Currie of Halifax, Mrs. Stirling, Right Reverend P. J. Nicholson, His Worship Mayor Morrison and Mrs. G. J. Currie.

At Arvida. The president chats with the chairman and vice-chairman of the branch: Messrs. D. F. Nasmith and G. K. Clement.

The president takes on all comers!

A good time at Quebec. Head table — left to right: Messrs. J. Saint-Jacques, A. Lariviere, Georges Demers, J. B. Stirling, A. R. Deeary and L. Gagnon.

The buffet supper was a great success.

Left to right: The president, chairman G. E. Sarault, Dr. Decary and L. Gagnon.

The ladies entertained Mrs. Stirling. Both dinners were at the Cercle Universitaire.

Above: The head table at Sherbrooke. Left to right: Mrs. George Dick, the president, George Dick, chairman; Mrs. Stirling, Mayor Levesque. The right-hand picture at the top of the page. In this group can be seen: Madame Levesque, I. R. Tait and Mrs. Austin Wright.

Shawinigan Falls. Left to right: L. A. Robillard, the president, A. M. Hubley, and the secretary, Charles Yoshida.

duly acknowledged in Montreal by many citizens and by the press throughout Canada. The Gazette Printing Company Limited is justly proud of the history and tradition of its great daily. To mark the occasion they have published a beautiful book, that tells the story in words and picture. As an example of the printer's art it is notable, but it is even more notable as an example of historic story telling.

The Engineering Institute joins with others to congratulate *The Gazette* on their great record, and to wish them continued success. The Institute is familiar with and appreciates this record because *The Engineering Journal* is a product of their printing presses. For over 20 years, The Gazette Printing Company have been an integral part of Institute life. It has been a pleasure to work with them, and to share with them the credit for the success of *The Journal*. It will be a pleasure to continue the association in the future.

Annual Meetings of Alberta and Quebec Professional Engineers

Association of Professional Engineers of Alberta

At the annual meeting of the Association of Professional Engineers of Alberta in April, J. J. Hanna, M.E.I.C., of Imperial Oil Ltd., Calgary, was elected president.

Other officers serving the Association this year will be vice-president, L. A. Thorssen, Edmonton; past president, H. H. Moor, Edmonton; councillors, J. N. Ford, Edmonton, C. A. Stollery, Calgary, M. S. Mitchell, Lethbridge, J. W. Young, Calgary, J. A. Harle, Edmonton, A. W. Howard, Calgary, R. D. Livingstone, Lethbridge, J. I. Strong, Calgary.

The representative on the Dominion Council is Dean R. M. Hardy, Edmonton; and of the Engineering Institute, P. M. Sauder, Lethbridge. The university faculty representative and deputy registrar is J. D. Dale of Edmonton. The registrar and executive secretary of the Association are, respectively, J. F. McDougall and A. E. McDonald.

Corporation of Professional Engineers of Quebec

The Corporation of Professional Engineers of Quebec held its annual meeting in April.

Trade and Commerce Minister C. D. Howe, Hon. M.E.I.C., spoke at the annual dinner, touching on such points of interest as the St. Lawrence Seaway, the permanent nature of the growth of Canada, and the advances he has observed in the engineering profession.

Robert F. Shaw, M.E.I.C., took office as president of the Corporation, at the annual meeting. Mr. Shaw is vice-president of the Foundation Company of Canada, in Montreal. Georges Demers, M.E.I.C., of Quebec, was elected vice-president and G. Lorne Wiggs, M.E.I.C., of Montreal was elected honorary secretary-treasurer. L. O'Sullivan, assistant general manager of the Quebec Hydro-Electric Commission, is past president. The councillors are D. C. MacCallum, M.E.I.C., T. A. Monti, M.E.I.C., R. A. Phillips, M.E.I.C., Maurice Royer, M.E.I.C., and Daniel Wermenlinger, JR.E.I.C.

News of Other Societies

The 1953 annual meeting of the **American Society of Civil Engineers** (33 West 39th St., New York 18, N.Y.) will be held at the Statler Hotel, New York City, October 19-23.

Sponsored jointly by the International Association for Hydraulic Research, and the hydraulics division of the A.S.C.E., a hydraulic convention will be held September 1-4, 1953, at Minneapolis, Minn.

Headquarters will be the University of Minnesota, Minneapolis. Information can be obtained from Professor Loyal A. Johnson, St. Anthony Falls Hydraulic Laboratory, Minneapolis 14, Minn.

Two meetings of the **American Institute of Electrical Engineers** (33 West 39th St., New York 18, N.Y.) have been announced: a meeting at the Hotel Vancouver, Vancouver, B.C., August 18-21, 1953; and an aircraft electrical equipment conference, at the Benjamin Franklin Hotel, Seattle, Washington, September 30 to October 2, 1953.

The Canadian sections of A.I.E.E. have announced the names of their officers for the 1953-54 season.

The Toronto Section, which is now planning a semi-centennial celebration in October this year, is headed by chairman W. R. Harmer, of the Hydro-Electric Power Commission, Toronto. Others active in the Toronto Section are immediate past chairman, C. E. McWilliam; secretary, R. J. Brown; treasurer, J. C. Burkholder; committee chairmen, P. J. Croft, M.E.I.C., G. F. Tracy, J. T. Fisher, J. C. de la Rosa, R. B. Steele; student counsellor, J. E. Reid, and G. D. Floyd, M.E.I.C., district vice-president.

The Montreal Chapter has announced the election of Leo Roy, M.E.I.C., as president. Mr. Roy is chief engineer of auxiliary services of the Quebec Hydro-Electric Commission.

Appointed to the chapter's executive committee were Felix L. French, Donald J. McDonald, Arthur M. Thompson, and Harold O. Wilson, M.E.I.C. Donald M. King is secretary treasurer; and C. Abbott Wright and Arthur C. Abbott, M.E.I.C., are committee chairmen. Past president is C. Lawrence Roach.

The annual meeting of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.) is scheduled for December 13-16, 1953, at the Hotel Jefferson, Saint Louis, Missouri.

The Institute of the Aeronautical Sciences (2 East 64th St., New York 21) will join with the Royal Aeronautical Society in sponsoring the Fourth International Aeronautical Conference, London, England, September 7-17, 1953.

A list of coming meetings of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18) includes: the A.S.M.E. industrial instruments and regulators division and Instrument Society of American exhibit and joint conference, Chicago, Ill., Sept. 21-25; the A.S.M.E. petroleum mechanical engineering conference, Rice Hotel, Houston, Texas, Sept. 28-30; the A.S.M.E. fall meeting, Hotel Sheraton, Rochester, N.Y., Oct. 5-7; the A.S.M.E. fuels division and A.I.M.E. coal division joint conference, Conrad Hilton Hotel, Chicago, Ill., Oct. 29-30; and the A.S.M.E. annual meeting, Statler Hotel, New York, N.Y., Nov. 29 to Dec. 4.

At the recent annual meeting of the **American Society for Testing Materials** (1916 Race St., Philadelphia, Pa.), Leslie C. Beard, Jr., assistant director of Socony-Vacuum Laboratories, New York, took office as president of the Society.

The **North East Coast Institution of Engineers and Shipbuilders** (Bolbec Hall, Newcastle-upon-Tyne, England), has announced that its president for 1953-54 will be Lt.-Col. T. Eustace Smith, joint managing director, Smith's Dock Co. Ltd.

Headquarters Records

Each time the *Journal* or other Institute mail is dispatched we are advised of undeliverable items due to incorrect addresses. Our records staff must follow up these changes and the regular service to members suffers thereby. *Please* advise headquarters when your address or occupation changes. The form below can be completed, clipped, and mailed to headquarters in a few moments.

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Personals

News of the Personal Activities of Members of the Institute

R. E. Smallwood, M.E.I.C.

R. E. Smallwood, M.E.I.C., project engineer in charge of all activities regarding gearing design, transmission equipment and rubber and plastic machinery for Dominion Engineering Company Limited, was elected to the executive committee of the American Gear Manufacturers Association during the annual meeting at Hot Springs, Va. He is the first member from the Province of Quebec to be elected since the Association was founded in 1917.

Leo Roy, M.E.I.C., chief engineer of auxiliary services of the Quebec Hydro-Electric Commission, was recently elected president of the Montreal chapter of the American Institute of Electrical Engineers.

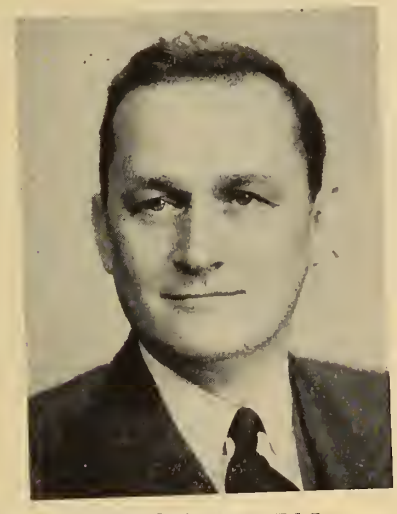
A civil engineering graduate of Ecole Polytechnique in 1930, Mr. Roy received his electrical engineering degree from McGill University two years later.

Before assuming his present position he was superintending engineer of Hydro-Quebec's transmission and distribution section.

J. A. Ouimet, M.E.I.C., is assistant general manager of the Canadian Broadcasting Corporation and its co-ordinator of television.

Mr. Ouimet is recognized as Canada's foremost authority on television matters in general, its technical aspects, costs and operation. Recognition within the country is exemplified in his position as chairman of the Television Technical Advisory Committee of the Canadian Radio Technical Planning Board, an organization made up of representatives of broadcasting, industry and the engineering profession which makes recommendations to industry and government authorities on matters of fundamental importance.

International recognition came in his recent appointment to the International Television Committee. In addition to being the only Canadian on the Committee, Mr. Ouimet has been named vice-president of its Social and Cultural Study Committee.



J. A. Ouimet, M.E.I.C.

Between his graduation in 1928 from the University of Montreal in arts, followed by his graduation from McGill University in electrical engineering in 1932, and the beginning of his career in national radio in 1934, Mr. Ouimet experimented with both television and the industrial application of electronic counters.

His experiments with television reached the point where the firm, Canadian Television Limited, with which he was employed as research engineer, was actually transmitting pictures in the Montreal area. These experiments were, however, twenty years ahead of time in terms of both technology and public opinion.

In addition to his knowledge of television, Mr. Ouimet has a thorough experience in the organization of national radio. From 1937 to 1941 he was CBC operations engineer in charge of all technical personnel and technical operations and maintenance. Between 1941 and 1949, as general supervising engineer, he was particularly concerned with the development of frequency modulation and keeping the CBC up to date on developments in television.

Mr. Ouimet was appointed chief engineer and co-ordinator of television in 1949, and in 1951 was named assistant general manager.

J. E. Hayes, M.E.I.C., formerly assistant to the chief engineer of the Canadian Broadcasting Corporation, has been named to the position of assistant to director general of engineering.

Mr. Hayes, who received his B.Sc. degree in electrical engineering from Queen's University in 1935, and his M.Eng. degree in communications from McGill University in 1947, has been with the Canadian Broadcasting Corporation since 1936.

Most of his time with the Corporation has been spent in the transmission and development department where he held the position of assistant transmission and development engineer for several years. His work with this department dealt with antenna design, propagation problems, and supervising development work done in the laboratory.

More recently, he has been actively engaged in television work and has visited England, France and the United States for the purpose of studying latest

J. E. Hayes, M.E.I.C.

television developments in these countries.

In his present position as assistant to director general of engineering, Mr.

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layes is chiefly concerned with engineering in television broadcasting.

F. W. Douglas, M.E.I.C., retired on May 1, 1953 from The Foundation Company of Canada Limited to take up residence in Dayton, Ohio.

He was born in Toronto and graduated as an honour student from the University of Toronto in civil engineering in 1914.

In 1916 he joined The Foundation Company in New York, and two years later enlisted in the United States Army. At the war's end he took a post-graduate course in 1919 in Paris, France, at Ecole Nationale des Ponts et Chaussees.

He then returned to New York and continued with The Foundation Company and was associated with such projects as the Detroit-Windsor Bridge, Quincy Memorial Bridge spanning the Mississippi and numerous steam power plants throughout the United States. In 1928 he went into business for himself until 1931.

That year he came to Canada and was employed by The Foundation Company as engineer on the Toronto Intake project during 1932-33. He was also engineer on the Baie Comeau Development, superintendent on the Sorel Wharf, Isle Julliet Dam at St. Timothy, Gouin Dam on the St. Maurice River and the anti-submarine net across Halifax Harbour during World War II.

In 1941 he returned to the Montreal office where he was engaged in estimating heavy engineering projects until his retirement.

Mr. Douglas has been instrumental in the construction of the Powell Wharf, Port Alfred, Que.; Fanshawe Dam, London, Ont.; two headframes for Canadian Johns - Manville, Asbestos, Que.; Vimy Ridge Mine at Black Lake, Que.; Sullivan Island Dam for Gatineau Power Co.; salt storage pits at Marathon Ont., and the Halifax-Dartmouth Bridge spanning Halifax Harbour.

Mr. Douglas is a member of The Foundation Company's 25-year Club.

A. J. Bennett, M.E.I.C.

A. J. Bennett, M.E.I.C., manager of the Frequency Conversion Division of Blenkhorn and Sawle Limited in St. Catharines, Ont., has been appointed chairman of the Niagara Peninsula Branch of the Institute.

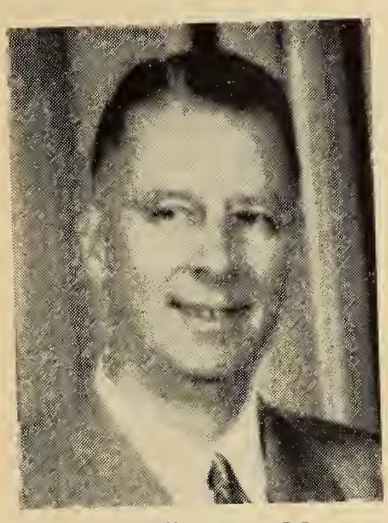
Mr. Bennett was born near Maniwaki, Que., and received his general education at the Ottawa Collegiate Institute.

After obtaining his B.Sc. Degree in electrical engineering from McGill University, he entered the Quebec Division of the Bell Telephone Company of Canada.

In 1929 he joined English Electric Company of Canada Limited in St. Catharines, Ont., and held the positions of sales engineer, plant manager, and Toronto district sales office manager.

Before entering Blenkhorn and Sawle Limited, Mr. Bennett was engaged for several years with the consulting engineering firm of R. A. Hanright.

N. J. Allison, M.E.I.C., of the International Pipe Line Company in Edmonton, has been appointed chairman of the Edmonton Branch of the Institute.



N. J. Allison, M.E.I.C.

Mr. Allison was born in Paisley, Scotland. He received his formal education at Paisley Grammar School, Strathallan School, the Paisley Technical College in Scotland and the Liverpool Technical College in England. He is the holder of the British Board of Trade Extra First Class Certificate, and the British Board of Trade First Class Motor Certificate.

He served his apprenticeship as engineer in the shops and drawing office of Thos. Reid & Sons in Paisley, and the Fairfield Shipbuilding & Engineering Co. Ltd. in Glasgow, Scotland.

In 1927 he was employed by Blue Star Line (1920) Ltd. of London as seagoing engineer in charge of watch on steam reciprocating, turbine and diesel-engined ships, as well as on refrigeration machinery.

Six years later he returned to Thos. Reid & Sons in Paisley as draughtsman on design of marine auxiliaries.

In 1934 he joined the Anglo-Iranian Oil Co. Ltd. as assistant engineer on the oil processing plant construction and general oil field maintenance in Iran.

The following year he entered Kuwait Oil Co. Ltd. as mechanical engineer in Kuwait on general construction, maintenance and development of a new field.

In 1940 he joined the Royal Indian Naval Reserve in New Delhi as equipment officer at Naval Headquarters. He was responsible for speeding shipbuilding for the Royal Indian Navy, modifying internal arrangements of ships and planning shore bases. During 1942-1944 he was in charge of planning construction and of operating the landing craft base at Bombay and of training personnel required for that base.

In 1944 he returned to Anglo-Iranian Oil Co. Ltd. and served as field engineer at Gach Saran, and superintendent engineer at Kuwait, Masjid-i-Sulaiman, Lali, Haft Kel, White Oil Springs and Ahwaz fields. By 1947 he became fields mechanical engineer responsible for mechanical engineering construction and maintenance, including welding and mobile plants in all oil fields in Iran.

He entered the producing department of Imperial Oil Limited in 1948 as construction and maintenance engineer. He has been in his present position since February, 1949.

In addition Mr. Allison has recently joined the Royal Canadian Naval Reserve with the rank of commander (E) and has been appointed engineer officer of H.M.C.S. *Nonsuch*.

Mr. Allison is a member of the Institute of Marine Engineers, and of the Institution of Engineers and Shipbuilders in Scotland, and of the Association of Professional Engineers of Alberta.

Allan Tubby, M.E.I.C., manager of H. J. Tubby and Son, Ltd. of Saskatoon, Sask., has been elected chairman of the Saskatchewan Branch of the Institute.

Mr. Tubby was born in Saskatoon and received his general education at Buena Vista Public School and Nutana Collegiate Institute there. He graduated in civil engineering from the University of Saskatchewan in 1932.

During the summer months from 1926 until 1935 he was employed by H. J. Tubby, general contractors in Saskatoon.

In 1935 he was chief of party on a water resources survey of Saskatchewan, and the following two years he was employed first as sales engineer of Currie Products Ltd. in Toronto and

Allan Tubby, M.E.I.C.

then as manager of the Ottawa branch and plant of the same firm.

He joined the Royal Canadian Air Force works and buildings branch in Montreal in 1943. Two years later he was employed as resident engineer in charge of construction of a townsite in northern Ontario for Defence Industries Limited.

Mr. Tubby went into partnership with his father, H. J. Tubby, in Saskatoon in 1949.

Donald L. Mordell, M.E.I.C., director of the Gas Dynamics Laboratory at Ste. Anne de Bellevue, Que., has been named chairman of the department of mechanical engineering at McGill University.

Born in London, Mr. Mordell obtained his M.A. degree at Cambridge. Until 1945 he was senior technical assistant with Rolls-Royce Ltd. and from 1945 to 1947 was the engineer responsible for combination research and development of that firm.

Professor Mordell was first named to the McGill staff in 1947. He was appointed senior research engineer within a year and research director the following year.

The old drill hall at Ste. Anne's was taken over in 1949 with Professor Mordell as research director. The laboratory has been expanded with the aid of private industry and public bodies. One of the major projects has been the development of a pilot gas turbine utilizing coal as a fuel.

Charles A. Robb, M.E.I.C., has retired as chairman of the department of mechanical engineering at McGill University.

Professor Robb's career dates back 49 years. At 15 years of age he joined the Robb Engineering Company in Amherst, N.S. on graduating from high school. After a year he entered Mount Allison University, for a two-year course in applied science, completing his mechanical engineering training at McGill for the degree of B.Sc. in 1909.

After experience with industrial firms, he entered the Massachusetts Institute of Technology where he gained his M.Sc. degree in mechanical engineering. He began his teaching career as a lecturer in mechanical engineering at the University of Alberta, then served with the Imperial Munitions Board at Ottawa and Washington, D.C. in World War I.

He returned to the University of Alberta and became professor of engineering, taking time out to obtain his doctorate in engineering at Johns Hopkins. At the outbreak of World War II he was named to the War Supply Board as chief of the gauge division, then as power consultant to the Department of Munitions and Supply.

He came to McGill in 1945 as visiting professor in mechanical engineering, and was made acting chairman and then chairman of the department in which research work and advanced training have been greatly stimulated.

R. E. Heartz, M.E.I.C., president of Shawinigan Engineering Company Limited in Montreal, has been appointed a governor of the Royal Edward Laurentian Hospital.

T. M. Moran, M.E.I.C., who, with Ernest Ridout, has purchased the 50-year-old Taylor-Forbes Company in Guelph, Ont., has been appointed president of the new company known as Taylor-Forbes (1953) Limited.

Well known in the industrial management field, Mr. Moran was formerly vice-president of the B. C. Electric Railway Company, and vice-president of Stevenson-Kellogg, management engineers.

He is a graduate of McGill University in mechanical engineering, class of 1923.

Lt.-Col. John H. Fox, M.E.I.C., has been named to the newly-created position of general sales manager of Minneapolis-Honeywell Regulator Company Limited, Leaside, Ont.

Colonel Fox graduated in applied science from the University of Toronto in 1927.

He joined the Minneapolis-Honeywell firm in 1935 as a sales and appliance engineer and in the following years served in various sales engineering and sales management capacities.

From 1939 until 1946 he was with the Canadian Army, enlisting as a lieutenant and being discharged with the rank of lieutenant-colonel. He commanded the Second Canadian Advance Base Workshop, R.C.E.M.E. in England and Northwest Europe.

Colonel Fox returned to the Company in 1946.

In his new position he will be responsible for the management and coordination of the sales activities of all divisions of the Minneapolis-Honeywell Company's 12 Canadian offices.

A. P. Shearwood, M.E.I.C., has been appointed a member of the board of directors of National Steel Car Corporation Limited. He is vice-president of the Company in charge of sales.

Mr. Shearwood was employed with the Dominion Bridge Company Limited in 1927 and 1928, and the Canadian Pacific Railway in 1929 and 1930.

He graduated from McGill University in arts in 1930 and in engineering in 1932, and joined the engineering department of National Steel Car Corporation Limited in Hamilton that same year.

Mr. Shearwood was transferred to the Montreal office in 1934, becoming assistant to the president in 1939 and general sales manager in 1947.

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Roy A. Crysler, M.E.I.C., structural engineer and consultant on concrete with Canada Cement Company since 1932, as recently joined the staff of M. M. Dillon & Company as a director and

Roy A. Crysler, M.E.I.C.

manager of the Company's Toronto office.

Mr. Crysler graduated in 1920 with a B.A.Sc. degree from the University of Toronto, his university career having been interrupted by a period of service in the C.E.F., with the Canadian Artillery.

He served on with the Hydro Electric Power Commission on the Queenston Power Canal, and later as a plan examiner in the city architect's office in Toronto. He worked with the H. K. Ferguson Company of Cleveland, Ohio, as chief structural designer. From 1927 to 1932 he was a member of the staff of Chapman and Oxley of Toronto as chief structural engineer responsible for the structural design of all types of buildings.

G. D. Sauer, M.E.I.C.

G. D. Sauer, M.E.I.C., formerly assistant hydraulic engineer with the B. C. Electric Company, is now chief engineer for Angus Robertson Limited.

After graduation from McGill University in 1931, he was draughtsman, designer and field inspector with Beauharnois Construction Company until 1935 when he became briefly associated with the Passamaquoddy tidal power project. He then moved to New York where he was employed by Ebasco Services Inc. for a few months and later by the American Gas and Electric Company and its subsidiaries.

In 1949 he joined the B. C. Electric Company in Vancouver, B.C. He entered his present position with Angus Robertson Limited a few months ago.

Frederick Charles Mechin, M.B.E., M.E.I.C., former director of Imperial Oil Limited has retired after 37 years' service with the Company.

An honours graduate from the University of Toronto in 1914, Mr. Mechin joined Imperial Oil Limited in 1916 as first assistant to the chief engineer and superintendent of construction for the Montreal East Refinery.

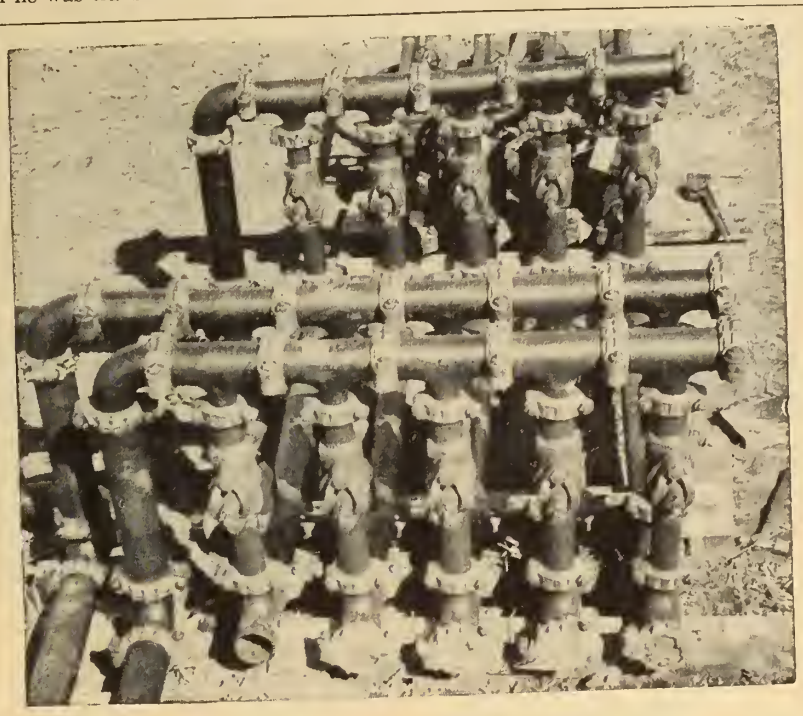
After service overseas he was superintendent of the Halifax plant until 1923 when he was transferred to the Montreal East refinery where he was manager until 1944. That year he moved to Toronto to become assistant to the president in charge of employee relations and personnel.

During the war he served as technical advisor to the Departments of Munitions and Supply and National Defence.

In 1945 he was appointed a director of the Company, and a year later he was awarded the M.B.E. in the King's Dominion Day Honours List.

Mr. Mechin joined the Engineering Institute as an Associate Member in 1917, and transferred to Member in 1938. He was granted Life Membership in the Institute in January, 1952.

Victor S. Chesnut, M.E.I.C., port engineer at Saint John, N.B., for the National Harbours Board, retired in April after 23 years' service.



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A graduate in engineering from the University of Toronto in 1912, Mr. Chesnut was employed for five years on the construction of the Welland Ship Canal. From 1919 until 1924 he was on the engineering staff of the Saint John Dry Dock Company Limited during the period when this plant was under construction. He spent the succeeding four years on elevator construction work at Midland, Ont. In 1928 he was a member of the designing staff of the Welland Ship Canal.

Mr. Chesnut was appointed port engineer under the Saint John Harbour Commission in 1930. Six years later when the National Harbours Board undertook the administration of Saint John Harbour, he retained his same position with the Board.

Mr. Chesnut served as councillor for the Saint John district in the Association of Professional Engineers during 1949 and 1950.

H. H. German, M.E.I.C., has been recently admitted into the Fraternity of the Free Shipwrights of London (England) at an impressive meeting of its Court. After his election as a Freeman of the Company, and obtaining the Freedom of the City subject to orders of the Lord Mayor and Court Aldermen, he was chosen, nominated and elected for admission into the livery of the Fraternity.

Mr. German retired in 1948 as senior partner in the firm German and Milne, naval architects in Vancouver, and now acts in a consulting capacity for the West Coast firm, Milne, Gilmore and German.

Mr. German has been for many years the chief surveyor for Canada for the Bureau Veritas Classification Society of England.

John McQ. Patterson, M.E.I.C., is transitman with the Canadian Pacific Railway Company in Penticton, B.C.

He was previously with Permanent Timber Products Limited at Vancouver, B.C., and with the British Columbia International Engineering Company in that city.

Mr. Patterson is a graduate of the University of Saskatchewan in civil engineering, class of 1948.

W. N. Papove, M.E.I.C., has been engaged recently as surveyor to the British Columbia-Yukon and the British Columbia-Northwest Territories Boundary Commission to establish at the crossing of the 60th parallel of latitude by the Liard River the corner common to Yukon, Northwest Territories and British Columbia.

W. N. Papove, M.E.I.C.

After graduating in civil engineering from the University of Saskatchewan in 1933, Mr. Papove was employed by the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C. on field construction in the development of its northern properties.

In 1946 he entered private practice in Vancouver, B.C. and has since been engaged in mineral claim surveys at Yellowknife, N.W.T.; as consultant to the Department of Mines and Resources on mining claims surveys in the Yukon; and with the B. C. Department of Lands and Forests on control surveys along the Alaska Highway, including right-of-way, settlement and timber reserves surveys. He has also been in charge of the survey of the Alberta-British Columbia boundary.

W. A. McDougall, M.E.I.C.

W. A. McDougall, M.E.I.C., has been appointed senior contract engineer of Ellis-Don Ltd.

Mr. McDougall received his B.Sc. degree in civil engineering from the University of New Brunswick in 1941, and had been estimator with Canadian Bridge Company in Walkerville, Ont. since his discharge from the Royal Canadian Engineers in 1946.

Lucien L'Allier, M.E.I.C., engineer in the office of the director of departments for the City of Montreal, has been named director of the public works department.

Mr. L'Allier is a graduate of McGill University, class of 1935. He joined the Bell Telephone Company upon graduation and worked there for three years before entering the Canadian Broadcasting Corporation where he was responsible for the operation and maintenance of all CBC transmitting and studio equipment in the Province.

In 1946 he joined the City's public works department where he worked in various capacities leading up to his recent appointment.

E. A. Olafson, M.E.I.C,. drainage engineer with the Prairie Farm Rehabilitation Association in Medicine Hat, Alta., has been granted a one-year leave of absence for a United Nations assignment as irrigation and drainage engineer with the Food and Agricultural Association in Pakistan.

Mr. Olafson received his B.Eng. degree in agriculture from the University of Saskatchewan in 1942, and his B.Sc. and M.Sc. degrees in civil engineering from Utah State University in 1947 and 1948, respectively.

F. A. Crawley, M.E.I.C., has retired after 24 years' service with Nova Scotia's Department of Highways and Public Works.

He is now Nova Scotia service representative for Osmose Wood Preserving Company of Canada, Ltd. of Montreal.

Thomas C. Macnabb, M.E.I.C., is assistant district engineer of the Canadian Pacific Railways' Algoma District in North Bay, Ont.

He obtained his B.Sc. degree in civil engineering from the University of Manitoba in 1940. Mr. Macnabb served during the summer months from 1929 until 1939 as axeman, chainman, labourer, helper with locomotive work, inspector, rodman and levelman with the C.P.R. and other employers until June, 1940, when he became transitman on maintenance with the C.P.R. in Winnipeg.

In 1940 he became blueprinter, draughtsman and transitman in Toronto, and the following year transitman for the Laurentian Division in Montreal.

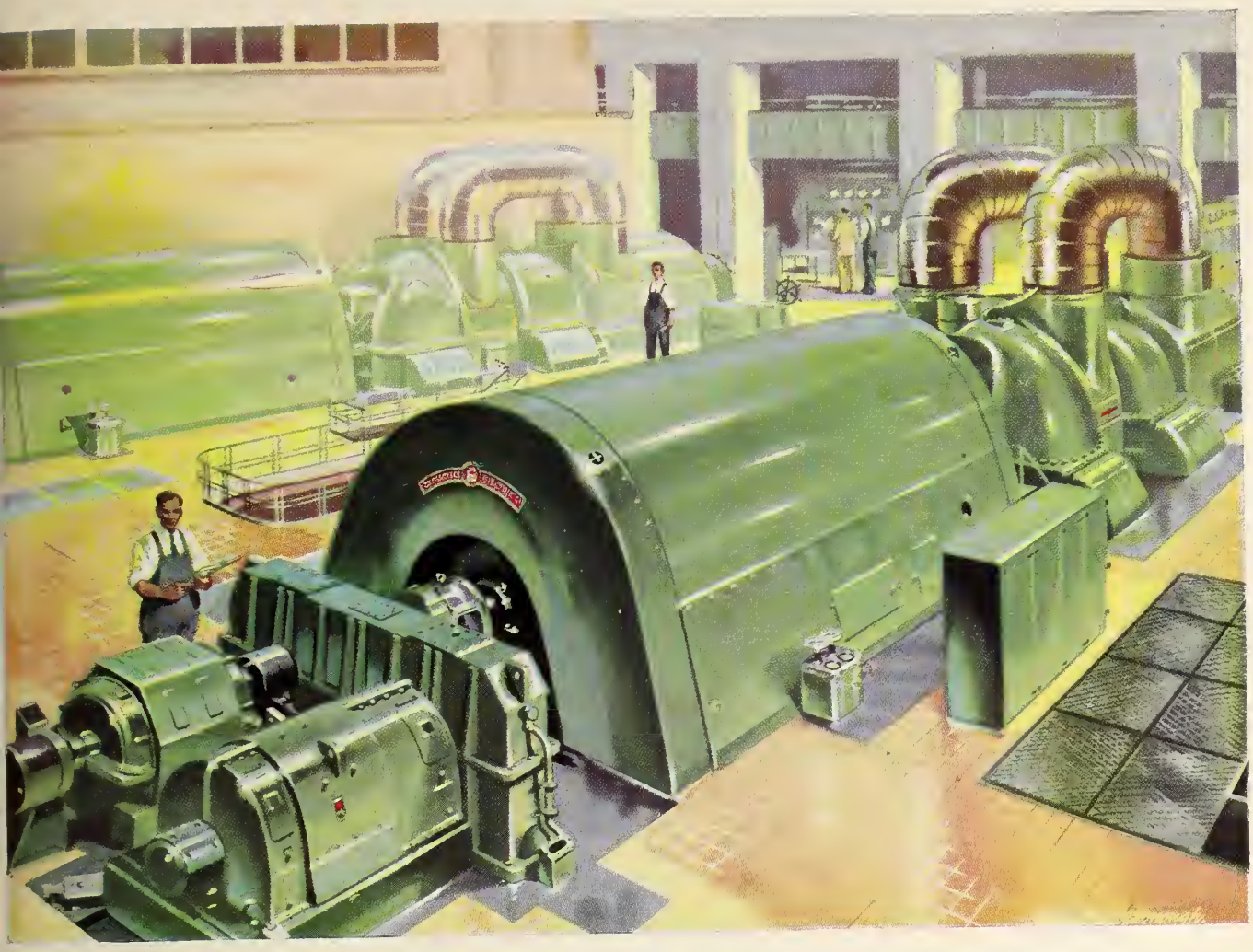
He was appointed assistant engineer of the Montreal Terminals in 1943, and the next year assistant special engineer in Montreal. In May, 1946, he was appointed assistant special engineer in Toronto, and in December of that same year he became special engineer.

Ross L. Dobbin, M.E.I.C., was presented a silver tray by the American Water Works Association at its convention banquet in Buffalo, N.Y. The presentation was made in recognition of Mr. Dobbin's long service in the water works field and on his election to the presidency of the Engineering Institute of Canada.

W. C. Miller, M.E.I.C., city engineer for St. Thomas, Ont., and **J. C. Keith,** M.E.I.C., general manager of the Windsor Utilities Commission in Windsor, Ont., were presented with life membership certificates in the American Water Works Association at its recent convention banquet in Buffalo, N.Y.

John S. L. King, M.E.I.C., of the Toronto engineering firm of King and Coons, is

J. S. L. King, M.E.I.C.



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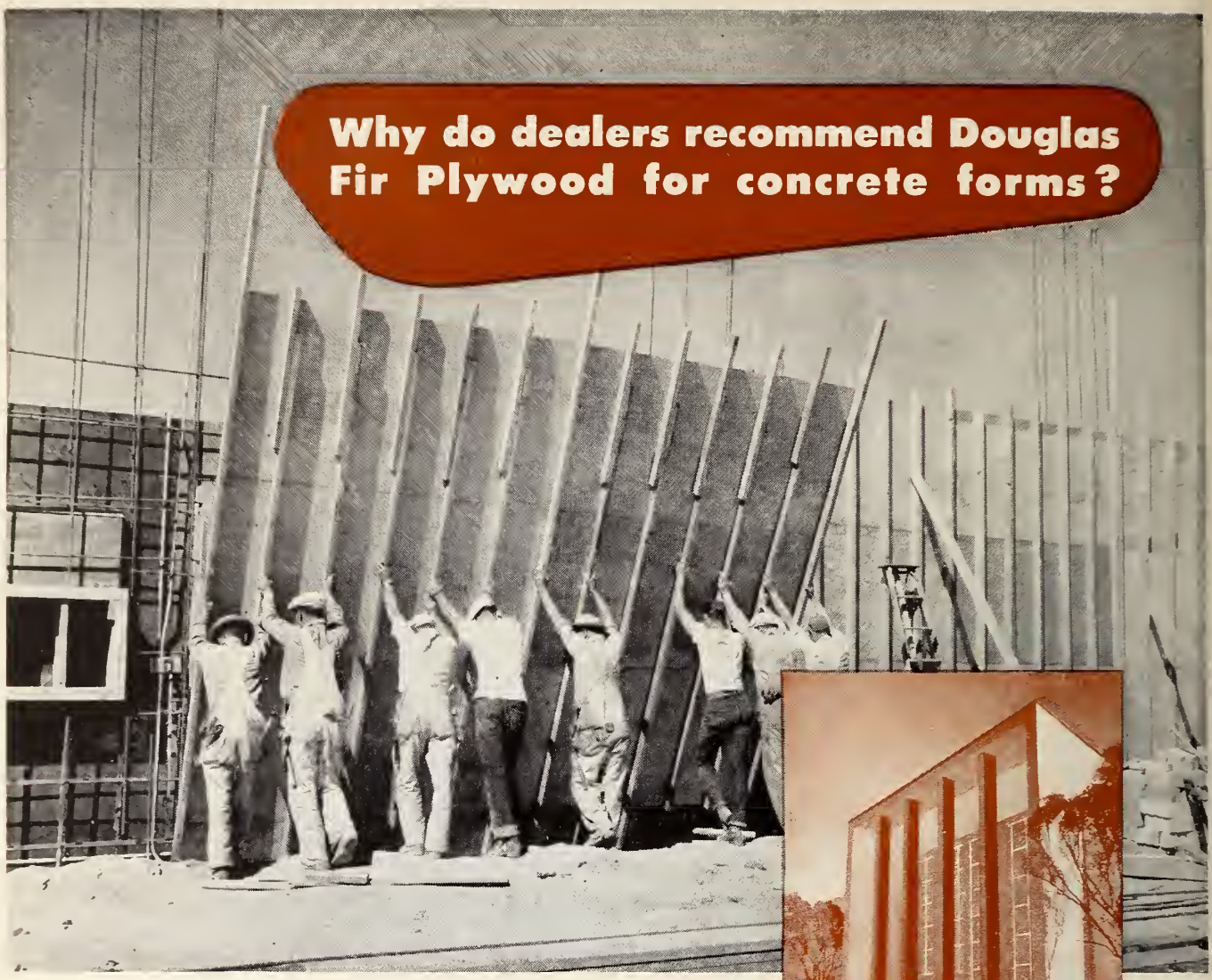

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nsulting engineer to Don Mills Development Limited. He is responsible r advising on requirements and development of suitable engineering installtions.

Mr. King is a 1947 graduate in engineering from the University of Toronto.

eorge L. Archambault, M.E.I.C., is sales anager with Northern Equipment imited in Montreal, Que.

He was formerly sales manager with es Produits en Aluminium et Acier noxydable L'Hoir Inc. at Levis, Que.

Mr. Archambault graduated in mehanical engineering from McGill Uniersity in 1939.

. C. Thomas, M.E.I.C., formerly deputy ommissioner of works in Halifax, N.S., s now city engineer in Calgary, Alta.

He received his B. Eng. degree from he Nova Scotia Technical College in 936, and his M. Sc. degree from Harard in 1946.

Robert W. Lister, M.E.I.C., has been appointed to the position of British Columbia district manager of Bepco Canada Limited in Vancouver.

R. W. Lister, M.E.I.C.

He was previously associated with Canadian Westinghouse Company, Limited in Hamilton, Ont.

Mr. Lister graduated in electrical engineering from the University of British Columbia in 1947.

S. R. Steinbock, M.E.I.C., has been transferred by Imperial Oil Limited to its affiliate company, International Petroleum (Colombia) Limited in Barranca Bermeja, Colombia, where he will serve as general engineering supervisor. Mr. Steinbock was previously located in Sarnia, Ont.

He is an engineering graduate of the University of London, class of 1942.

J. J. MacKenzie, M.E.I.C., has joined the Bowyer Boag Limited in Winnipeg, Man.

He was previously with Inland Steel & Forgings Co. Ltd. in Winnipeg, Man.

Mr. MacKenzie is a graduate in electrical engineering from the University of Manitoba, class of 1938.

M. M. Uloth, M.E.I.C., has been transferred by the Canadian General Electric Company Limited from Industrial Centre No. 5 in Quebec City to the Company's engineering department in Peterborough, Ont.

Mr. Uloth entered the Company as junior engineer in Peterborough, Ont. after graduation in 1942 from the Nova Scotia Technical College in electrical engineering. During 1945-1946 he served with the Directorate of Electrical Engineering, R.C.N., after which he returned to his previous position. He was transferred to Quebec City last year.

R. F. Sadler, M.E.I.C., has joined Standard Dredging Company Limited in Saint John, N.B.

He was formerly with Northern Electric Company Limited in Montreal.

Mr. Sadler is a 1950 mechanical engineering graduate from McGill University.

Major J. H. MacLean, M.E.I.C., is now attending the Military College of Science in Shrivenham, England.

Major MacLean received his B.A. Sc. degree in mechanical engineering from the University of Toronto in 1941, and his M.A. Sc. degree in 1949.

W. H. Powell, M.E.I.C., is now general manager of the Peterborough Utilities Commission in Peterborough, Ont.

He was formerly chief engineer of the Commission in Kingston, Ont.

Mr. Powell is a graduate of the University of Toronto in civil engineering, class of 1939.

R. M. Wickwire, M.E.I.C., has been appointed building engineer for the Atlantic region of Canadian National Railways with headquarters at Moncton, N.B.

After graduation from the Nova Scotia Technical College in 1947, Mr. Wickwire entered the railway service as an instrumentman at Campbellton, N.B. A year later he was transferred to Moncton, and in 1949 was appointed

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2-3

structural designer, the position he has held until his present appointment.

H. V. Evans, M.E.I.C., has joined Rankin Company Limited in Montreal as chief of technical design.

He was formerly with Bathurst Power & Paper Co. Ltd. in Bathurst, N.B.

Mr. Evans graduated in mechanical engineering from West Essex Technical College in London in 1949.

E. W. Wenhardt, M.E.I.C., has joined the United States Gypsum Company in Oakfield, N.Y.

He was formerly with H. G. Acres & Company in Niagara Falls, Ont., and with the Prairie Farm Rehabilitation Association in Regina, Sask.

Mr. Wenhardt is a graduate in civil engineering from the University of Saskatchewan, class of 1947.

Eric F. Walker, M.E.I.C., is now with the Medical X-Ray Division of Philips Industries Limited in Toronto, Ont.

He was formerly with Picker X-Ray in Montreal and Halifax, N.S.

G. H. Gillett, M.E.I.C., has been appointed manager of the Pacific District of the Apparatus Division of Canadian General Electric Company Limited in Vancouver, B.C.

He was previously manager of the same division of the Montreal district office.

Mr. Gillett graduated with a B.Sc. degree in electrical engineering from McGill University in 1924. After receiving the Company's "test" training at Peterborough, Ont., he was transferred to the Davenport Works in Toronto, and then to the Company's head office. In 1928 he was transferred to the Montreal Apparatus Division.

R. J. Smith, M.E.I.C., is associated with Lewis Brothers Construction (Ontario) Ltd. in North Bay, Ont.

He was formerly with Champlain Oil Products Ltd. in Montreal.

Mr. Smith is a graduate in civil engineering from the University of Toronto, class of 1947.

John Smith, M.E.I.C., is regional construction engineer with Central Mortgage & Housing Corporation for Alberta, Northern British Columbia and Yukon Territories. He is located in Edmonton, Alta.

Mr. Smith was previously chief engineer with Dominion Bridge and Riverside Iron Works in Calgary, Alta.

D. A. Kennett, M.E.I.C., formerly camp and surveys supervisor on the Bow River (P.F.R.A.) project is now with the producing department of Imperial Oil Limited in Redwater, Alta.

He graduated in civil engineering from the University of Saskatchewan in 1944.

Donald B. Kilpatrick, JR.E.I.C., is associated with the Canadian International Paper Company in Montreal. He was formerly with Brown Corporation in Berlin, New Hampshire.

He is a graduate in engineering from McGill University, class of 1949, and of the Harvard Graduate School of Business Administration, class of 1951.

L. A. Zalkind, JR.E.I.C., has been transferred from the Montreal office of Libby Air Conditioning Limited to Toronto where he is now serving as district manager.

Previous to joining the Company in 1951, he was sales engineer with Sheldons Ltd. in Galt, Ont.

Mr. Zalkind graduated in mechanical engineering from McGill University in 1947.

John Tutecky, JR.E.I.C., has joined the St. Lawrence Corporation Limited of Montreal.

He was formerly structural designer with Abitibi Power & Paper Co. Ltd., in Sault Ste. Marie, Ont.

Mr. Tutecky is a 1947 graduate of the University of Toronto in civil engineering.

H. E. Cole, JR.E.I.C., is project engineer for Central Mortgage and Housing Corporation at the R.C.A.F. station in Centralia, Ont.

He was previously plan examiner with the building department of the City of Toronto.

Mr. Cole is a graduate in civil engineering from the University of Toronto, class of 1948.

Erratum

R. J. Trafford, JR.E.I.C., previously with Dominion Textile Company Limited in Magog, Que., was mentioned in the May *Personals* as having joined Frances Hankin and Company, consulting engineers in Montreal.

Mr. Trafford has advised that this is not the case.

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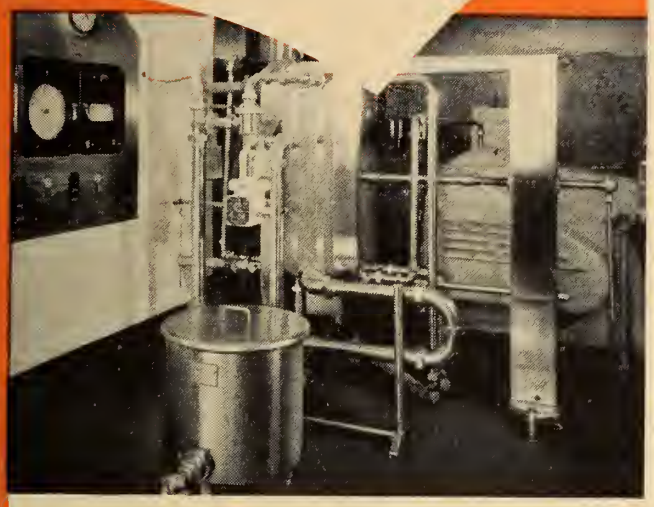
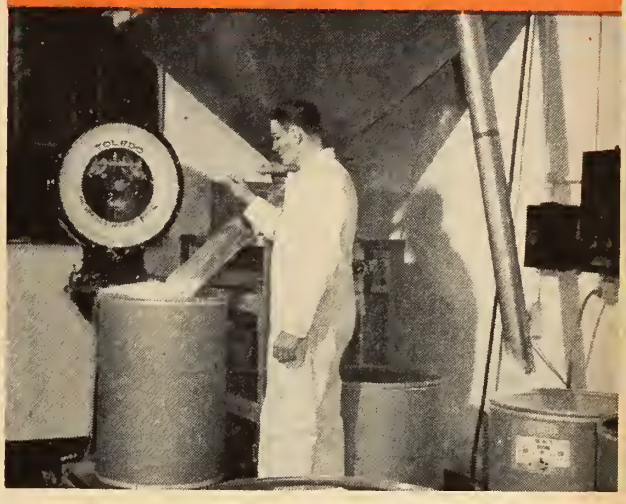
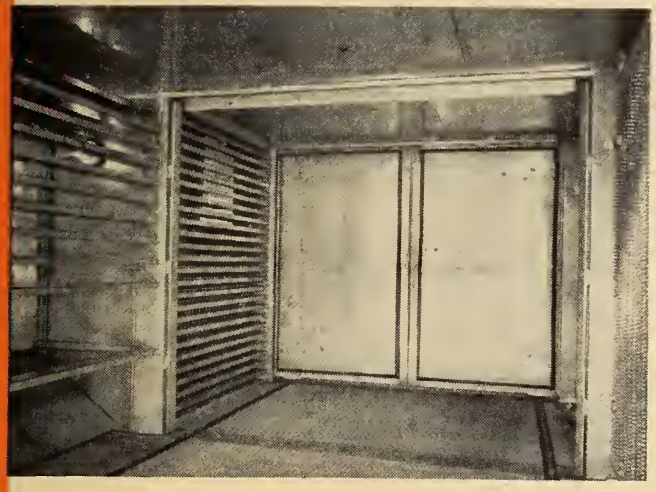


DAIRY Stainless steel tubing and nickel alloy fittings protect purity of dairy products and add to appearance of equipment in a Toronto dairy.



CHEMICAL To provide a durable, easy-to-clea surface, this hopper and chute in large Canadian chemical plant ar made of stainless steel.



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A. E. Speers, JR.E.I.C., is assistant engineer with Canadian National Railways at St. Thomas, Ont. He was recently transferred from the Toronto district engineer's office.

Mr. Speers was formerly instrumentman in Belleville, Ont.

He is a graduate in civil engineering from the University of Toronto in 1949.

N. T. Christie, JR.E.I.C., has been appointed geological field supervisor for Canadian Gulf Oil Company in the Stettler area of Alberta. He joined the Company in 1950.

Mr. Christie is a graduate in geology and mineralogy from Queen's University, class of 1951.

John E. Davis, JR.E.I.C., has joined the Calgary consulting engineering firm of Haddin, Davis and Brown Limited.

He was previously associated with McTavish McKay Co. Ltd. in Calgary.

Mr. Davis is a civil engineering graduate of the University of Alberta, class of 1950.

Oskar Friesen, JR.E.I.C., has been transferred by Imperial Oil Limited from Edmonton to Peace River, Alta. He was previously with the Company in Calgary.

Mr. Friesen graduated in geological engineering from the University of British Columbia in 1950.

S. M. Roberts, JR.E.I.C., is now assistant electrical superintendent with Price Brothers & Co. Ltd. in Kenogami, Que.

He was previously an engineer in training with Canadian Westinghouse Co. Ltd. in Hamilton, Ont.

Mr. Roberts is a graduate in electrical engineering from the University of Manitoba, class of 1950.

John J. Marlow, JR.E.I.C., has joined A. B. Cairns & Sons Ltd. in Willowdale, Ont.

He was previously with J. L. E. Price Construction Company in Toronto, Ont.

Mr. Marlow is a 1950 graduate in civil engineering from the University of Toronto.

Wilfred J. Smith, JR.E.I.C., has been appointed Welland County engineer in Welland, Ont.

He was previously assistant district engineer for the Department of Highways in Hamilton, Ont.

Mr. Smith graduated in civil engineering from the University of Toronto in 1950.

Auguste A. Albert, JR.E.I.C., is with the Department of Public Works of Canada in Rimouski, Que.

He was previously with the Department in Saint John, N.B.

Mr. Albert is a graduate in civil engineering from the University of New Brunswick, class of 1950.

R. M. Benjamin, JR.E.I.C., has recently joined the control department of Bathurst Power & Paper Co. Ltd. in Bathurst, N.B.

He is a 1950 graduate in chemical engineering from the Nova Scotia Technical College.

Ward A. Smyth, JR.E.I.C., is associated with The Stanley Tool Company of Canada at Roxton Pond, Que.

He was previously with the Ingersoll-Rand Company in Sherbrooke, Que.

Mr. Smyth is a 1950 graduate in mechanical engineering from McGill University.

Rene Martineau, JR.E.I.C., has joined The Key Construction Limited in Montreal.

He was formerly with The Preload Company of Canada in Montreal.

Mr. Martineau is a 1950 graduate of Ecole Polytechnique in civil engineering.

W. A. Anderton, JR.E.I.C., has joined the Public Health Engineering Division of the Department of National Health and Welfare in St. Catharines, Ont.

He is a 1950 graduate of the University of Toronto in chemical engineering.

J. Kunigiskis, JR.E.I.C., has joined Accurate Geo. Limited in Falher, Alta.

Mr. Kunigiskis is a graduate of the University of Alberta in electrical engineering, class of 1950.

John E. Wachowich, JR.E.I.C., is now associated with Benjamin Brothers Ltd. in St. Boniface, Man.

He was formerly with Underwood & McLellan Ltd. in Saskatoon, Sask.

Mr. Wachowich is a 1950 civil engineering graduate of the University of Manitoba.

Robert C. Wannop, JR.E.I.C., has joined Dominion Bridge Company Limited in North Vancouver, B.C.

He was formerly with Swan, Rhodes & Wooster, consulting engineers in Vancouver, B.C.

Mr. Wannop graduated in civil engi-

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neering from the University of British Columbia in 1950.

Renaud Hinse, JR.E.I.C., has joined Anglo-Canadian Pulp & Paper Mills Ltd. as assistant chief of party at Forestville, Que.

Mr. Hinse is a 1951 mining engineering graduate of Laval University.

J. A. Paxton, JR.E.I.C., has joined the International Nickel Company of Canada Limited in Port Colborne, Ont.

He was previously with Abitibi Power & Paper Co. Ltd. in Iroquois Falls, Ont.

Mr. Paxton received his B.Sc. degree in mechanical engineering from the University of Saskatchewan in 1949, and his M.Sc. degree in 1951.

J. E. Whenham, JR.E.I.C., is now associated with Moody and Moore, Winnipeg architects, as architect-engineer.

He was previously strucural engineer and architect with H. K. Black in Regina, Sask.

Mr. Whenham received his B.Arch. degree from the University of Manitoba in 1950 and his M.Sc. degree in civil engineering from the University of Minnesota in 1951.

Camille Marcoux, JR.E.I.C., has joined Eastern Metals Corporation in Daaquam, Que.

He was formerly with Normetal in West Abitibi, Que.

Mr. Marcoux graduated in 1951 from Laval University in mining engineering.

Norman L. Baldwin, JR.E.I.C., is now associated with H. A. Simons, consulting engineer in Vancouver, B.C.

He was formerly with Long Lac Pulp and Paper Co. Ltd. in Terrace Bay, Ont.

Mr. Baldwin is a 1951 graduate in civil engineering from the University of Toronto.

Jack C. Morris, JR.E.I.C., is now Ontario sales representative for Sandvik Canadian Limited in Toronto.

He was formerly an engineer in training with Bailey Meter Co. Ltd. in Toronto.

Mr. Morris graduated from the University of Toronto in 1951.

D. C. Lempriere, JR.E.I.C., has been appointed equipment engineer in the Plant Engineering Gas Turbine Division of A. V. Roe (Canada) Limited in Malton, Ont.

He was formerly co-ordinator with the Company.

Mr. Lempriere is a graduate of the Borough Polytech of London, class of 1951.

Robert Leslie Denison, JR.E.I.C., has been transferred by the Canadian Locomotive Company to Montreal. He was previously with the Company in Kingston.

Mr. Denison is a graduate in mechanical and electrical engineering from the University of Sydney, class of 1952.

D. R. Hickey, S.E.I.C., was awarded a master's degree in petroleum engineering (refining division) from the University of Tulsa, Okla. at its June convocation.

Mr. Hickey received his B.Sc. degree in chemical engineering from McGill University in 1950.

Robert Olaf Olsen, S.E.I.C., has accepted employment with the Electric Reduction Company of Canada at Buckingham, Que.

Mr. Olsen is a 1950 electrical engineering graduate of Queen's University.

D. G. Logan, S.E.I.C., is now with the Shaw Engineering Company in St. Roch, Que.

Mr. Logan is a graduate in civil engineering from the Nova Scotia Technical College, class of 1952.

Clifford H. Lien, S.E.I.C., has joined Calgary Power Limited in Calgary, Alta., as an engineer in training.

He is a 1952 graduate in electrical engineering from the University of Alberta.

Robert Borduas, S.E.I.C., is now located at the R.C.A.F. Station in Rockcliffe, Ont.

Mr. Borduas is a 1952 graduate in mechanical engineering from Ecole Polytechnique.

E. S. Bengston, S.E.I.C., is undertaking the two-year training course with English Electric Company of Canada Limited in St. Catharines, Ont.

He is a 1952 graduate in mechanical engineering from the University of British Columbia.

J. A. Gordon Moore, S.E.I.C., has joined the engineering department of the Department of Public Works in Charlottetown, P.E.I.

He was previously with Foundation Company of Canada Limited in Chalk River, Ont.

Mr. Moore is a 1952 graduate in civil engineering from McGill University.

B. A. West, S.E.I.C., is with Canadian Celanese Co. Ltd. in Drummondville, Que.

He is a 1952 graduate of the University of Alberta in chemical engineering.

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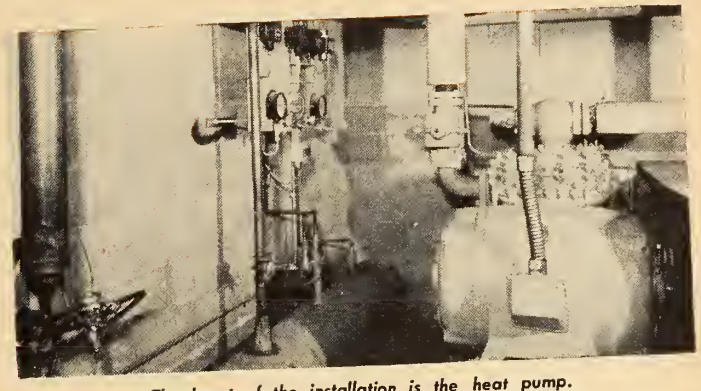
A heat pump installation of widespread interest is now operating in the new wing of the Commercial and Technical High School, London, Ontario. It was found to be the practical solution to a specific problem with the ability to effect economies right from the start.

Heat reclaimed from exhaust air in the ventilating system is employed to warm the floor area of the shower room, around the pool and the water for showers and pool. In summer, the pump provides cooling capacity for air-conditioning the cafeteria. At the same time it uses the extracted heat along with that taken from the air through coils on the roof to heat shower and pool water.

Anaconda Copper Tube, because of its heat transfer properties, corrosion resistance and consistent uniformity, acts as a connecting link with the many mechanical units of the project. Copper tube is also an essential part of the heat exchanger coils, compression equipment and condensers.

Commercial and Technical High School, Landan, Ont.
Architect: Robert B. Schaales
Consulting Engineer: Nichalas Fadar
Consultant: Dr. A. D. Misener, University af Western Ontario.



The heart of the installation is the heat pump. This equipment supplied by John Inglis Co. Limited.

View of the cafeteria, air-conditioned by means of the heat pump.

ANACONDA

FOR COPPER AND ITS ALLOYS *consult* **ANACONDA**

Walter Bloch, S.E.I.C., has joined W. C. Becker Equipment Company Limited in Toronto.

Mr. Bloch is a 1952 graduate in electrical engineering from the University of Toronto.

A. D. Jones, S.E.I.C., has joined the Shell Oil Company in Calgary, Alta.

Mr. Jones graduated in civil engineering from the University of British Columbia in 1952.

Edward D. Sawchuk, S.E.I.C., a recent graduate in mechanical engineering from the University of Manitoba, has accepted an English electrical fellowship from the John Inglis Company Limited in Toronto. The fellowship entitles him to two years' post-graduate study in England.

After spending the summer months in Toronto observing the Canadian manufacturing units of the Company, Mr. Sawchuk will leave for England in September.

Edmund Hugh McIntyre, S.E.I.C., a 1953 graduate in metallurgical engineering, has been awarded an Athlone Fellowship entitling him to two years' post-graduate training in Great Britain.

Mr. McIntyre is particularly interested in industrial applications of metallurgical principles, and plans to spend two years in British metals manufacturing works.

Theodore Cameron Kenney, S.E.I.C., who graduated this year with the title of "university scholar" at McGill University, has been awarded an Athlone Fellowship covering two years' industrial and university post-graduate training in Great Britain.

He plans to enter the Imperial College of Science and Technology in London, England, for a year of post-graduate training in soil mechanics and afterwards a year of professional experience under the direction of a consulting engineer.

Rene Arsenault, S.E.I.C., a recent graduate of Ecole Polytechnique, has been awarded the Athlone Fellowship covering two years' post-graduate training in Britain.

Mr. Arsenault has devoted his summers to Royal Canadian Navy (Reserve) training. Now a sub-lieutenant (engineer), he plans to pursue studies in naval engineering and obtain technical experience at the same time in British shipyards and industry.

Leonard Allen, S.E.I.C., a graduate this year in civil engineering from the University of Alberta, has been awarded an Athlone Fellowship for two years' post-graduate study in Britain. He will leave for the United Kingdom in September.

R. J. Kavanagh, S.E.I.C., is presently employed in the Radio and Electrical Division of the National Research Council in Ottawa.

Mr. Kavanagh is a 1953 graduate in electrical engineering from the University of New Brunswick.

Marcel Longpre, S.E.I.C., has entered the Canadian General Electric Company in Peterborough, Ont. as testman.

Mr. Longpre is a 1953 B.A.Sc. graduate of Ecole Polytechnique.

Frank P. Tagliamonte, S.E.I.C., has entered the geology department of the International Nickel Company of Canada at Boston Creek, Ont.

He was previously at the South Dakota School of Mines and Technology in Rapid City, South Dakota.

M. G. Neumeister, S.E.I.C., has joined the Northern Electric Company Limited in Montreal, Que.

Abdul Majid Ibrahim, S.E.I.C., is now with the Alberta Department of Highways in Okotoks, Alta.

J. H. Braams, S.E.I.C., has joined the Aluminum Company of Canada, Limited in Vancouver, B.C., and is presently located at Skino Lake, B.C.

W. S. Gard, S.E.I.C., is now associated with the Northern Electric Company Limited in Montreal.

William F. Wells, S.E.I.C., is now resident highway engineer for the Alberta Department of Highways at Olds, Alta.

Fred Chow, S.E.I.C., is associated with the Sunshine Lardeau Mine in Beaton, B.C.

Visitors to Headquarters

T. M. Moran, M.E.I.C., Toronto, Ontario, June 15, 1953

Major-General G. R. Turner, M.E.I.C., Ottawa, Ontario, June 15, 1953.

Gordon K. Clement, M.E.I.C., Arvida, Quebec, June 19, 1953.

G. H. Heyne, M.E.I.C., Toronto, Ontario, June 19, 1953.

ELEVATED TANK

This Horton elevated steel tank is used to provide gravity water pressure for fire protection at the Fine Foods of Canada Limited's plant at Ste. Martine, Que. It has a capacity of 100,000 gals. and supplies water to the automatic sprinkler system in the plant.

Write our nearest office for tenders or complete information on Horton elevated tanks for fire protection or general service.

HORTON STEEL WORKS LIMITED

TORONTO, ONT. FORT ERIE, ONT. MONTREAL, QUE.

REPRESENTATIVES

Mumford-Medland Ltd., Winnipeg, Man. - Gordon Russell Ltd., Vancouver, B.C.

ONLY

Josam **NON-CLOG FLOOR DRAINS have all these features**

Series No. 5420

Triple drainage is found only in floor drains having a sediment bucket for intercepting debris from waste water, and auxiliary drainage combined with the well-known double drainage feature of Josam drains.

Main flow of water discharges through grate slots into sediment bucket and then into the waste pipe. When the sediment bucket becomes completely filled, the surface drainage is still maintained through the holes in the auxiliary drainage surface.

The auxiliary drainage surface consists of drainage holes so located in the top rim surface of the drain that they afford a by-pass for draining surface water when the sediment bucket becomes clogged. A positive guard against carelessness is the fact that the grate cannot be returned to proper position until sediment bucket has been set in place in drain body.

THE JOSAM LINE INCLUDES: Floor, Shower and Urinal Drains; Roof Drains; Backwater Valves; Interceptors for Grease, Oil, Sediment and Hair; Swimming Pool Fittings; Shock Absorbers for Pipe Lines.

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Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Carl Stenbol, M.E.I.C., chief engineer of Algoma Steel Corporation Limited, died at his home in Sault Ste. Marie, Ontario, on May 11, 1953.

He was born in Askim, Smaalenene, Norway, on November 21, 1881, and received his general education in the public and high schools of that country. Before coming to Canada at the beginning of this century he had been employed as a farmer, a lumberjack and a sailor.

Carl Stenbol, M.E.I.C.

Mr. Stenbol studied mechanical engineering through the American School of Correspondence, and, at the same time, began his career in the engineering field as a labourer with the Dominion Steel and Coal Company in Sydney, Nova Scotia. Within a period of nine years he advanced to furnace helper, iron worker, millwright, blueprint boy and draughtsman. In 1909 he became chief draughtsman and continued as such until 1911 when he joined Algoma Steel Corporation Limited in Sault Ste. Marie, Ontario, in the same capacity. The following year he entered the Canadian Copper Company (now the International Nickel Company) as smelter engineer and chief draughtsman.

After a short trip to Norway and Sweden in the summer of 1914, he entered the Anaconda Copper Company in Montana as designer. In September of the following year, he joined the Dome Mines Company as mechanical engineer, and a month later, was appointed chief engineer in charge of designing and building a small steel and forge plant erected by the Canada Cement Company in Montreal for the manufacture of shells for the Allied Armies. He was named superintendent of the steel and forge department of this plant in 1916. Upon the completion of this work, he returned to Sault Ste. Marie as general manager of the Algoma Construction Company, then to be formed. Shortly afterwards he was transferred to the Algoma Steel Corporation as assistant to the managing director. He was appointed mechanical superintendent of the Company in 1917 and served in that position until 1939 when he was named chief engineer.

An enthusiastic skier in Norway, Mr. Stenbol recognized the possibilities for the sport in the hilly terrain of the Sault Ste. Marie area, and was instrumental in organizing the Sault Ski Club. He served as honorary president of the Club for many years. In addition, he took an active interest in the Country Club at Sault Ste. Marie, serving a term as president, and for many years, as special director appointed by the bondholders.

Mr. Stenbol joined the Engineering Institute of Canada as a Member in 1921, and was elected councillor for the Sault Ste. Marie Branch for two consecutive terms from 1944 until 1947. He was granted Life Membership in the Institute in January, 1952.

Stanley Thomas Lewis, M.E.I.C., former assistant supervisor and division engineer for the E. & N. Railway in Victoria, British Columbia, died in the Jubilee Hospital in Victoria on May 15, 1953.

Mr. Lewis was born at Indian Head, Saskatchewan, on February 13, 1888. He received his introduction in railroading at the age of 12 when he served for the summer as water boy with Canadian Pacific Railway.

While undertaking his general schooling and civil engineering study through the International Correspondence School in Winnipeg, Manitoba, he continued to work during the summers for the same Company. He was employed in such varied positions as blueprinter and junior assistant, draughtsman in the chief engineer's office, instrumentman on railway construction, transitman on preliminary and location surveys, and resident engineer on railway construction.

In 1918 he was appointed division engineer for the Company at Medicine Hat, Alberta, and two years later became roadmaster at Empress, Alberta. From 1924 until 1947 he occupied the position of division engineer in Regina, Saskatchewan.

He then joined the E. & N. Railway in Victoria, British Columbia, as assistant supervisor and division engineer, a position he held until his retirement in March of this year.

Mr. Lewis became a member of the Association of Professional Engineers of Saskatchewan in 1930.

He joined the Engineering Institute of Canada as a Member in 1938.

Herbert Armstrong Stephenson, M.E.I.C., vice-president and general manager of E. S. Stephenson and Company Limited in Saint John, New Brunswick, died at his home in Saint John on March 11, 1953, at the age of 63 years.

Mr. Stephenson was born in Saint John and received his general education there.

At the age of 16 he began his engineering apprenticeship with Fred Thomson and Company in Montreal, after which he joined Otis Fensom Elevator Company Limited as an electrical engineer, and later, the McGill University Power House as superintendent.

He returned to Saint John around 1911 to become associated with the electrical engineering firm, E. S. Stephenson and Company Limited, founded by his father, and continued as vice-president and general manager of the Company until the time of his death.

Mr. Stephenson was prominent in the work of many fraternal, business and social organizations in Saint John.

He was a member of the Association of Professional Engineers of New Brunswick.

Mr. Stephenson joined the Engineering Institute of Canada as a Member in 1942.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER required age 25 to 35 who has had some experience in formulating lacquer, lacquer thinners and brake fluids. The work will entail laying out evaluating programs in our application labs and contacting accounts all over Canada. Salary will be dependent on experience and qualifications and all replies will be held confidential. File No. 4599-V.

CIVIL

CIVIL ENGINEER, required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

EXPERIENCED STRUCTURAL design engineer must be Canadian citizen, graduate in engineering from a university of recognized standing and with a number of years of experience in the design and construction of engineering structures in both reinforced concrete and steel. Applicants should state age and qualifications and give full particulars of experience. Salary open depending on experience. File No. 4536-V.

CIVIL ENGINEER recent graduate required by suburban municipality, Montreal area for general municipal work. Reply stating age, experience, and salary required. File No. 4596-V.

COMMISSIONER OF WORKS required in Halifax, N. Scotia. This position involves administrative and professional engineering work in directing, under the jurisdiction of the City manager all activities of the Public Works Department. Extensive knowledge of the modern principles and practice of administration as applied to the design, construction and maintenance of streets, sewers and other public works facilities. File No. 4608-V.

ELECTRICAL

RECENT GRADUATE electrical engineering (Power Option) required by industrial organization in Ottawa. Engineer would be employed in the design and control department working on electrical power installation. He would be trained in the company's methods of design, cost accounting, material expedition and personnel relations. Salary would be commensurate with past experience and ability. File No. 4598-V.

MECHANICAL

APPLICATIONS ARE invited for sales engineering position in long established engineering department. Age 19-30, should have mechanical training or education in engineering. Positions are permanent and would entail designing and also selling mechanical equipment. Give full details and phone number to file No. 4601-V.

MECHANICAL ENGINEER required in new department of organization in Montreal manufacturing industrial heating equipment. Work involves preparation of shop drawings, production schedules with some sales and plant investigations. File No. 4605-V.

MISCELLANEOUS

ENGINEERS REQUIRED for work on new types of electro-mechanical instruments for marine and air craft use. University degree and two to eight years experience required. Preference given to men with manufacturing experience. All replies will be treated in confidence. Please write full details of education and experience. File No. 4594-V.

A WESTERN CANADIAN manufacturer requires an experienced and capable sales manager to direct the sales of its products which includes commercial semi-trailers and sneet metal and plate products for the petroleum and petrochemical industry. The company wishes to enlarge its operations in the sheet metal plate work and mechanical fields and requires an energetic and capable man with vision to assist in this department. File No. 4595-V.

MECHANICAL ELECTRICAL ENGINEER as factory manager for medium sized plant engaged in the manufacture of both light and heavy industrial handling equipment in Southern Ontario. Essential qualifications comprise sound knowledge of plant engineering and factory layout, contract estimating, wage incentives, methods study for volume production and quality control. Must be good disciplinarian. File No. 4597-V.

INSPECTING ENGINEER with wide experience in the erection and maintenance of materials handling equipment to organize a service department covering the Provinces of Ontario and Quebec and there after assume full responsibility for technical installation of all new equipment and the servicing of that already in use. File No. 4597-V.

SIX SALES ENGINEER graduate mechanical or civil. Sales experience in air conditioning, refrigeration, heating products or technical products. Graduates 1949 to 1953. File No. 4600-V.

PRODUCTION CONTROL SUPERINTENDENT. Engineering graduate or equivalent. Background and experience in methods trade automotive or production machine industry. Knowledge of plant layout, process engineering, industrial engineering, production control and cost control essential. Salary $6,000. Location Ontario. File No. 4600-V.

INDUSTRIAL ENGINEER mechanical or metallurgical graduate or equivalent Background and experience in production standards, time and motion study, plant layout and process engineering in metals trade industry. Salary $4500.00 Location Ontario. File No. 4600-V.

SALES ENGINEER engineering graduate or equivalent. Proven sales record in heating field or allied industry. Contacts with architects engineers and contractors desirable. Should be capable of developing plans and estimates for radiator and boiler installations in dwellings, apartments, institutions, commercial and industrial buildings. Salary $5,000.00. Location Ontario. File No. 4600-V.

WORKS MANAGER mechanical or metallurgical graduate. Experience plant engineering and factory management in grey iron foundry and machine shop production. Knowledge of production engineering industrial engineering, plant rehabilitation, time and motion study and cost control. Salary $10,000. Location Ontario. File No. 4600-V.

YOUNG ENGINEER for industrial engineering in textile industry. Experience in textiles preferable but not necessary. Full training will be given in our plants in N.B. and Ontario. Besides technical ability work will require ability to sell ideas and to deal successfully with mill personnel. Replies should outline experience, age and salary expected. File No. 4602-V.

INSPECTION ENGINEER required in Toronto. The job involves making inspections of a wide variety of power equipment, including prime movers, generating equipment and switch gear, pumps and compressors, and other types of power equipment. Applicant will work out of Toronto in various plants in Province of Quebec and Ontario. Age range 25 to 35 years. Degree in mechanical or electrical engineering. File No. 4603-V.

RESEARCH ENGINEER required by Saskatchewan Department of Mineral

Resources. Salary dependent on qualifications. Excellent pension plan and conditions of employment. Minimum requirements: graduate in ceramic, chemical or geological engineering, preferably with post graduate experience. Duties: to carry out laboratory and pilot scale experimental work, field exploration and economic surveys dealing with the non-metallic or industrial minerals of the province. File No. 4604-V.

METALLURGIST REQUIRED with some experience in the heat treating of stainless steel, should be interested in development work and have sales ability. Three months training period. File No. 4606-V.

MECHANICAL AND CIVIL engineer required by oil company located in Montreal, for plant refinery work and structural design. File No. 4607-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEER recent graduate, required by water treatment company for sales and service. Location Eastern Canada. Applicants must be free to travel. File No. 4550-V.

CHEMICAL ENGINEERING GRADUATES required by power and paper company located in Toronto. Applicants should have up to 5 years experience and be interested in research. File No. 4579-V.

CHEMICAL ENGINEER WITH experience in chemical plants, capable of designing process services, plant layouts, and supervising erection and installation of process equipment. File No. 4589-V.

CHEMICAL ENGINEER required by a company in Montreal for the industrial division which embraces the brewing, paper and oil industries. Applicant must have sales ability and be able to meet company officials. When applying please enclose recent photo. File No. 4590-V.

CIVIL

TWO CIVIL ENGINEERS for structural design by large organization in Ontario. Graduates should have minimum of three years experience. Applicants should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

CIVIL ENGINEER, for permanent position with experience in the design and construction of sewers and other municipal works. Salary range $400.00 to $480.00 per month, plus cost of living bonus of approximately $30.00 per month. Apply giving full particulars of education and experience. File No. 4554-V.

INSPECTIONS ENGINEER required by City in Western Canada to administer the Inspections Department and to coordinate varied civic inspections for public safety programs and to supervise subordinate technicians and inspectors engaged in construction and trade inspections and related tasks. University graduates in Civil Engineering, supplemented by extensive related experience in building construction engineering. Preference will be given to applicants of mature years who have had municipal engineering positions of an administrative nature. File No. 4563-V.

PROJECTS ENGINEER required by City in Western Canada to work under general administrative direction to supervise design and construction of varied municipal works and to interpret plans and specifications to employees and contractors; to make technical studies and maintain related cost and other records. University graduation in civil engineering, supplemented by some related experience in design and in projects supervising. File No. 4563-V.

ASSISTANT CHIEF DRAUGHTSMAN structural steel industry Niagara District. All replies confidential. File No. 4585-V.

CIVIL ENGINEER WITH drawing office experience, for layout, design, and development work. To prepare plans and estimates for small industrial buildings in timber, steelwork, plain and re-inforced concrete, roads and drainage. Should possess several years practical experience in building construction work carried out by contract and direct labour. File No. 4589-V.

SENIOR DRAUGHTSMAN for structural design in timber, steelwork, plain and re-inforced concrete for small industrial buildings. File No. 4589-V.

GRADUATE CIVIL ENGINEER with from two to five years experience in hydro-electric work or water resources study. This work would be in connection with the large power project in the Yukon Territory and Northern British Columbia. File No. 4591-V.

ELECTRICAL

ELECTRICAL ENGINEER, experience necessary, capable of laying out power stations and all electrical work for the construction of a pulp mill at Saint John, N.B. Permanent employment to qualified person. Salary is open depending upon experience and qualifications. File No. 4548-V.

ELECTRICAL ENGINEER for electrical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience and should state complete particulars of experience and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

RECENT ELECTRICAL engineering graduate required by Montreal firm for sales and engineering work in Montreal and district. Good opportunity for advancement. File No. 4557-V.

ELECTRICAL ENGINEER required by city in Western Canada to perform a variety of technical tasks in surveying system facilities, developing standards of electrical utility distribution, preparing reports concerning wholesale power supply to consumers, maintaining technical records, assisting in layout and design and related engineering tasks as assigned. University graduate in Electrical Engineering, supplemented by some related experience, preferably in an electrical distributing system. File No. 4563-V.

ELECTRICAL SALES ENGINEER graduate with 1 or 2 years field experience, good appearance and high sales ability by the leading manufacturing company in their line. Duties consist of calling on architects and engineers and assisting in preparing specifications and technical data in connection with low tension signaling equipment. Experience in dealing with electrical contractors will be helpful. Territory to be served is Montreal, Province of Quebec and the Maritimes after a short specialized training program at our plant. This is a salaried position with an excellent future also participation in full group sick and accident insurance and pension plans. Applicants to give full details including age, marital status and experience first letter. Personal interview will be given selected applicants. File No. 4569-V.

LIGHTING SALES ENGINEER required by leading manufacturer of lighting and switchgear. Actual sales experience in commercial and industrial lighting in Ontario, contacts with architects, consulting engineers and contractors would be an asset. Unusual opportunity with better than average earnings to right man. Good salary and commission. New car supplied plus car allowance and expenses. File No. 4577-V.

MECHANICAL

TWO OR THREE 1953 graduates, preferably mechanical required by large size industry in Ontario. File No. 4551-V.

TWO MECHANICAL ENGINEERS required for mechanical layout and design by large organization in Ontario. Graduates should have a minimum of three years experience. Applicants should state complete particulars and education in their first letter. Salary will be commensurate with qualifications. File No. 4552-V.

RESEARCH MINDED YOUNG textile company in Granby, Quebec, wishes to add a mechanical engineer to its staff. Attractive opportunity for right man interested in production and development work. Recent graduate with some working experience preferred, but exact nature of work not important. All communications will be treated strictly confidential and interviews will be arranged with applicants having suitable qualifications. Address reply to File No. 4562-V and please include telephone number.

MECHANICAL ENGINEER for Montreal Brewery, recent graduate with practical leanings for on-the-floor training and imminent supervision of installation and maintenance of bottling, pasteurising and conveyor equipment. Administrative and production control future. File No. 4568-V.

SALES ENGINEER preferably mechanical interested in the sale of air handling equipment such as fans, heating coils, air conditioning units, etc. Present location Toronto. File No. 4572-V.

MECHANICAL ENGINEER university graduate with two or three years experience in mechanical or metallurgical fields and above average literary ability. Permanent employment in Ottawa with well-known industrial association. Pension plan. File No. 4578-V.

THE SERVICES OF A design engineer mechanical preferred are required by large organization in Montreal Canada. Must be thoroughly familiar with portable and permanent crushing plants, asphalt plants, ready mix concrete plants and all types of road building equipment with eight to ten years experience in this field and with engineering degree or equivalent. Permanent position if applicant is qualified. Please give age, experience and references and state salary expected. All replies will be treated in strictest confidence. File No. 4586-V.

MECHANICAL ENGINEER with two to three years experience in design of air conditioning and heating required by Montreal Contractor and manufacturer. State age, training, experience and salary expected. File No. 4587-V.

MECHANICAL ENGINEER with industrial experience in the design, layout, and installation of equipment for heating, hot water, ventilation, factory mains comprising compressed air, steam and water, and general mechanical equipment. File No. 4589-V.

MECHANICAL DRAUGHTSMAN for preparation of plant layouts, equipment and installation drawings. File No. 4589-V.

MECHANICAL ENGINEER for the mechanical engineer's division of the Chief Architect's Branch of the Department of Public Works at Ottawa, Ontario. Duties: to take charge of the mechanical engineering section of the chief architect's Branch of the department of Public Works and will be responsible for the design of power plants, heating systems, ventilation systems, plumbing installations, air conditioning systems, sprinkler systems, refrigeration and for the installation of such equipment in public bldgs, laboratories and hospitals. The desirable qualifications include university graduate from a university of recognized standing, member of the Engineering Inst. of Canada or

SALES ENGINEER

Mine Hoists

Required by Canadian manufacturer of mine hoist machinery. Some experience with mine hoist equipment desirable. Contact experience with Canadian mines essential. This position will lead directly to the management of the mine hoist division for the right man. File No. 4609-V.

The City of Moncton, N.B.

Requires a

Municipal Engineer

DUTIES:

Subject to the approval and direction of the City Council, to perform the duties devolving upon the City Engineer for The City of Moncton, including the City's Water Department.

QUALIFICATIONS:

University graduation in Civil Engineering, supplemented by extensive related experience in all municipal services, including water works and services.

SALARY:

Commensurate with ability and responsibilities.

Apply in writing to
The City of Moncton,
P.O. Box 56, Moncton, N.B.

in a Provincial Assoc. of Prof. Engineers. Applications received until September 1, 1953. Salary up to $7,200.00. File No. 4593-V.

MISCELLANEOUS

SALES ENGINEER required for transmission equipment. Man with good technical qualifications and with high voltage transmission line design and operating experience required to advise on the use and sell insulators and transmission line equipment to power supply companies. Well known firm located in Toronto. File No. 4545-V.

THREE DRAUGHTSMEN, required by automotive industry located in Toronto area. Applicants must be capable of making detailed drawings or sketches from designs made by either a mechanical or an electrical engineer, also required to initiate sketches or drawings of miscellaneous minor equipment in connection with plant maintenance. File No. 4547-V.

SALES ENGINEER 22-30 years of age. Woodworking, box making and pulp and paper making machinery and supplies. Location eventually Western Canada. File No. 4556-V.

SALES ENGINEER or manufacturers agents required to sell American automatic boilers, (package type) already in operation from coast to coast in Canada, as agents representatives for Quebec City and surroundings, further for Toronto, London, Hamilton, Windsor, North Bay, Abitibi District, etc. Mechanical or electrical engineers with experience in the combustion and heating line would be an asset. File No. 4558-V.

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources $273.-$348. per month, a variable cost of living bonus presently $6.40 is paid in addition to above stated basic salary. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metalic or industrial minerals of the province. Good pension plan and conditions of employment. File No. 4564-V.

METALLURGICAL CHEMIST required. A graduate with 2 years experience for analysis of metals and slugs required for a firm located in Guelph. Good prospects for advancement. File No. 4567-V.

METALLURGIST REQUIRED with a background in foundry practice for large organization with headquarters in Montreal. Applicant should be in the age range of 22 to 35 years. File No. 4571-V.

CITY IN ONTARIO invites applications for the position of city engineer. The applicant must be a registered professional engineer of Ontario, and shall state age and education, and professional experience especially in municipal work. File No. 4573-V.

REQUIRE QUALIFIED engineer with good all round experience in general machinery and machine construction to solicit main and sub-contract work for large new machine plant. Able to discuss at top management level throughout Canada. Salary according to qualifications. Writing first instance giving fullest details to File No. 4575-V, all applications treated in strictest confidence.

CHIEF ENGINEER required in West Toronto. The man we seek is now a chief engineer or an assistant ready to step into this key position. Through a promotion in our organization we can offer this highly desirable position to a man with an E.E. degree, conversant with television; home and auto, radio circuits. Should have strong experience in successfully administering a small flexible engineering group. Excellent opportunity for right man to take a big part in a fast growing aggressive organization and earn an excellent salary. Free medical services and company profit sharing plan. Please send complete resume to file No. 4576-V.

PLANNING ENGINEER required by rapidly growing municipality in Ontario, to act as chief physical planner and manager of industrial commission. Applicant should have town planning experience and be able to co-ordinate all planning and development activities. Salary according to qualifications. File No. 4580-V.

BUILDING COMMISSIONER and zoning administrator required by rapidly growing municipality in Ontario to be in charge of the operation of the building and zoning by-laws. Applicant must be able to check construction and have administrative experience of some kind. File No. 4580-V.

REGISTERED ENGINEER with municipal experience in the operation and superintendence of sewer systems. Rapidly growing municipality in Ontario. Estimated population of 100,000 within seven years. Age thirties or early forties. Salary according to experience. File No. 4580-V.

TOWN IN ALBERTA IS seeking applicants for the position of Town Engineer. Duties include supervision of the public works program, direction of the town crews, administration of building inspection and zoning control, and development detail of the general plan for the town as circumstances require. Special consideration will be given to applicants with executive training and to those with some experience or training in town planning. Population now 3,000 every prospect of growing into a small city within the near future. Salary depending upon qualifications. File No. 4581-V.

POSITION OPEN AS assistant to the plant superintendent. Duties in connection with the opcration and maintenance of a low head hydro plant consisting of 5 Francis type units with a total capacity of 167,000 K.W. Location about 125 miles from Rio de Janeiro in a healthy climate. Preferably single between 30 and 40 with at least 5 years experience in hydro plants. File No. 4583-V.

CHIEF SUPERINTENDING ENGINEER (7,000.00 - 8,500.00) for the post office department at Ottawa. Details and application forms at your nearest Civil Service Commission Office, National Employment Office or Post Office. File No. 4592-V.

Situations Wanted

ELECTRICAL ENGINEER 32 years of age, veteran, married, graduated in 1950 from McGill University. For the past 3 years worked on a large diversification of electrical equipment for a Power and paper company whose mills are undergoing rehabilitation and speed up programs. Experience in layout and design of lighting power distribution, motor control, industrial electronics etc.; estimating and preparing of specifications. Prefer position offering advancement and incentive to ambitious engineer. Will accept position anywhere in Canada or U.S.A. Available on short notice. I have also several years of practical experience as electronics technician and electrician. File No. 666-W.

ELECTRONICS ENGINEER, age 40, Queen's University 1944. Miscellaneous industrial experience, ten years teaching experience in radio, television and industrial electronics, at technical school and college levels, experience in organizing and directing small staff, bilingual, desires position with small progressive electronics firm with an eventual view toward management. File No. 2635-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., McGill, age 32, married, bilingual, 9 years diversified experience — structural and municipal engineering, field supervision, estimating, preparation of specifications, project administration; presently employed with consulting firm. Seeks further opportunity as project engineer or equivalent administrative position. Location immaterial. Minimum salary $7500. File No. 2817-W.

MECHANICAL ENGINEER, 1947 graduate with 6 years industrial experience in design, maintenance and some production. Single. Also has Arts Degree. Ready to become sales engineer with Montreal firm. File No. 3208-W.

MECHANICAL ENGINEER Jr. E.I.C., age 28, B.Eng. 1948. Desire position with advancement possibilities preference for pulp & paper industry. Experience: 2 summers with a pulp & paper industry, 2½ years as project engineer of a hydro power development. 2½ years with large production firm on liaison work. File No. 3358-W.

CIVIL ENGINEER M.SC., M.E.I.C., A.M.I.C.E., P.Eng. 42, with 17 years of varied experience (England, U.S.A., Canada) in: structural design (industrial and municipal buildings, power stations, oil refinery plants, hospitals, schools, harbour and river works, bridges, concrete cyllindrical shells and domes, prestressed concrete), sewerage, surveying, estimating. 3 years experience in supervision of const. Seeks responsible position. Also would be interested in partnership. File No. 3369-W.

MECHANICAL ENGINEER Jr. E.I.C., B.Eng. N.S.T.C., 1951, age 25, single. Experience includes 12 months sales and installation of equipment in propane gas and 6 months in building construction. Desire permanent position preferably in sales covering Maritime Provinces. File No. 3903-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

RESEARCH ENGINEER

required by

SASKATCHEWAN DEPARTMENT OF MINERAL RESOURCES

Salary dependent on qualifications

Excellent pension plan and conditions of employment.

Minimum requirements: Graduate in ceramic, chemical or geological engineering, preferably with post-graduate experience.

Duties: To carry out laboratory and pilot scale experimental work, field exploration and economic surveys dealing with the non-metallic or industrial minerals of the Province.

Write for application forms to the:

Public Service Commission,
328 Legislative Bldgs., Regina.

Public Health Engineer
REQUIRED BY
Saskatchewan Department of Public Health

Graduate civil engineer, preferably with graduate work in public health engineering and some public health engineering experience; to do field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewerage systems, steam pollutions, deficient drainage and other environmental factors.

For application forms and further information apply to: Public Service Commission, Legislative Bldg., Regina.

ELECTRICAL ENGINEER desires position with consulting firm or utility. Jr. E.I.C., B.Sc.E.E. University of Manitoba, 1949, Canadian citizen, age 26, married. Experience record: 1949-50 electrical designer-draughtsman with well known firm of consulting engineers in Los Angeles, Calif., on steam power plant, substation & transmission line projects. 1950-1952 on active duty in U.S. Army, assigned to guided missile centre as electrical engineer on related power and lighting projects. At present with former employer as electrical designer on substation, control house; transmission line project, but contemplate returning to Canada if suitable employment is found. References & further details on request. File No. 4030-W.

GRADUATED ELECTRICAL and mechanical engineer, Jr.E.I.C., Vienna technical university, 1½ years in Canada, fluent in English and French, seeks responsible position in design, project or plant engineering with consulting or contracting firm, oil, chemical, paper or related industry. 4 years experience as: draftsman, checker, designer, estimator, field engineer and project engineer in: heating, air conditioning, drying, thermo electric power stations; piping, steel, instrumentation, etc. File No. 3945-W.

ELECTRICAL ENGINEER 27 years of age, veteran, graduate of Manitoba 1950, completed Canadian Westinghouse Test Course. Desires job of technical aspect in Western Ontario or Western Canada. File No. 4021-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A.-Sc., age 35, married with children. Seeks position as Regional or District sales manager with progressive company in some branch of electrical industry. Extensive experience in sales and distribution of electrical hardware and associated products to public utilities in Province of Ontario. Experience included five years sales engineer, two years public utilities, two years own business, three years Army (Captain.) Excellent record and have available for examination recent report from well known firm management consultants. Presently located in Southern Ontario Available on one month's notice. File No. 4039-W.

CIVIL ENGINEER, B.A. (Honours in mathematics); B.Sc. (Civil Eng.) Has done post-graduate work at McGill University. Outstanding academic record; about one and a half years experience in irrigation dam design and bridge work; working on soil problems at present. Available from November 1st, 1953 anywhere in Canada. Best references. File No. 4108-W.

MECHANICAL ENGINEER Jr.E.I.C., age 31, bilingual, with some teaching experience at leading university and production experience in a nationally known sewing machine company etc., seeks position in a well established peace time mass production industry. (automotive, chemical, oil, etc.) Interested in working on development of new processes or machines or preferably an extensive period of training leading eventually to an executive opening. Services available May 15, or possibly before if employer offers an attractive long term future. File No. 4161-W.

ELECTRICAL ENGINEER, English, A.M.I.E.E., P.Eng., age 29, married, no children. 7 years' experience in switchgear manufacturing 4, years' experience in consultants on H.V. substations and steam power plants, 2 years' experience with large Canadian electrical manufacturer. Desires responsible position with consultant, manufacturer or utility. Available on short notice. File No. 4162-W.

COULD YOUR FIRM use a young civil engineer P.Eng., (Ont.), B.Sc. Queen's 1950 Jr.E.I.C., age 24, single. Desires to change from present job to something new. Will make up in enthusiasm what I lack in experience in your line of work. Type of work or location not governing. File No. 4203-W.

ELECTRICAL ENGINEER, P.Eng., M.E.-I.C., B.Eng. 1942, age 32, married, 3 children. Experience includes layout and supervision of all types of industrial electrical construction and installations, heat-treating, standards committeees, specification writing and presently on management of small manufacturing concern. Located in Ontario at present but desire opportunity in Western Canada, preferably Alberta. Available on reasonable notice. File No. 4205-W.

CIVIL ENGINEER, B.Sc. 1949 single, age 25, Jr.E.I.C., railway experience, consisting of location survey, construction, track work, design and supervision of frame and reinforced concrete structures, estimating and administration. Particularly interested in work in the north or foreign assignment. Available on short notice. File No. 4206-W.

MECHANICAL ENGINEER, graduated, over 20 years engineering experience in heating, plumbing, ventilating, air conditioning, refrigeration, waterwork and sewer installation, experience in process industries steam power plant, boilers, pumps, valves, seeks adequate occupation. Experience includes design, construction, maintenance and planning. File No. 4211-W.

CIVIL ENGINEERING GRADUATE (BSc., St. Andrews University Scotland) 1952, at present studying for honours, wishes post with structural engineering firm, preferably in West or Mid-West. Some experience of steelwork design and detailing, interested in reinforced concrete. (Age 25). File No. 4212-W.

ELECTRICAL ENGINEER Jr.E.I.C., P.-Eng., B.Sc. graduate of Alberta 1950, age 29, married, no children. Completed 2 years training course with internationally known electrical industry. Presently residing in Montreal — sales department for industrial apparatus. Interested in sales and construction industry. Previous experience city engineering department, Naval Petty Officer. File No. 4213-W.

MECHANICAL AND CHEMICAL ENGINEER, M.E.I.C., P.Eng. age 37 — hold degree in Mechanical engineering, chem. Eng. also 1st class stationery engineers papers. Considerable experience in Plant Maintenance Engineering and personnel administration. No particular location preferred and willing for out of Canada position. Interested in plant maintenance, installations, technical sales and engineering administration. Presently employed but looking for position where opportunities and advancement are available to one with initiative. File No. 4215-W.

CHEMICAL ENGINEER Jr. E.I.C., B.Eng. McGill 1947. Will obtain Ph.D. from Princeton in fall 1953. Age 28 single. Three years experience in production, tech service to production, and development work (economic feasibility studies). Interested in process design or development, tech. service to production, or production. Available fall or winter of this year. File No. 4216-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill 1951, age 28, single. Presently completing 2 year graduate student training course offered by large electrical industry. Desires position with opportunity to demonstrate ability, Preferred location Montreal or Toronto area. Available in June. File No. 4217-W.

CIVIL ENGINEER Jr.E.I.C., P.Eng. 2 years heavy construction field work and supervision desires work in Ontario or Western Canada. File No. 4218-W.

MANAGEMENT ENGINEER, age 38, family. Queen's 1936, B.Sc. Mechanical (honours) M.E.I.C., and volume sheet-metal industries. Thoroughly experienced all phases factory supervision, production and material control, industrial engineering, tool planning and manufacture, quality control, engineering design supervision and liaison, etc. Recent experience includes general management responsibilities in company organization, sales and contract administration, labor relations, and management control. Seeking position offering management career possibilities; Southern Ontario location preferred, but will consider others, including foreign. Available after May 1st. File No. 4219-W.

ENGINEERING PHYSICIST, Jr.E.I.C., B.Sc. 1942, M.Sc. 1946, P.Eng., age 30, married, with 7 years all round experience of physics applied to industry desires position with laboratory (electrical or other industry). Previous work includes super-sonics, electronics, magetic materials, high-voltage testing, radio-active materials. Would prefer small city, if possible up North. File No. 4229-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.-Eng. (Ont.) 1949 graduate, age 37, married, no children, R.C.A.F. veteran (operational air navigator) 5 years teaching experience. 4 years varied experience in rural distribution including administration, consumer service, employee training, rate analysis, pole line construction and maintenance, tower line maintenance and some metering. Two summers surveying. Desires job with a definite opportunity for advancement and greater responsibility. Location of secondary importance if job suitable. Available on reasonable notice. File No. 4230-W.

FACTORY MANAGER available M.E.I.C., P.Eng., graduate civil engineering 1935, 13 years experience as factory manager in rubber and plastics molding plant employing over 600 persons. Experience covers production, plant layout and expansion, engineering and maintenance, standards (time-study, estimating, and specifications) labor negotiations and personnel etc. References will show career of unqualified success to date — with necessary knowledge, experience, ability, and personal qualities required in factory management. Age 39, married with family, and in good health. File No. 4231-W.

CHEMICAL ENGINEER, M.A.Sc. (U.B.C., 1951) Jr.E.I.C., age 25, single, with 1½ years experience desires a position in an industry offering opportunity for advancement. Presently employed and available on reasonable notice. Location in Ontario or Western Canada preferred. File No. 4232-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 1951 graduate, age 28, married, without children. Desires position in electrical design with a power company or consulting engineers in Montreal. Experience includes one year with a large firm of contractors in England on design of substations and transmission lines. At present with a large manufacturer of electronic equipment. Available on one month's notice to present employer. File No. 4233-W.

SANITARY ENGINEER, P.Eng., M.E.I.C., age 35, married, desires change in employment. Qualifications include a B.A.Sc. in Civil engineering and a MSc.E. in Sanitary Engineering. Experience includes two years in hydraulics and hydrometrics and six years in public health and sanitary engineering. Desire job involving the planning, design or administration of water supply systems, sewage disposal systems or industrial waste treatment facilities. File No. 4234-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.-Eng. (McGill 1951). Experience: two year training course with Canadian Westinghouse Company including courses toward a Masters Degree. Desires position with consulting firm in Montreal, in power or industrial electronics field. Presently employed in Ontario. Available on approximately one month's notice. Age 25, married. File No. 4235-W.

ELECTRICAL ENGINEER Jr.E.I.C., B.Sc., 1949, aged 28, R.C.A.F. veteran, currently engaged in automatic controls and rolling mill electrics with a large firm in England, desires to return to Canada end of September 1953. Experience since graduation includes substation operation, development engineering, demonstrating at a Canadian uni-

versity, lecturing at a British technical college, industrial control engineering, rolling mill engineering, commercial experience in estimating and tendering. File No. 4237-W.

CIVIL ENGINEER Jr.E.I.C., P.Eng., B.Sc., Queen's 1948, veteran, aged 31, married, with five years experience on design, layouts and surveys related to steel and reinforced concrete structures, desires position as design engineer with construction company or consulting firm. Available on 30 days notice to present employer. Will locate anywhere in Canada if position suitable. File No. 4238-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A.Sc., (Electrical, 1951) U.B.C., P.Eng., Ont., graduate training course with large electrical manufacturer, also design and administrative experience in Canada and overseas, desirous of improving present position with wider scope of responsibility and opportunities of growth, preferably in the administrative field. File No. 4239-V.

APPLICATION ENGINEER returning to Canada from completed foreign assignment. Six years experience in the design, construction and placing in operation of air conditioning and refrigeration plants. Desires responsible position either in Canada or foreign. Willing to travel. B.A.Sc. and M.Sc. degrees. Registered professional engineer in Ontario. Working knowledge of Spanish. References and background resume upon request. File No. 4240-W.

CIVIL ENGINEER member E.I.C., A.C.I. graduate Univ. of Pennsylvania U.S.A., bilingual married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice to present employer. File No. 4242-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc. technological university of Delft, Netherlands with 20 years executive experience as consultant-sales engineer on continent. Design experience in Canada, specialist in Steam, air, instrument ration and internal transportation. Perfect English and fluent French seeks position. File No. 4243-W.

1943 GRADUATE IN CIVIL Engineering University Berlin, age 34, married, 2 children. Specialist in hydraulics, 7 years experience in design of navigable waterway, dams locks and hydro power stations, hydraulic research and hydraulic laboratory work, and also river regulations and water supply. File No. 4244-W.

MECHANICAL ENGINEER, M.E.I.C., 31, married, family. Desires position in Ontario. Higher National Certificate (Gt. Britain) and endorsement in industrial administration, 10 years experience in medium and heavy special purpose machine design. At present employed in Montreal as mechanical engineer on machine design. File No. 4245-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. Ont. B.Sc. Sask. 1945, age 29, single. Last 5 years engaged in project design for two large petro-chemical plants. Plant engineering studies to improve and replace equipment for 3 years. Deslre one of the following supervisory positions in a process industry, plant design and construction, production or works engineering in that order. Greater than average responsibility of a small industry or plant desirable. Available after middle of August. Location not a prime consideration. File No. 4248-W.

SENIOR CHEMIST, graduated in chemical engineering. Have held leading positions in Hungary, France and Brazil. Two years in Canada in Pulp and Paper Research Institute. Broad scientific knowledge and experience. Desires position in paper or related industry, mineral oil laboratories or rubber tire manufacturer. Languauges spoken, English, French and German. Excellent references. Single, will accept work anywhere. Available immediately. File No. 4249-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age, 30, 5 years varied construction experience including small homes, apartments, hospitals, heating plants, airforce and industrial bldgs., where work entailed project supervision, estimating contracts, complete liaison with owners, architects, engineers and sub-contractors. Fully experienced in office routine, accounting, and purchasing, and knowledge of design of timber, concrete and steel construction. Desires position where experience and administrative ability may be best utilized. File No. 4254-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.E. (mechanical) Nova Scotia Technical College 1949. Several years experience in machine shop practice, some experience in the design and installation of mechanical drying systems, three summers experience on survey parties, desires an engineering position, not necessarily in the mechanical field, in or in the vicinity of St. Johns' Newfoundland. File No. 4255-W.

ELECTRICAL ENGINEER, P.Eng. (Ont.) B.A.Sc. U.T. 1951 age 28, married. Have completed training course with large electrical manufacturer. Additional experience on power and lighting layouts for large buildings. Prefer position in plant engineering or inspection work in vicinity of Toronto. File No. 4256-W.

ENGINEERING PHYSICIST, Ph.D., British married with about 20 years experience in industry and government service desires responsible position in Canada. Special experience: vibrations, noise, wear, metrology and design of research apparatus for laboratory, test bed and field use, particular on steam and gas turbines and gears. File No. 4257-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. University of Alberta, 1949 test course graduate and two years field experience on power apparatus. Desires position in Western Canada. Age 30, married with one child. File No. 4263-W.

CIVIL ENGINEER, B.A. degree in engineering, Cambridge, England, 1945, A.M.-I.C.E., M.E.I.C., single. Experience in airfield work in Malaya, Hydro-electric and other works in the United Kingdom. Since 1948 and until leaving for Canada in 1952 employed by a well known firm of consulting civil engineers in London. Experience in reinforced concrete design, hydraulic design and investigations, site experience on tunnels, dams and associated works. Presently employed as resident engineer on the supervision of defence contracts in the Province of Alberta and comprising hangars, other buildings, water supply project and services. Would like work on engineering supervision or administrative staff or on investigations. and preferably in the Province of British Columbia or Ontario or Eastern Canada. File No. 4264-V.

INDUSTRIAL MECHANICAL ENGINEER, Jr.E.I.C. McGill graduate single, age 31, R.C.A.F. veteran (4 years as pilot navigation instructor and pilot, also liaison and administrative work etc.) Experience includes management and operating control systems, plant layout. material handling systems, tool design and control, liaison and supervision of building construction and small machinery installation. Has some experiece in refrigeration, building and machinery maintenance, and manufacture, acting as administrative and technical assistant to top executives in the brewing and aircraft industries. Has ability in the supervision and handling of people. Interested in position where a willing, intelligent young engineer can enthusiastically use some of the above outlined background, experience and talent. Available on short notice anywhere in Canada. File No. 4267-W.

PARTNER WANTED TO form construction company with McGill 1944 graduate M.E.I.C., who has had previous experience with own company. Applicant should have available capital and experience. File 4268-W.

CIVIL ENGINEER Jr.E.I.C., available. Experience includes one year in Canada. Interested in field work on construction or design with highway department. railway or construction firm. File No. 4270-W.

ELECTRICAL ENGINEER, age 31 years; formerly electrical superintendent of large mining and milling property, at present distribution superintendent in city of 300,000; experience in hydro, steam, and diesel plant operation and maintenance, electrical construction of lines and substations, electrical shop operation. Desires similar work of equal or great responsibility in Canada. File No. 4271-W.

CHEMICAL ENGINEER, 43, graduated at the Technical University in Dantzig, Europe, in 1953, with practice in analitycal and research work in Poland and several years of activity in open-hearth steel plants as production engineer and assistant manager in Poland and in South America, seeks an adequate position preferably in Quebec or Ontario. File No. 4272-W.

CIVIL ENGINEER Jr.E.I.C., McGill 1951. married, one child. Two years experience in steel, concrete, and timber design, architectural planning on office and industrial buildings. One year on projects involving piping layouts for the petroleum industry. Seeks further opportunity for advancement and diversified work. Available on reasonable notice to present employer. File No. 4273-W.

METALLURGIST EMIGRATING October 1953 seeks appointment. M.Sc., Ph.D. (Manchester) with 14 years of experience in metallurgical fields. Experience includes five years conducting investigations in one of the largest iron and steel plant laboratories. Nine years in planning administration and conductance of research in a newly built metallurgical laboratory as the official in charge. Desires position in industry or research organization on development work or in administration-cum-technical capacity. File No. 4274-W.

News of the Branches

Activities of the Forty-four Branches of the Institute and abstracts of papers presented at their meetings

Central British Columbia

H. L. Topham, Jr.E.I.C.,
Secretary-Treasurer

M. L. Zirul, M.E.I.C.,
Acting Secretary

Meeting with B.C. Engineering Society

The regular joint dinner meeting of the two societies was held at the Club House of the Kamloops Golf Club on May 15, 1953. Arrangements for this meeting were the responsibility of the E.I.C.

Approximately 36 were present, 18 of whom were E.I.C. members.

Dinner was served at 7:15 p.m., after which the regular business meetings of the two branches were transacted, R. L. Bigg in the chair for the E.I.C. Central B.C. Branch.

Minutes of last general meeting, held at Vernon, March 13, 1953, were read and adopted.

Chairman R. L. Bigg read the report of Col. L. F. Grant on his meetings with the executive of the Central B.C. Branch at Penticton and at Kamloops, April 10 last and also the account of his meeting at Whitehorse, where a new Branch was inaugurated.

A general discussion regarding subsequent meetings ensued. The next general dinner meeting, which will be an Engineering Society responsibility, will be held at Penticton July 10 and Andy Stewart, divisional engineer, C.P.R., Revelstoke, has promised to present his talk, which was postponed from the March meeting, at that date. The following meeting, "Ladies Night", will be August 14 at Kelowna. September 18 is proposed as the date of the Penticton meeting which will be addressed by Dr. Harry Warren of the University of B.C. An extra effort will be made to bring the members out from the mining areas of Hedley and Princeton.

The regular business session of the Engineering Society was then conducted, S. D. H. Pope assuming the chair.

Following a brief intermission, the meeting was addressed by Dr. Lyle G. Trorey, leading consultant in aerial photography, who gave a most interesting account of the theory and practice of mapping by aerial photography. Mr. Trorey was brought to the meeting and introduced by N. E. McConnell, executive engineer of Photographic Surveys (Western) Limited, Vancouver, B.C. Interesting slides and exhibits were used to illustrate the talk.

Both Mr. Trorey and Mr. McConnell had many friends among the gathering, with whom they were able to renew acquaintanceship.

Cornwall

L. H. Snelgrove, Jr.E.I.C.,
Secretary-Treasurer

J. E. Pescod, Jr.E.I.C.,
Branch News Editor

J. Lefort Addresses May Meeting

The May General Meeting of Cornwall Branch of the Engineering Institute of Canada was held on May 12 at Courtaulds Assembly Room.

J. Lefort spoke on "Salary Administration" with particular reference to job evaluation and merit rating. Mr. Lefort was a 1936 engineering graduate of McGill University and took his law degree in 1939. Since 1941 he has been actively engaged in industrial engineering and is presently associated with J. E. Dion, consulting industrial engineers of Montreal.

Mr. Lefort outlined the system which has been developed over the last few years by which the relative value of a job as among several departments of one industry or company, and hence the salary range which that job should pay. The overall purpose of job evaluation is the equitable distribution of the funds available to renumerate employees.

The speaker was introduced by Howard Campbell and thanked by John Pescod. John Hawkes was chairman of the meeting.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

Annual Meeting

The annual dinner meeting of the Kingston Branch was held at the LaSalle Hotel on Tuesday, May 26. Dr. R. Beeching, a director of Imperial Chemical Industries of Canada, Ltd., spoke on "The New Terylene Plant at Millhaven". This was Ladies' Night, and was well attended by about 250 members and guests.

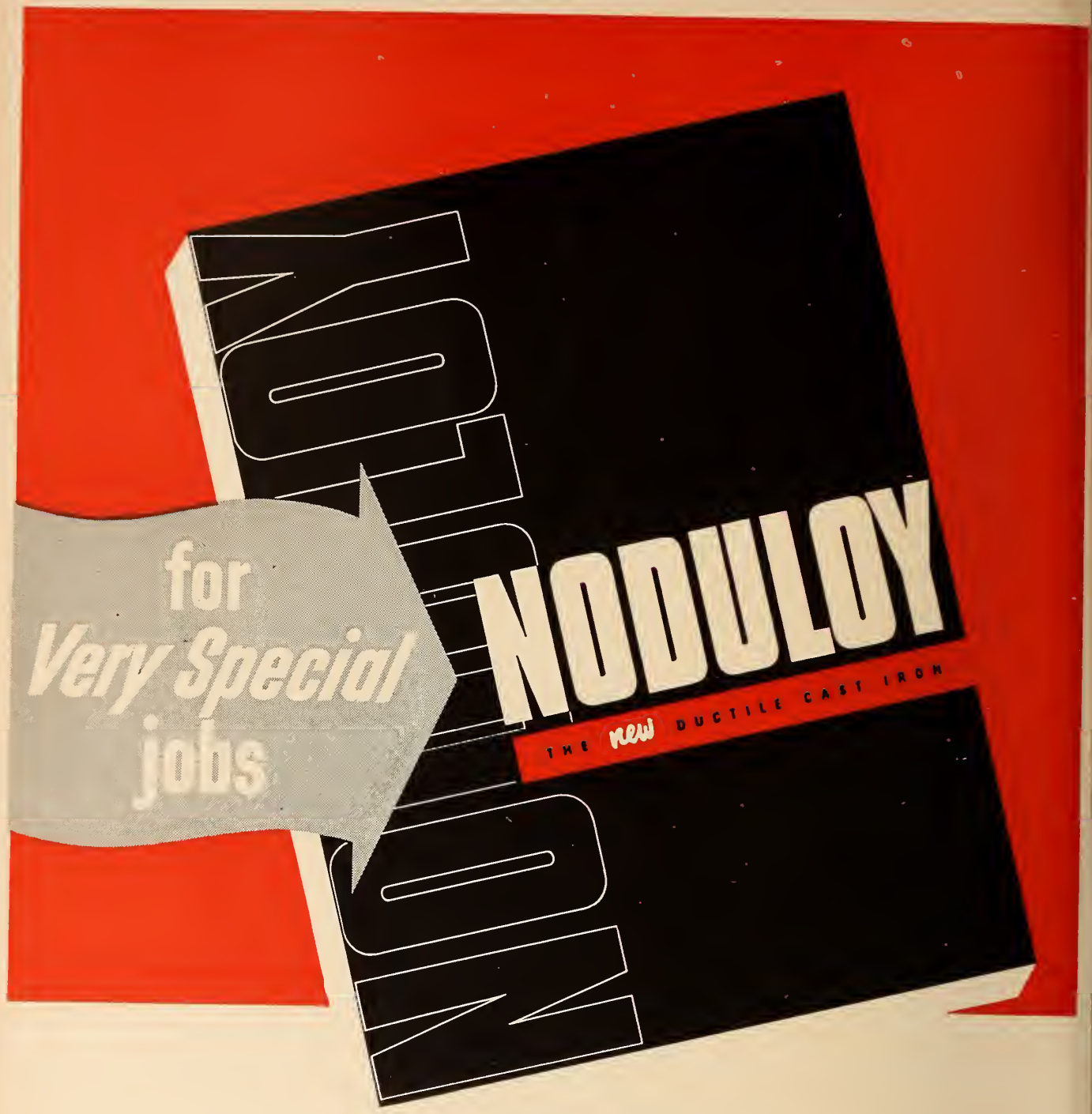
In a talk about what the company proposes to do and how it proposes to do it, Dr. Beeching said the plant is expected to be completed by the middle of 1955 and when in production will provide employment for some 1,000 persons. Process labour and engineering maintenance labour will total about 800 persons, he said.

Hoping that the majority can be recruited in the Kingston area, Dr. Beeching said it was not the company's intention to develop a housing project as part of the construction program. "It is expected that staff coming to Kingston from other parts of Canada will find or provide their own houses in the Kingston, Napanee, Bath and Millhaven area," he added.

With a plant occupying about 80 acres, the manufacture of "Terylene" is a clean one, he said. The process will not pollute the atmosphere or produce troublesome liquid effluent.

Cooling water and process water will be taken from a cold pool in the lake, the presence of this pool being one of the reasons for choosing the Millhaven site. However, he said, the water will be purified before being returned to the lake.

There will be buildings of pleasant appearance. The largest structure, where fibre will be spun and processed, will occupy a ground area of about 170,000 square feet. In addition there will be plants for polymer production, together



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ith workshops, stores and office buildngs, as well as buildings for various ervice plants.

Generally, the speaker said, the buildngs will be steel framed and clad with rick. A total of 5,000 tons of structural teel will be required and the whole ssembly will be sited and designed to resent a pleasing appearance from the oad all along the lakeshore. The elecricity load is expected to be between ,000 and 7,000 kilowatts.

Design of the plant, based on a imilar plant which is being built at Vilton on the northeast coast of Engand, has been entrusted to the H. K. erguson Company of New York.

A United States firm was used for this urpose, Dr. Beeching said, "because we new of no Canadian company which ould have provided, ready made, a nified engineering team large enough to ndertake this design and engineering anagement function straight away.

"I am sure such a team could be uilt up in Canada but when I tell you hat this project was approved in Britain n January, that a site was selected in ebruary and purchased at the end of Iarch, and that work on the site is ust starting, a subsidiary company havng been formed in the meantime, you vill realize that there was little time o spare."

Dr. Beeching declared that a "very ubstantial" proportion of the work will e placed with Canadian construction nd supply companies," adding: "I hope oo that we shall receive. help from companies here in the Kingston area both during the construction period and when the plant is operating."

"Terylene," trade name for a new synthetic fibre of British origin and being produced in the U.S. under the name of "Dacron," has outstanding properties, the speaker pointed out.

It will be produced in two forms—as a continuous filament yarn of silky appearance and as a staple fibre from which yarn can be spun in the same way as wool or cotton fibres are spun.

Annual elections of the Branch were held and the following executive accepted the leadership of the Branch program for the 1953-54 season: chairman, S. H. Rochester; vice-chairman, C. H. R. Campling; secretary-treasurer, H. D. Forbes; executive, A. V. Corlett, A. E. Hyde, C. W. Jones, S. F. Pauley, W. A. Trotter; Ontario Division representative, G. T. L. Andrews; councillor, D. L. Rigsby; and immediate past-chairman, J. S. Campbell.

Montreal

R. J. HARVEY, M.E.I.C.,
Secretary-Treasurer

S. T. RUDKIN, M.E.I.C.,
Publicity Vice-Chairman

Special Meetings in June

One of the major endeavours of the Montreal Branch is the encouragement of closer co-operation between the various phases of the engineering profession, and with other allied professions. To this end, two special meetings were held in June, after the termination of the regular session of branch activities.

W. Sefton Lectures

On Thursday, June 4, a meeting jointly organized by the Montreal Branch of the E.I.C., and the Province of Quebec Association of Architects, was attended by one hundred and eighty members and guests of the two organizations, who had come to hear a paper on "Concrete Shell Roofs" delivered by W. Sefton, senior engineer with C. D. Howe Limited. G. N. Martin, chairman of the Montreal Branch, was meeting chairman.

Mr. Sefton, an associate member of the Institute of Civil Engineers, of the American Society of Civil Engineers, and of the Institution of Structural Engineers, as well as a member of the E.I.C., is especially well qualified to speak on his subject. His extensive experience, gained mainly in England, includes being a senior reinforced concrete designer with Frederick Snow and Partners, of London; being the resident on the construction of several large projects including a fifty million dollar atomic energy station, and a considerable amount of work in the design of shells.

The paper on "Concrete Shell Roofs", illustrated by a number of well chosen slides, was of a general rather than highly technical nature. The speaker pointed out that twenty years ago very few technical papers, and those only

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Shawinigan Falls entertains a distinguished visitor — left to right: His Worship the Mayor, Dr. Lillian M. Gilbreth, A. M. Hubley, chairman of the branch and Mrs. Hubley, Dr. E. O. Keay, Robert Dorion and Charles Yoskida, secretary-treasurer of the branch.

by European designers, had dealt with the subject. Now, especially in England, scores of technical papers are being written, and hundreds of structures involving the use of shell roof construction, sometimes concurrently, sometimes competitively with prestressed concrete, are being built. The acute shortage of structural steel during and after the war probably provided a great impetus to this type of design on the continent and in England, and by the same token, the relative ease with which steel is obtainable in North America probably accounts for the fact that our engineers and architects have to date built very few structures of this type. The Quebec Arena is probably much better known to most of our engineers, and certainly to most of our laymen, for its relationship with one Jean Marc Beliveau of hockey fame, than for the fact that it is one of the relatively few examples of shell roof construction in the Dominion of Canada.

Some of the advantages claimed for the shell type of roof construction by Mr. Sefton are that (1) large areas can be covered with the use of relatively few supports; (2) it is architecturally clean

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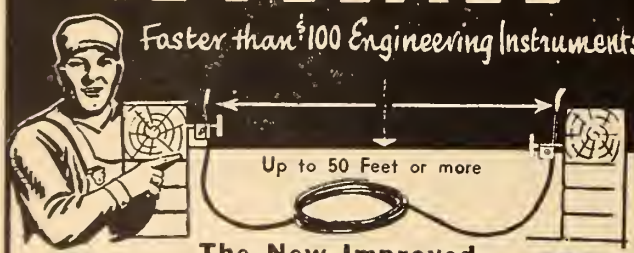

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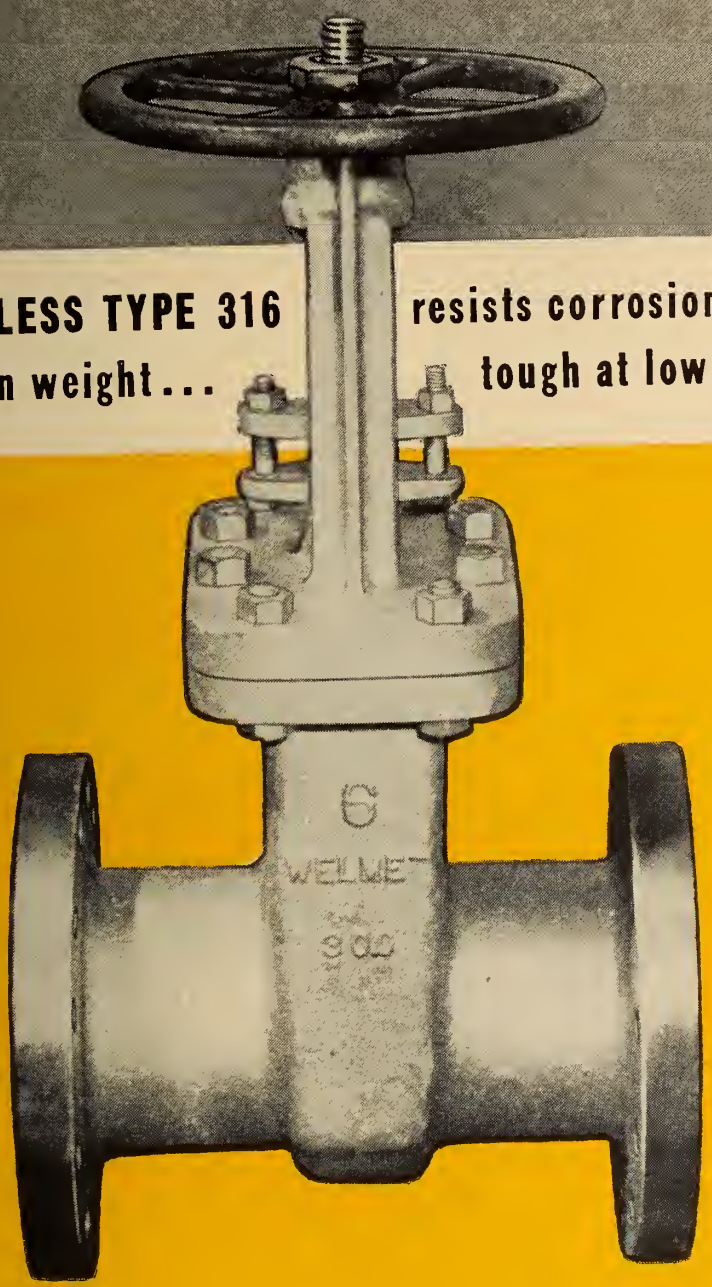

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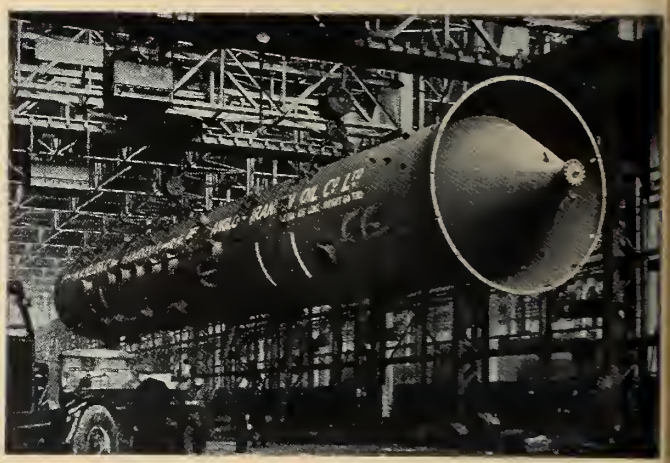

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nd good looking; (3) it lends itself dmirably to good lighting; (4) it has ood acoustical properties; (5) it is re- atively fireproof and has stood up re- arkably well under bombing; (6) its ost compares favourably with any other ype of roof construction, and should ecrease with development of more fficient erection methods.

A lively discussion period followed the ompletion of the paper, after which Ir. Sefton was thanked by K. R. Blatherwick of the P.Q.A.A. Professor Bland of the McGill School of Architecture added his word of thanks for the rrangement of the joint meeting, for vhich R. H. Quintal, E.I.C., ad K. R. Blatherwick, P.Q.A.A., were responsible. ight refreshments were enjoyed by the arge gathering at the close of the meeting.

Dr. A. G. Christie Discusses Power

The second meeting of a joint nature was held on Tuesday, June 9, when Dr. A. G. Christie, research professor of mechanical engineering at famous Johns Hopkins University, Baltimore, Maryland, delivered a paper on "Future Sources of Power" to some hundred E.I.C. and A.S.M.E. members. Chairman of the International A.S.M.E.-E.I.C Council, which was holding a meeting in Montreal, Dr. Christie kindly consented to address the Montreal Branch of the E.I.C. at an evening session, to which a special invitation had been extended A.S.M.E. members. R. E. Heartz president of the Shawinigan Engineering Company Limited, was meeting chairman. The address was of such interest that the meeting approved a motion to the effect that the paper be submitted to the Publication Committee of the *E.I.C. Journal* for their consideration. Consequently, no attempt will be made here to summarize Dr. Christie's remarks. G. N. Martin, Branch chairman, was called upon to thank the speaker, after which light refreshments were served. E. S. Yuill was responsible for meeting arrangements.

Saint John

J. A. B. Brenan, Jr.E.I.C.,
Secretary-Treasurer

H. S. McCleave, M.E.I.C.,
Branch News Editor

April and May Program

The Saint John Branch of the Engineering Institute has been very active of late as a review of their activities shows.

During the month of April the regular meeting was held at the Admiral Beatty Hotel with A. G. Watt, chairman, presiding. At this meeting Harold Isaacs of the Perkins Electric Company spoke on "Communications" stressing how the need for faster communications had led to the development of carrier systems and "Ultra Fax".

A series of five lectures were held during the months of May and June as part of a Professional Development Program.

The first lecture on April 12 was given by Don Armstrong of the G. E. Leslie Co., on "The Working of the Stock Exchange". This proved to be a highly interesting and profitable lecture, as the question and answer period proved.

The following week, Dr. Kelsey Jones, conductor of the Saint John's Symphony Orchestra, spoke on "The Symphony—It's Music and Musicians" and illustrated by means of recordings the growth

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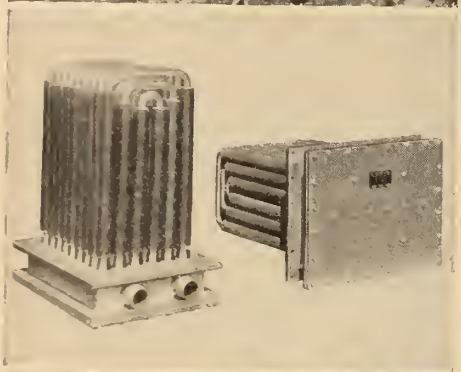
Unifin* eliminates all common finned tube difficulties

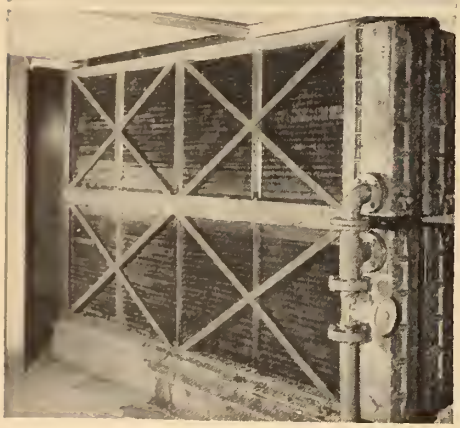
IT IS UNAFFECTED BY VIBRATION

Shown here are two Canadian Ingersoll-Rand 125 CFM All-Canadian air compressors fitted with Unifin intercoolers fabricated from copperline tubing, an integral aluminum finned tube with a seamless copper liner. These compressors are supplying air to pneumatic hammers at several thousand feet above sea level on the Aluminum Company of Canada's Kitimat-Kemano project.



IT WITHSTANDS INTENSE HEAT

This Unifin water cooling coil is used by Dominion Foundries & Steel Ltd., Hamilton, Ont., for cooling manufactured gas prior to its entry into a transmission line. The temperature of the gas before cooling is approximately 1000° F. Unifin is the only finned tube capable of withstanding this temperature.

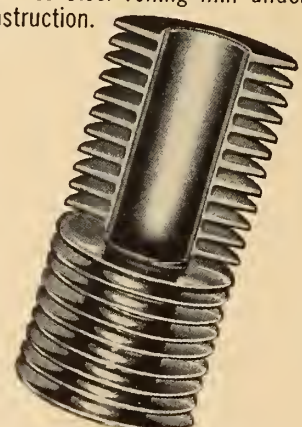


IT RESISTS THE EFFECTS OF AGE

These Unifin Removable Cover Plate Water Cooling Coils were installed more than 12 years ago at Atlas Steels Ltd., Welland Ont. Their function is to cool the motor generator sets supplying power to the main rolling mills. These coils have given completely satisfactory service over the years and Unifin is presently supplying a similar set of cooling coils for the new stainless steel rolling mill under construction.

Unifin Tube Company

LONDON, CANADA



In addition to the characteristics mentioned above, Unifin tubing withstands severe bending and forming, and can be safely welded or brazed. The superiority of Unifin tubing for all heat transfer applications is due to one unique feature — **the integral construction of fins and tube.** The fins are extruded from the actual metal of the tube wall. There is no jointing or bonding of any kind. . . . The fins and the tube are one!

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of the orchestra from its early days of a few instruments to its present state where as many as 150 musicians may be involved.

On May 6, Dr. E. J. Alexandre spoke on "The History of Mathematics". The abacus, counting board and court of exchequers were some of the counting devices used. It came as quite a surprise to a good many members to find that one of the greatest aids to mathematics was the discovery of a way to represent 0 long after other numbers had been in use.

The next lecture, on May 13, by the curator of the museum, Dr. Avery Shaw was entitled "Art and the Engineer". Dr. Shaw contended that a good engineer is an artist because of his use of form, mass and space.

The final lecture of the series, on May 21, by Lester G. Hoar dealt with "The Engineer and the Law". The great responsibility of the engineer was stressed, inasmuch as it does no good to plead ignorance of the law after a mistake has been made.

All the lectures were followed by question and answer periods and due to the interest shown by members it is hoped to continue the series in the fall.

St. John's, Nfld.

R. W. PIKE, M.E.I.C.,
Secretary-Treasurer

Annual Meeting

The annual meeting of the St. John's Branch of the E.I.C. was held at the Bungalow, Bowring Park, on Monday, May 11. After the members had enjoyed a most delicious turkey dinner, Branch Chairman S. J. Carew welcomed the large number of members present.

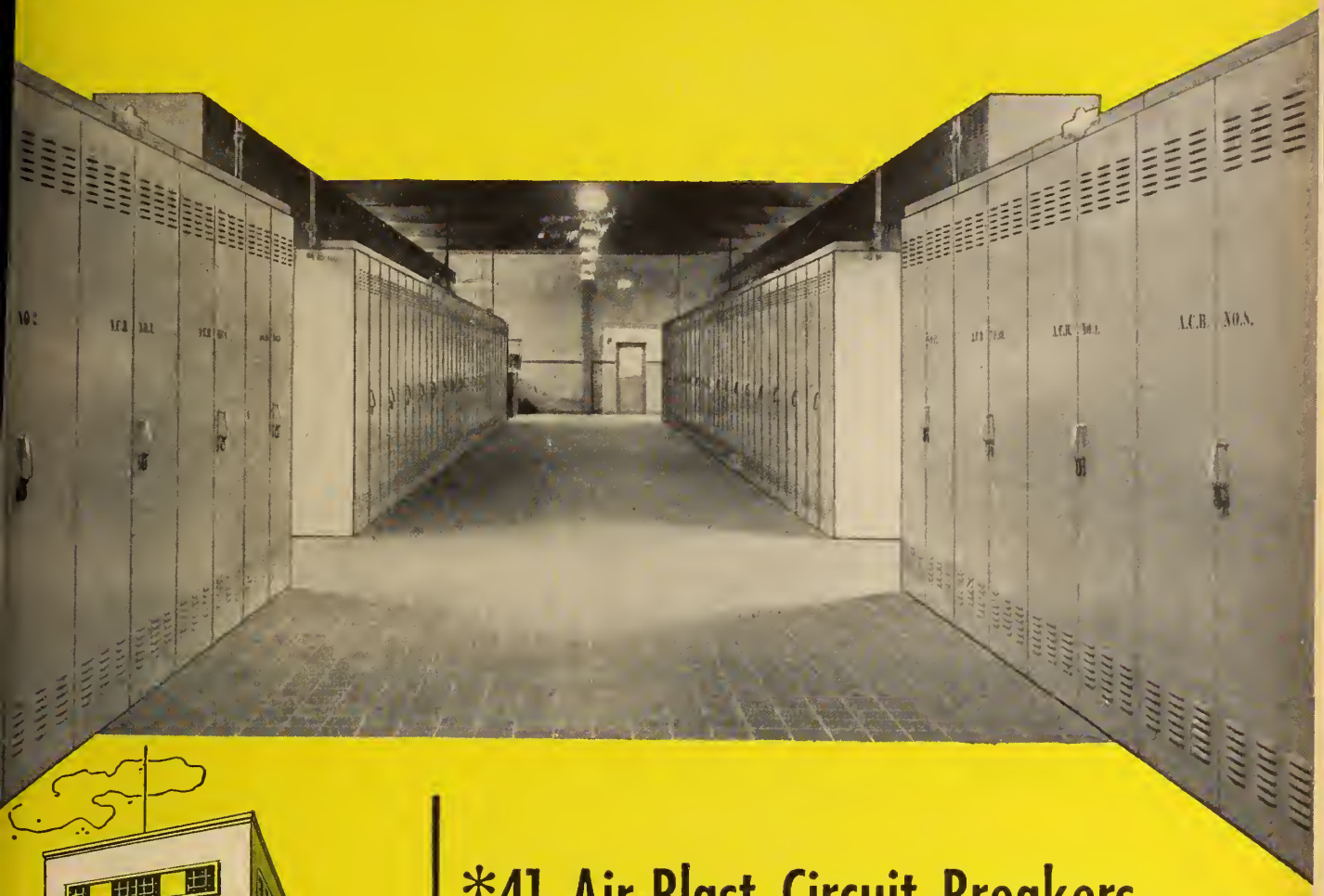
The minutes of the last annual meeting were read by the secretary-treasurer. The prize winners among engineering students who spoke at the March meeting were announced by Mr. Carew. They were: first place, Mr. Ryan; second, Mr. Staples, and third place, Mr. Tucker. Unfortunately the winners could not be present to receive their awards. The treasurer's report showed the Branch to be in good financial position.

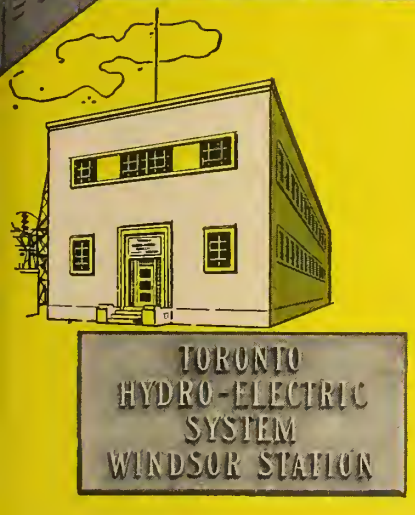
The following heads of committees reported on their year's activities: publicity committee, J. M. Hopkins; attendance committee, Albert O'Reilly; entertainment committee, G. Knight, who also reported on the inaugural meeting of the Corner Brook Branch which he attended as representative from the St. John's Branch. J. W. Morris reported for the membership committee.

The chairman then announced the results of the election for the executive for the ensuing year. Officers are: chairman, C. Knight; vice-chairman, Wm. Watson; past chairman, S. Carew; executive members: A. Butt, B. Higgins, E. L. Ball, R. P. Hunt, E. Cooper, and E. Dickenson, who is also councillor for the coming year. Clarence Knight, the new chairman, is a graduate of Memorial College and Nova Scotia Technical College in 1935, in civil engineering. He is now assistant roads engineer with the Department of Public Works of Newfoundland. He is also an executive member of the Association of Professional Engineers of the Province of Newfoundland.

Mr. Knight, the new chairman, congratulated the outgoing executive for a very succesful year and expressed the hope that, with the co-operation of all

Another Brown Boveri Installation*





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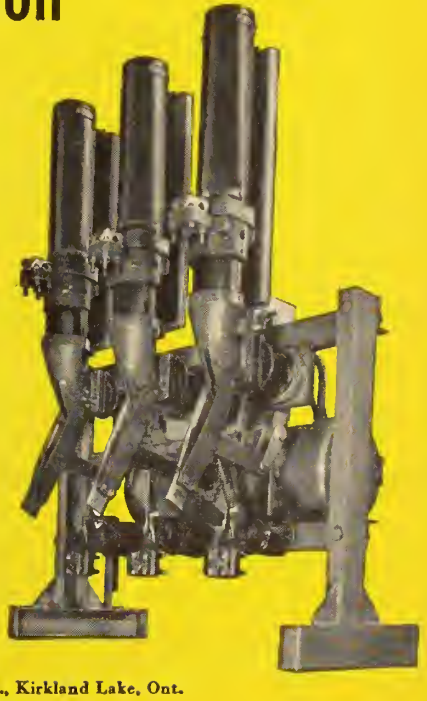

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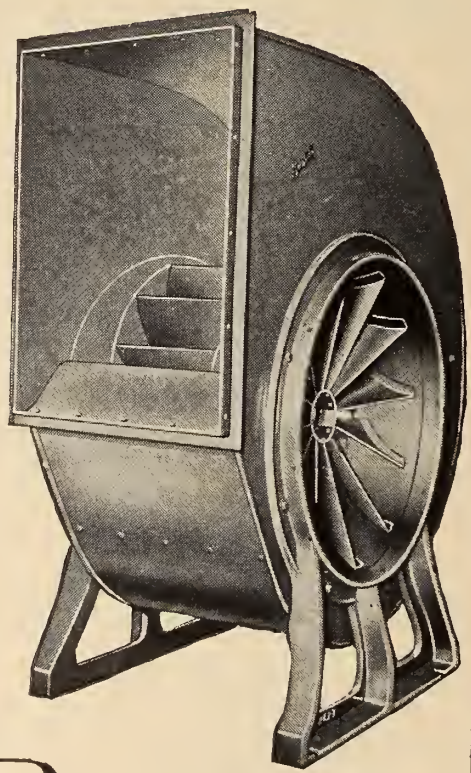

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members, the Branch would be equally successful in the coming year.

Mr. Knight moved a vote of thanks be extended to the Engineers Wives' Club for all their assistance throughout the past year and J. B. Angel moved that thanks be extended to the president of Memorial University who had authorized the use of the ladies' common room for Branch meetings.

Before the meeting adjourned H. J. Hermanson moved that a vote of thanks be extended to Mr. Carew. This motion was heartily endorsed by those present.

Vancouver Island

P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer

Joint Meeting, May 15

At the Douglas Building Cafeteria thirty-six members attended a joint meeting of the Vancouver Island Branch of the Engineering Institute and the British Columbia Engineering Society.

The guest speaker was H. Peter Oberlander, assistant professor of planning and design, University of British Columbia. His subject was "Water Pollution in the North Arm of the Fraser River". Using charts of the area in question, Professor Oberlander graphically described the survey work carried out by the U.B.C. engineering students and explained the remedial measures that will ultimately be necessary to reduce pollution.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

Electrical Section

L. E. Marrin, Jr.E.I.C.,
News Editor

Two Lecture Meetings

March 26 and April 16 were dates of special interest to the electrical members of the Winnipeg Branch as on both occasions they were privileged to have as guest speaker, an engineer of prominence in his chosen field of engineering.

C. H. Flurscheim, assistant chief electrical engineer, Metropolitan-Vickers Electrical Company, addressed the group in March. The speaker, introduced by D. Hunter, gave a general resume of European air circuit breakers and of the advances toward higher voltage and larger capacities.

Mr. Flurscheim's talk was followed by a spirited discussion on the relative merits of oil and air circuit breakers after which C. Haltalin expressed the appreciation of the gathering.

J. T. Madill, B.Sc., E.E.M.Sc., purchasing agent (electrical), Aluminum Co. of Canada, addressed the group in April The speaker, introduced by C. D. Osterland, chairman of the Electrical Section, discussed the various electrical design features and some operating problems to be faced in Alcan's Kemano power station, the 300-kv. transmission lines, and the Kitimat reduction works. Included were references to generators, transformers, H.V. cable and other apparatus being supplied. Mr. Madill's complete paper appeared as a feature article in the April issue of the Engineering Journal.

Because of the wide interest occasioned by Mr. Madill's paper, invitations to attended were extended to all sections of the Branch. L. Briggs thanked the speaker on behalf of the large gathering.

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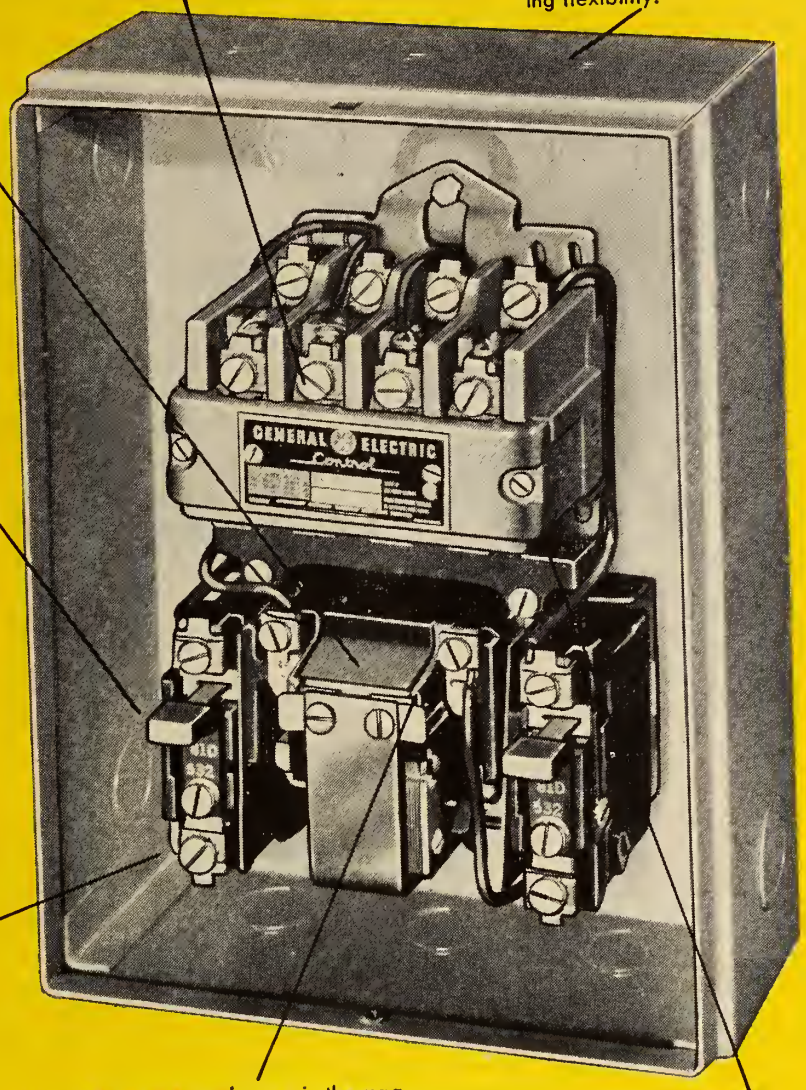

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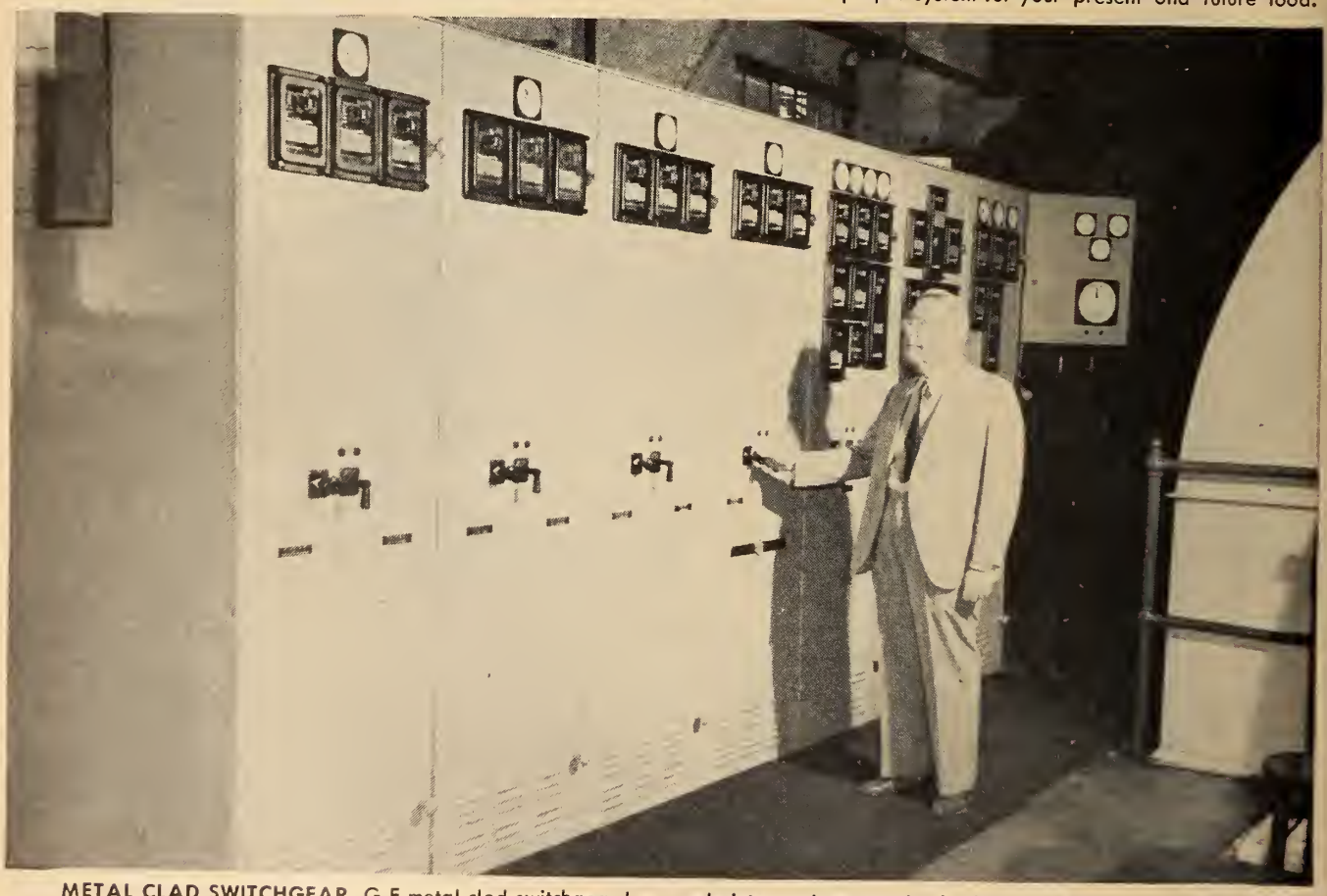

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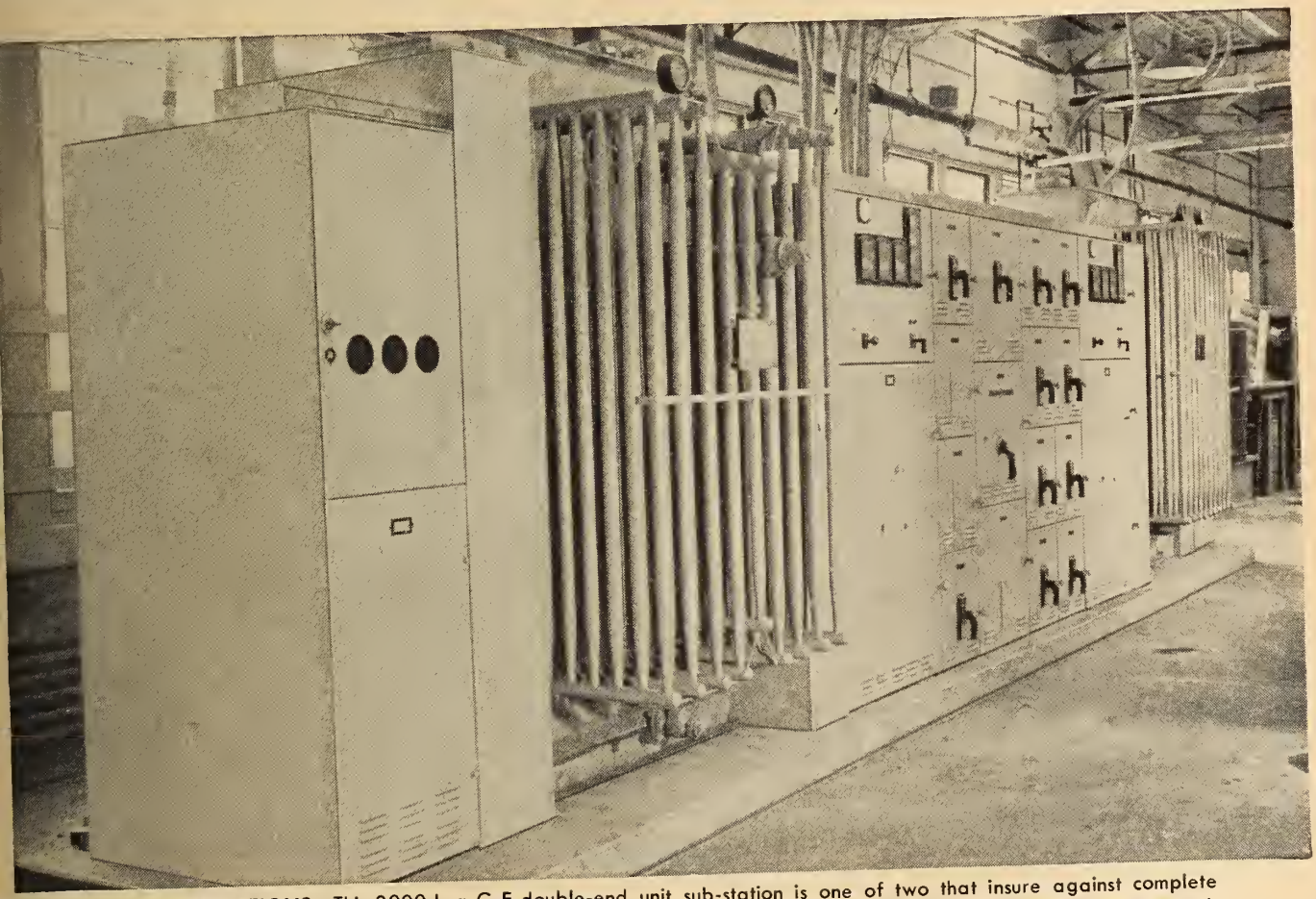

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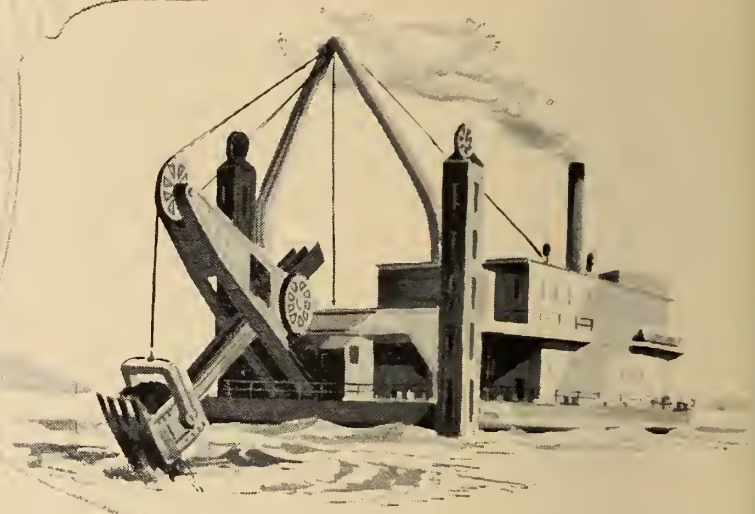

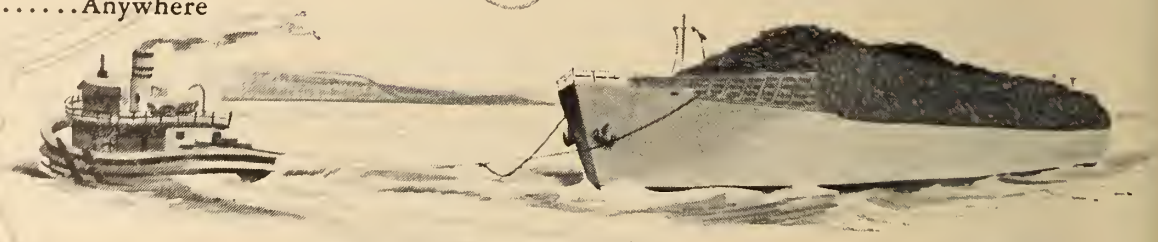

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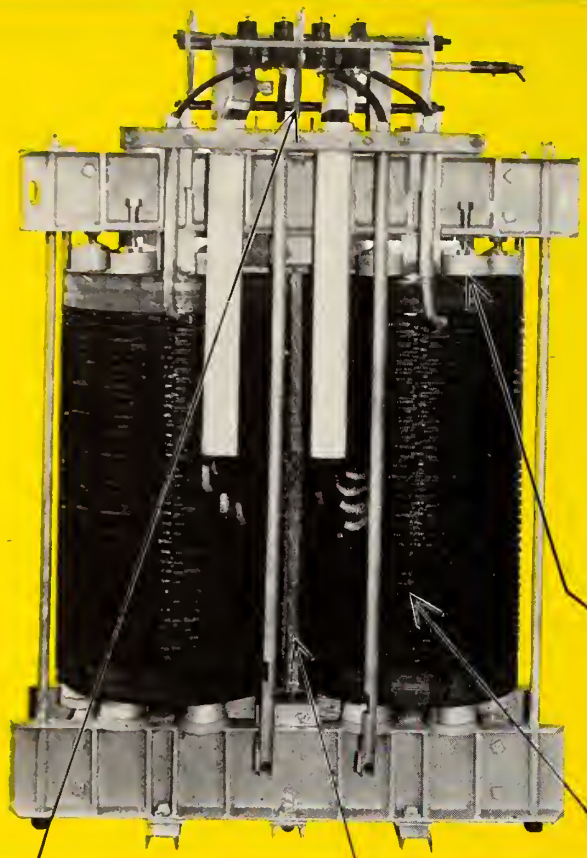
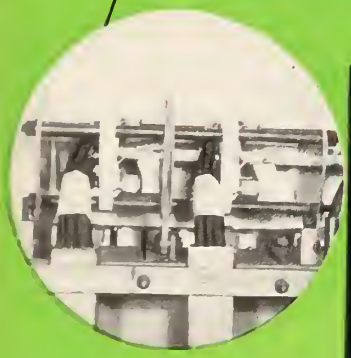
"Smooth-a-Surge"

POWER TRANSFORMERS



In the design and construction of Smooth-a-Surge Power Transformers no efforts or materials are spared to supply apparatus that will meet the needs of the customer and provide reserve capacity for emergencies under severe service conditions.

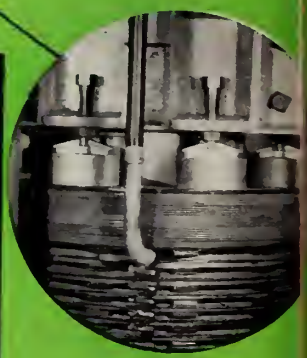
The core and coil assembly here illustrated is the interior of the transformer illustrated on the preceding page. In addition to these internal features, Supreme Smooth-a-Surge transformers possess noteworthy external advantages. Four channel stiffeners welded to the flat sides of the case ensure against leaks due to stress and strain of shipping, hoisting and installation. A skid-type base permits rolling of the transformer in either direction. Where design calls for demountable radiators, these are supplied with Supreme shut-off valves to allow removal without lowering oil level in the transformer.



One of the many advantages of the side-operated tap changer is that it allows the tap leads to go directly to the tap switch. This is superior both electrically and mechanically.

Note generous clearances and substantial insulating barrier between windings. Adequate impulse levels are thus assured.

Smooth-a-Surge Power Transformers are designed with disc type windings of which a close-up is shown. This eliminates layer stresses and reduces to a minimum local heating or "hot spots" within the coil. The result is a high overload capacity.



Spaced around the e collar of the windings a number of compressi rings of high insulati value which compress t windings.

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For continuous heavy duty in hardening, carborising, nitriding, vitreous enamelling, etc. Temperatures up to 2102° F. Available in various chamber sizes. Elements of heavy gauge nickel-chromium rod or tube in hair-pin shape.

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For high speed steel hardening and similar heat treatment service.
A highly efficient furnace with accurate temperature control up to 2462° F
Heating elements of re-crystallised carborundum.

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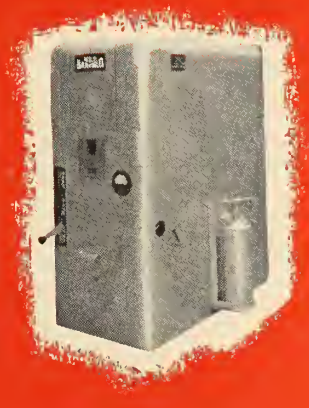

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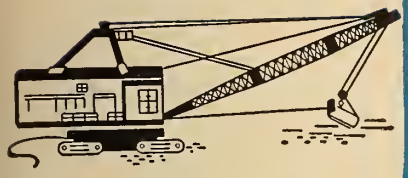
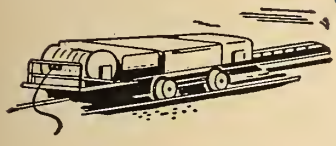


CONSTRUCTION

MANUFACTURING



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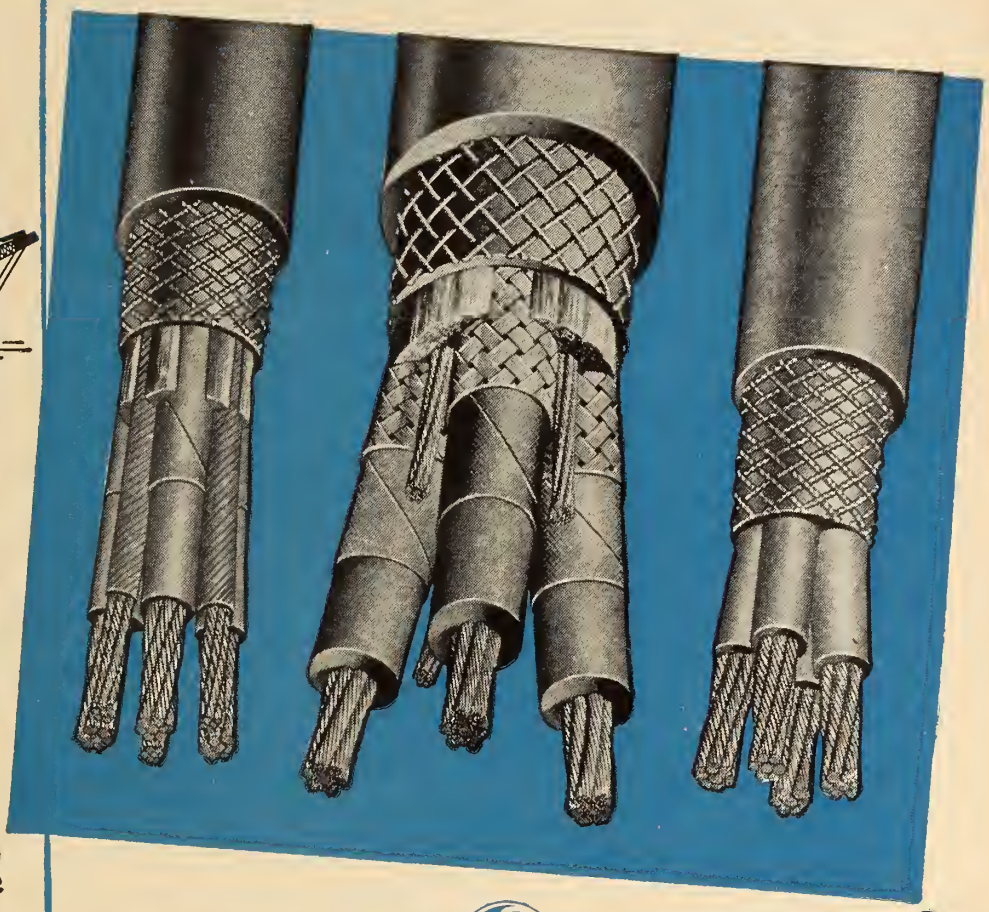

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Technical data on fuel. ed. H. M. Spiers, 5th ed. London, British National Committee, World Power Conference; Montreal, Engineering Institute, 1952. 517 pp., illus., 25/—.

The World Power Conference is by now a familiar name to all of our readers.

This "Technical Data on Fuel" was originally planned as one of the British contributions to the Fuel Conference held in London as a sectional meeting of the World Power Conference in 1928, and, to quote the chairman, "the possibility of a need for further editions was not then visualised."

With the constant demand for the book ever since, it is now in the second impression of its fifth edition, which is the volume under review.

For practical purposes, the book is divided into — General information, Heats and heat transfer and materials, and fuels.

The section on General information includes such tables as atomic weights, trigonometrics, conversion factors, standard screens and sieves, pyrometers, viscosity, freezing points, etc.

Air, water and gases, specific heat, thermodynamics and heat transfer are included in the second section, along with metals, alloys, and refractory materials. The latter part of the volume is concerned with fuels, liquid, gaseous and solid, and miscellaneous thermal data.

The six-page bibliography at the end is roughly classified, and two pages of British Standards enhance its value.

Thirty-five pages of detailed index is further indication of the excellent editorial policy that prevails throughout this volume.

To the large number of our members who are giving constant evidence of their interest in the publication of the World Power Conference, and to any other readers who are interested in fuel and its implications and problems, we would draw their special attention to this book.

E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Automation; the advent of the automatic factory. John Diebold. Toronto, Van Nostrand, c1952. 181 pp., $4.00.

The word "automation" was coined by Mr. Diebold to describe both automatic operation and the process of making things automatic. His book is an attempt to review any past developments in this broad field and to forecast future trends. It is not a technological analysis of automatic control or machinery but is rather concerned with the business problems of automation and indicates the manner in which technological developments can be useful to the businessman. The potentials and limitations, the economic and social consequences, of these industrial possibilities are pointed out. The author goes on from automatic control, which is not a new concept, to the more imaginative fields of the redesign of product and process and the automatic handling of information in offices, based on the high-speed digital computer and other "thinking" machines. The possibilities of co-ordination between an automatic plant and office are outlined. One chapter deals with making machines more fully automatic and describes what they will mean in terms of jobs, cost of goods and services, standards of living and increased leisure time. The index is not very detailed and there is no bibliography.

British Commonwealth scientific conference, Australia, February-March, 1952: report of proceedings. Ottawa, United Kingdom information office, 1952. 74 pp., 75c.

The second meeting of this conference dealt with many questions including the application of the results of scientific researeh, especially in industry and agriculture, methods of Commonwealth collaboration in several fields of science, the development of information services, the movement of scientists within the Commonwealth, the relations of the constituent organizations with international bodies concerned with science or its application, and the provision of technical manpower to assist underdeveloped countries. Subjects that were given special consideration because of their economic or scientific importance included industrial microbiology, research on low grade ores, and on the utilization of solar energy, infertility of ruminant animals, and agricultural engineering. The organization of national research bodies and the problem of supplying experts to advise in the development of backward areas were also discussed. The proceedings are not indexed but there is an adequate table of contents.

Elements of food engineering, vol. 1. M. E. Parker, E. H. Harvey, and E. S. Stateler. New York, Reinhold, c1952. 386 pp., illus., $8.75 (U.S.)

Food engineering, as distinguished from both chemical engineering and food technology, is "concerned with the design, construction, and operation of industrial processes or plants in which controlled physical, chemical and biological changes in food may occur, wherein the analysis and prediction of their costs under specified working conditions are provided." This first of three volumes deals with the origins, vital properties, and classifications of foods; the scope and extent of the food-processing industries; the significance of the engineering factors employed in food processing and a discussion of refined-foods processing. The major classifications of foods include wheat and corn, rice and oats, and minor cereal flours; fats and oils; sugars, syrups, starches, and gums; food protein derivatives; spices, condiments, and flavoring extracts; beverages and fermentation products; nuts. The book is written from the viewpoint of the unit operation and unit process, with emphasis being placed upon large-scale equipment to handle, process and distribute foods.

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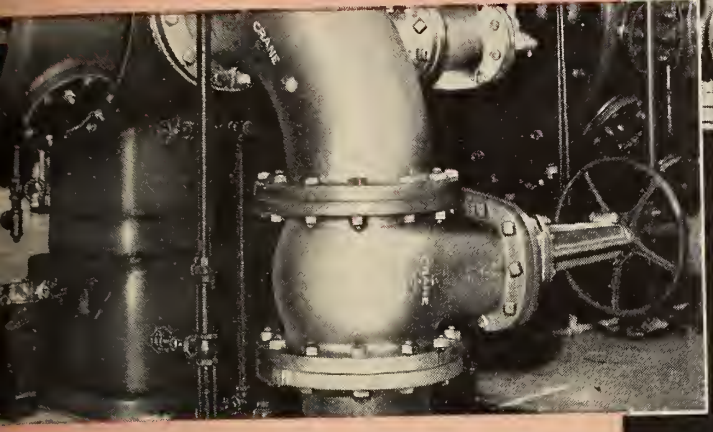
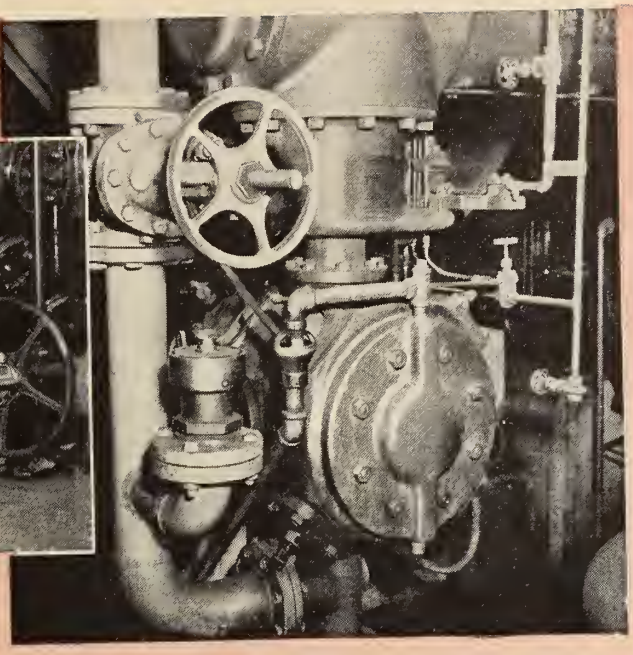
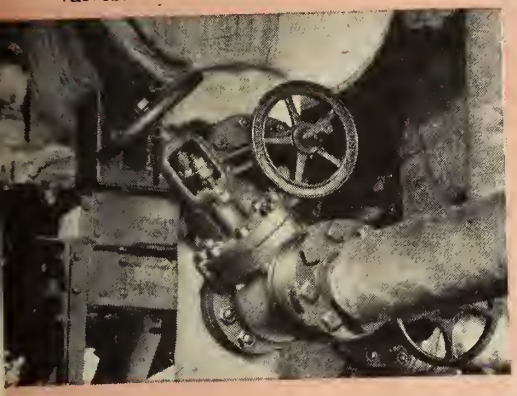
COMPRESSOR IN COPPER MINE power house featuring Crane iron body gate valve and flanged fittings.





LINES TO CLOSED FEED hot water heater showing Crane 4-in. steel gate valves.



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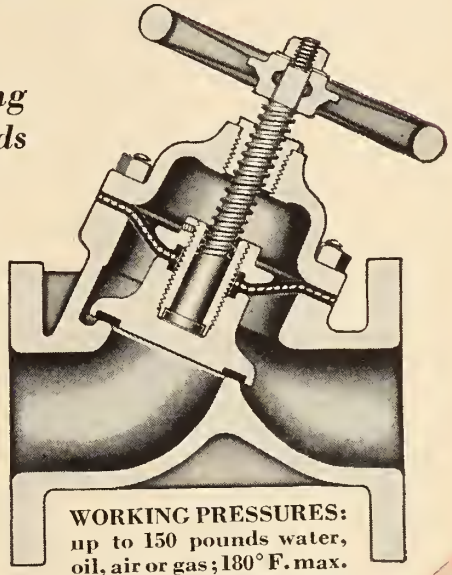

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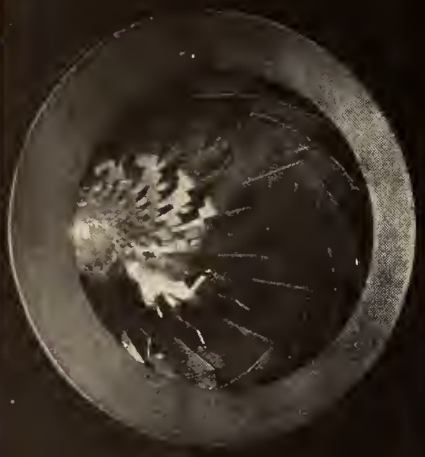

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he book is well illustrated and there is a etailed index. Volumes 2 and 3 are to be ublished this year.

lements of the theory of functions. Konrad Knopp. New York, Dover publications, c1952. 140 pp., $1.25 (U.S.)

This will serve as an introduction to a nore complex treatment of the theory of nctions although, to read it, a knowledge f the foundations of real analysis and of ne elements of analytic geometry are ne-essary. The topics treated include the ystem of complex numbers and the aussian plane of numbers, the Riemann phere of numbers, mapping by means of near functions, normal forms and par-icular linear mapping, the logarithm, the yclometric functions and the binomial eries. There are a few figures to illustrate he functions and equations that are leveloped, a short bibliography and an ndex.

Flatland, 6th ed., rev. E. A. Abbott. New York, Dover, c1952. 103 pp., illus., $1.00 paper (U.S.)

This seventy-year-old classic in science iction will still provide a delightful evening's reading for anyone interested in ntellectual adventures in the realm of pure mathematics and logic. Flatland is a country in two-dimensional space peopled by geometrical figures that think and speak and have human emotions. In his introduction Banesch Hoffmann says "flat they may be physically, but their characters are well rounded." The book is an exciting account of the way the inhabitants of Flatland live: their climate and houses, methods of recognizing each other, their laws and their clergy. A female, in Flatland, is a creature by no means to be trifled with since she is a straight line and thus, so to speak, all point, at least at the two extremities. To run against a woman means absolute and immediate destruction! The adventures of the hero in Spaceland, and his subsequent efforts to teach the theory of three dimensions to his own people form the latter half of this novel tale.

Industrial leadership and joint consultation. W. H. Scott. Liverpool, University press, 1952. 207 pp., 12/6.

The sub-title of this book is "a study of human relations in three Merseyside firms", which are described in detail but not identified. The principle aim of the research was to examine the relationship between formal and informal leadership processes in an industrial organization. Joint consultation between manager and worker is a new formal procedure of leadership and this was studied in the first firm by direct observation of meetings, by analysis of its history and specific achievements, and by examination of attitudes towards the administrative system at all levels of the organization. In Firms B and C there was a more detailed study of the interdependence of the formal and informal processes mentioned above together with others such as questionnaires distributed to employees. A new aspect of this research was the examination of any one relationship in terms of the whole field of relationships of which it forms a part. Specimen copies of council minutes are given which illustrate the actual nature of joint consultation. A short bibliography and index are included.

Lectures on Cauchy's problem in linear partial differential equations. Jacques Hadamard. New York, Dover publications, c1952. 316 pp., $1.70 (U.S.)

This mathematical treatise is a re-issue of the 1923 edition. In his preface the author acknowledges the origins of his investigations in the works of Riemann, Kirchhoff and Volterra on spherical and cylindrical waves. His aim was to apply the theories of the latter to all normal hyperbolic equations, instead of only to one of them. The book is divided into four parts, covering general properties of Cauchy's problem, the fundamental formula and the elementary solution, equations with an odd number of independent variable, and those with an even number, and the method of descent. There are a number of references in footnotes which are covered in the index.

La mécanique ondulatoire. T. Kahan et B. Kwal. Paris, Armand Colin, c1953. 220 pp., 260 fr.

This new treatise on wave mechanics by two French scientists prominent in the field presents both historical and original material on the subject. The relativity theories of Einstein and the Hamilton-Jacobi equation are covered, among others, and a section is devoted to the pioneer work of Louis de Broglie (who wrote the preface to this book), the scientist who first applied the wave conception of light to matter. One chapter covers the mechanics of matrices followed by a section covering the transformation theory, the theory of atomic collisions and the perturbation theory. The authors also deal with the problem of many particles and electron spin, then go on to the applications of wave mechanics in the field of nuclear physics, including the equations of Gordon-Klein and Dirac. The authors have illustrated their text with examples and equations, making their explanations of a difficult science as clear as possible. A short bibliography and a table of contents are found at the end of the book.

National conference on industrial hydraulics, 8th meeting, September 4-5, 1952. Proceedings, vol. 6. Chicago, Illinois institute of technology, c1952. 242 pp., illus., $4.50 (U.S.)

The interchange and elevation of technical knowledge was the major aim of the conference, which was attended by ten technical societies and over one hundred industrial organizations. The papers are grouped according to the session at which they were presented, generally two in each, followed by a panel discussion. These sessions were general, during which papers were given on low temperature application of industrial hydraulic oils, and on hydraulic equipment; automotive; instrumentation; pumps; machine tools; aircraft; hydro power; hydraulic presses; tractive equipment and material handling; and accessories sessions. The subject in each paper is carefully developed with many illustrations, schematic diagrams, footnotes and mathematical tables to augment the text, and each one concludes with a short summary. New developments in the field are brought out in the papers and the panel discussions add to the general fund of knowledge.

National fire codes, vol. 2: The prevention of dust explosions, 1952 ed. Boston, National fire protection association, c1952. 288 pp., illus., $3.00 (U.S.)

These codes have been approved by the American Standards Association and used by the U.S. Department of labour. The volume begins with fundamental principles for the prevention of dust explosion in industrial plants which include precautions to be used in the construction and equipment of plants. The industries covered by the codes include aluminum bronze and magnesium powder manufacturing, plastics, flour and feed mills, pulverized fuel systems, confectionery plants, starch factories, grain elevators, spice grinding plants, and woodworking plants. There are also codes for the prevention of sulphur dust explosions and fires, and for the use of inert gas for fire and explosion prevention. There are appendices on static electricity hazards in dusty industries; on recommendations for venting explosion pressure; and a record of dust explosions

in the United States, listed chronologically within industrial classifications. A directory of manufacturers of dust prevention equipment is found at the end of the book.

La pratique des traitements thermiques des métaux industriels, 4. ed. Gerard de Smet. Paris, Dunod, 1953. 405 pp., illus., 2900 fr.

Another edition of this book claims to present some new methods of heat treatment of metals in industry. These include sulphinization, gaseous case-hardening, standard classification of steels and certain alloys and others. Starting from the melting of the ore, it covers such aspects of the subject as steels, cast iron, light alloys, copper, babbitt, zinc alloys, and protection of metallic surfaces. It also treats the main types of furnaces, pyrometry, tempering, and systematic analysis in the use of cyanide baths. The volume concludes with a fairly long section on the testing and checking of metals in the shop by various processes, machines, and analyses, with tables to augment the text. This information will be of interest to metallurgists, industrialists, engineers, technicians, and students and it is to be hoped that the language of the text will not be too great a barrier. It is well illustrated with diagrams and the table of contents at the end is very complete.

Theory of electrons, and its applications to the phenomena of light and radiant heat, 2nd ed. H. A. Lorentz. New York, Dover, c1952. 343 pp., $1.70 (U.S.).

This edition was first published in 1915 but it is still a valuable item in the literature of electrons. The five main chapters cover general principles, emission and absorption of the Zeeman-effect, propagation of light in a body composed of molecules and the theory of the inverse Zeeman-effect, and optical phenomena in moving bodies. The author states that he has only touched on Voigt's Treatise on magneto-optical phenomena, Planck's views on radiation and Einstein's principle of relativity. In spite of this, and of the fact that many developments have taken place during the last thirty-five years, readers of this book will find a clear and extensive treatment of the theories covered. There is an adequate index.

Vacuum-tube oscillators. W. A. Edson. New York, Wiley, c1953. 476 pp., figs., $9.00.

The senior or graduate student, and the practising engineer will find in this book a systematic and practical treatment of the many factors affecting the behavior of vacuum-tube oscillators. The author writes from the viewpoint of design rather than of analysis and attempts to gather together material that had been formerly too scattered to be readily available. Some subjects, such as microwave oscillators, which are fully treated elsewhere have been omitted. The various chapters give a highly technical and mathematical treatment of such questions as transient behaviour of linear systems, nonlinear oscillations, feedback systems, resonators, conventional harmonic and crystal-controlled oscillators, intermittent behaviour and operation at high-power levels, practical relaxation oscillators, locking and synchronization, tube and thermal noise, automatic frequency control and long-line and multiple-resonance effects. The MKS system is used in all analytic work, although apparatus dimensions are sometimes given in inches and feet. The abbreviations, symbols, network terminology, and graphical representations used conform to the Standards of the Institute of Radio Engineers. The references in the fourteen-page bibliography are to material almost exclusively in English. There are name and subject indices.

What is science? Norman Campbell. New York, Dover, c1952. 186 pp., $1.25 (U.S.)

Although it was first published in 1921 this book, by a well-known scientist, remains an excellent introduction to the nature of scientific thought. One of its outstanding features is the clear and understandable English in which it is written which adds to its value as basic reading material for those interested in, or beginning, the study of science. Mr. Campbell has written this book around his own definition of science i.e. "the study of those judgments concerning which universal agreement can be obtained." His concern is with pure science, as opposed to its practical aspects, and he presents the various kinds of scientific laws, pointing out the difference between these and scientific theories. He explains the role of experiment and measurement, and of mathematics, in the discovery of laws and concludes with a chapter on the applications of science to practical life. There is a brief index to the book.

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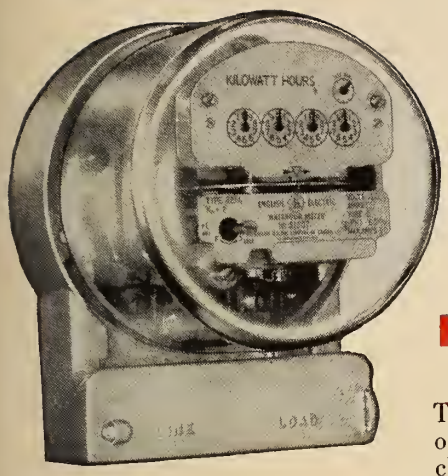


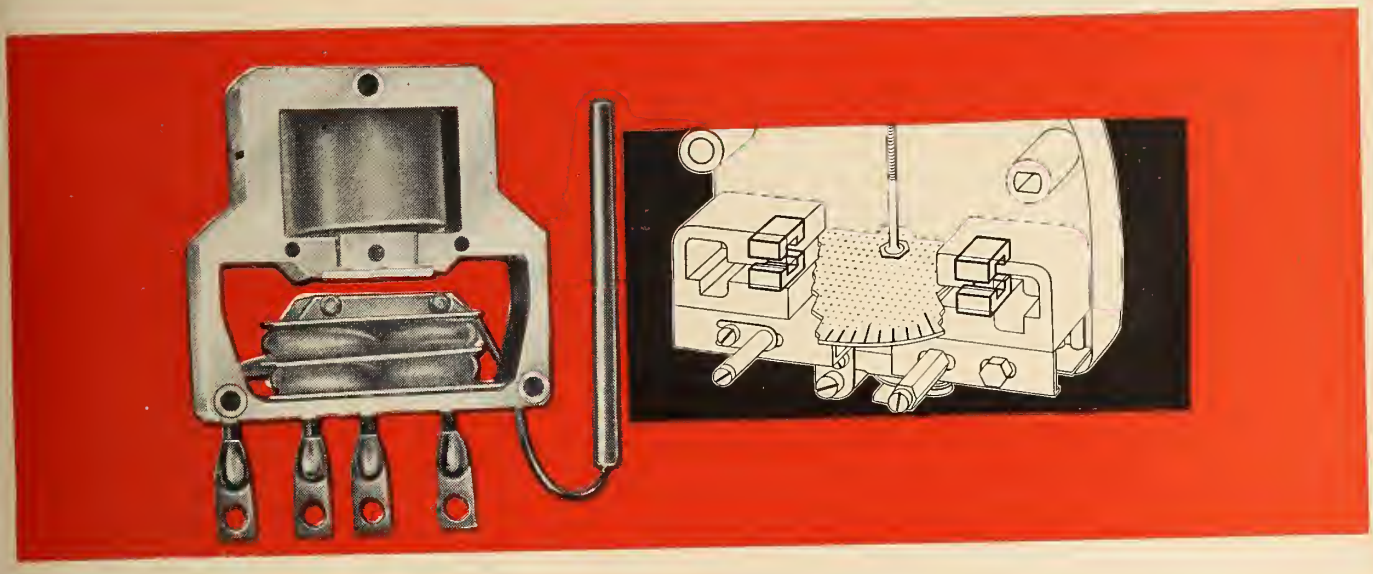
permanency of calibration ensured

Here's why

The configuration of the air gap determines the flux distribution on which depends the driving torque and speed of the meter. Any change in the air gap—however small—will affect the flux pattern and upset the calibration. In this English Electric meter there is no chance of this happening as the air gaps are permanently fixed by the use of one-piece laminations.

Another factor controlling permanency of calibration is brake magnet stability. This has been achieved by using magnets of Alcomax III, a material possessing a high coercive force (650 oersteds) able to withstand considerable stray fluxes indefinitely.

This combination of fixed air gaps and completely stable brake magnets ensures permanency of calibration.



EXCEPTIONAL ACCURACY over a wide load range is obtained by low speed of operation; high degree of linearity in the electromagnet design; and high ratio of permanent magnet damping to A.C. damping flux.

BEARING LIFE is increased enormously by two pairs of double pole permanent magnets arranged to reduce vibration and side thrust, and by using a low speed of rotation.

PA5321A

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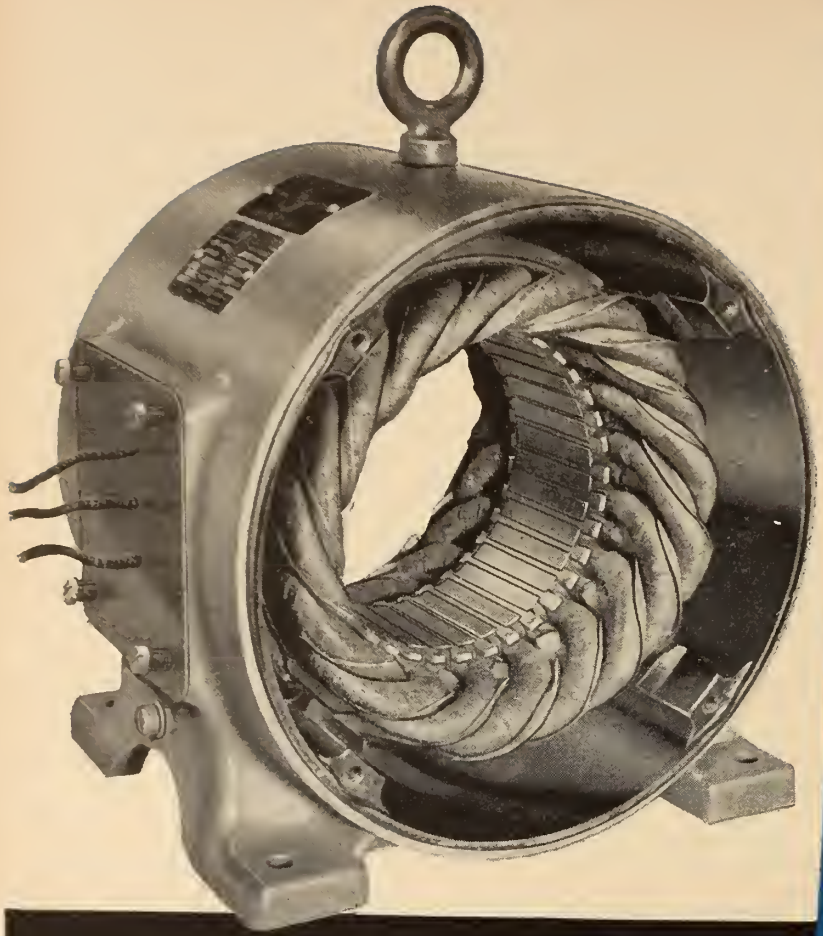
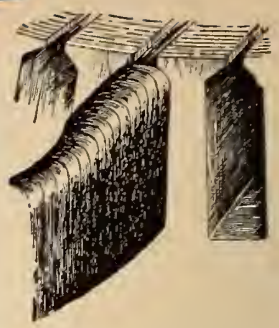
English Electric Company of Canada Limited *Head Office and Factory: St. Catharines, Ontario*



BEPCO OFFERS THESE FEATURES

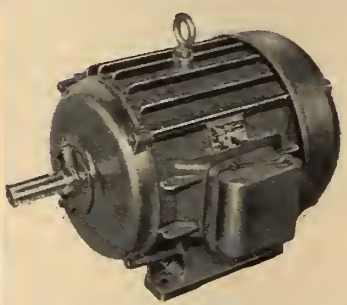


End windings fully taped on 220, 440 and 550 Volt machines, no matter what the enclosure.

Windings hermetically sealed with mica on machines of 2200 Volts and higher. Slot portion of coils provided with solid mica covering moulded while hot, all traces of air being squeezed out so that a solidly impregnated coil side is produced.

A complete range of motors are available from Bepco. Several thousand motors up to 200 HP are in stock for immediate delivery and other motors up to 7500 HP are readily available.

If desired, Bepco Engineers will assist in selecting the right motor for your drive. Contact your Bepco Representative.



For over a quarter of a century Bepco totally enclosed fan-cooled motors have had special ribbed frames to provide highly efficient cooling. No internal cooling ducts to choke with dust or dirt, or to corrode.

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The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Electric control systems, 3rd ed., R. W. Jones. New York, Wiley, 1953. 511 pp., $9.30.

The primary concern of this book is with control systems for motor drives, with emphasis on the utilization of electric power. Aspects of control in generation and transmission are not considered. The author concentrates on basic types, emphasizing the functional aspects of control, rather than attempting a complete treatment of all control elements and systems. Most of the discussion is devoted to systems having no feedback, but the essential features of feedback systems are introduced. A list of references accompanies each chapter.

Elements of propeller and helicopter aerodynamics. D. O. Dommasch. New York, Pitman. 1953. 178 pp. $4.50 (U.S.)

Considering helicopter aerodynamics as an extension of propeller theory the author has combined the two for a single course. The first half of the book consists of three chapters on basic principles and definitions, blade-element theories, and propeller characteristics. The other three chapters are more specialized treatments: axial flow through the helicopter rotor; the helicopter in forward flight; and helicopter stability and control.

Equipment for the thermal treatment of non-ferrous metals and alloys. London, The Institute of Metals, 1953. 104 pp., 15/–. (Monograph and Report Series, No. 14).

The seven papers in this symposium deal with the following topics: electric furnaces; gas equipment for heat treatment; batch and continuous annealing of copper and copper alloys; bright annealing of nickel and its alloys; batch heat-treatment of light alloys; flash annealing of light alloys; and continuous heat-treatment of aluminum alloys of the Duralumin type. There is a general subject index covering all the papers.

Sewerage and sewage treatment. 7th ed. H. E. Babbitt, New York. Wiley, 1953. 674 pp., illus., $8.80.

Extensive revision of this standard work has been necessitated by developments of the last five years, especially in the fields of stream pollution, recovery of values from industrial wastes, disposal of radioactive wastes, and standards for design of sewerage systems and elements. The comprehensive coverage deals with all aspects from the basic hydraulics of sewers through the most up-to-date sewage-treatment processes, including system planning and construction work. For more effective use, the literature references now appear as footnotes instead of being collected in a bibliographic appendix.

Television and radar encyclopedia. W. MacLanachan, ed. New York, Pitman, 1953. 216 pp., illus., $6.00 (U.S.)

Designed both as a reference manual for engineers and for general use by the non-specialist, this compilation covers terms likely to be in common use in the United States and Great Britain. Brief definitions of terms and abbreviations and longer signed articles under the more important headings are listed in a single alphabet, with numerous cross-references. An appendix includes a list of symbols, tables of inductances, and other pertinent data. Sketches, diagrams, and photographs are freely used for illustration.

BOOKS RECEIVED

Aeronautical engineering catalog, 9th ed., 1953. W. A. Shrader, ed. New York, Institute of the aeronautical sciences, c1953. 413 pp., illus., $7.50 (U.S.)

***Alternating current wave forms: theory and practice,** 2nd ed., rev. & enl. Philip Kemp. London, Chapman & Hall, 1952. 406 pp., diagrs., $10.00. (Monographs on electrical engineering, volume 1).

Analysis of aluminum alloys. G. H. Osborn and W. Stross, eds. New York, Chemical publishing co., c1953. 144 pp., illus., $3.50 (U.S.)

***Architects', builders', civil and highway engineers' reference book,** 4th ed. London, George Newnes ltd., 1952. 971 pp., illus., $21.00.

Canadian depreciation guide, 4th ed. Toronto, CCH Canadian ltd., 1953. 92 pp., $2.00.

***The cathode ray oscillograph in industry,** 4th ed., rev. London, Chapman & Hall, 1953. 273 pp., illus., $7.25.

***Coast erosion & protection; studies in causes and remedies.** R. R. Minikin. London, Chapman & Hall, 1952. 240 pp., illus., $6.00.

***Commercial a.c. measurements,** 3rd ed., rev. G. W. Stubbings. London, Chapman & Hall, 1952. 377 pp., illus., $10.00.

Dechema-monographien, nr. 245-268, band 21. Frankfurt Am Main, Dechema, 1952. 464 pp., illus.

***Diesel engine manual,** 2nd ed. E. Molloy. London, George Newnes ltd., 1953. 224 pp., diagrs., $4.00.

***Electricity supply engineering.** E. Molloy, ed. London, George Newnes, 1953. 164 pp., illus., $4.00. (Practical electrical engineering series).

Equivalent radio tubes vade-mecum, 10th ed. P. H. Brans. Antwerp, c1953. 303 pp.

Examples of the design of reinforced concrete buildings in accordance with the British standard codes. C. E. Reynolds, 1952. London, Concrete publications ltd., 1952. 214 pp., figs., $2.40.

Experimental nuclear physics, volume 1. E. Segre, ed. New York, Wiley, c1953. 789 pp., diagrs., $16.50.

***Fatigue of metals.** R. Cazaud. London, Chapman & Hall, 1953. 334 pp., illus., $12.00.

Heating, ventilating, air conditioning guide, 1953. New York, American society of heating and ventilating engineers, c1953. 1,560 pp., illus., $8.50.

Industrial relations handbook, rev. ed. Great Britain. Ministry of labour and national service. London, H.M.S.O., 1953. 284 pp., $1.15.

International boundary commission. Joint report upon the survey and demarcation of the boundary between Canada and the United States from Tongass passage to Mount St. Elias. Ottawa, Queen's printer, 1952. 365 pp., illus.

***Major faults on power systems.** A. F. Lyle. London, Chapman & Hall, 1952. 355 pp., illus., $9.00. (Monographs on electrical engineering, volume 13).

Mechanical engineering thermodynamics. D. A. Mooney. New York, Prentice-Hall, c1953. 540 pp., graphs, fold. maps., $9.35 (U.S.)

***Newnes electrical pocket book,** 11th ed, 1952. E. Molloy, ed. London, George Newnes ltd., 1952. 375 pp., illus., $2.00.

***Newnes engineer's reference book,** 5th ed. F. J. Camm, ed. London, George Newnes, 1952. 1,909 pp., diagrs., $12.75.

Oxidation of metals and alloys. O. Kubaschewski and B. E. Hopkins. London, Butterworths scientific publications, 1953. 239 pp., diagrs., $6.00.

Physical constants of some commercial steels at elevated temperatures. British iron and steel research association, ed. Toronto, Butterworths scientific publications, 1953. 38 pp., (spiral bd) diagrs., $3.50.

Plane surveying, 2nd ed. F. R. Theroux, L. A. Smith, L. V. Nothstine. New York, Pitman publishing corp., c1953. 407 pp., illus., fold. maps, $4.75.

Pompes, ventilateurs, compresseurs centrifuges et axiaux. A. de Kovats et G. Desmur. Paris, Dunod, 1953. 336 pp., illus., $12.00.

***Power station work.** E. Molloy, ed. London, George Newnes ltd., 1953. 164 pp., illus., $4.00.

***Power transmission engineering.** E. Molloy, ed. London, George Newnes ltd., 1953. 180 pp., illus., $4.00.

Psychology of industrial relations. C. H. Lawshe and others. Toronto, McGraw-Hill, c1953. 350 pp., $6.60.

Quebec tax acts consolidated, 5th ed., 1953. Toronto, CCH Canadian ltd., 1953. 171 pp., $2.50.

***Radio engineers' servicing manual.** E. Molloy, ed. London, George Newnes, 1952. 760 pp., illus., $8.50.

Remote control by radio; an amplitude-modulation and an impulse-modulation system. A. G. Bruinsma. Eindhoven, Philips' technical library, 1952. 96 pp., illus., $1.95 (U.S.)

Les rendements planétaires en diagrammes. G. Fleischel. Paris, Dunod, 1953. 52 pp., diagrs., $4.75.

***The resonant cavity magnetron.** R. S. H. Boulding. London, George Newnes ltd., 1952. 147 pp., illus., $4.25.

***Rocket propulsion.** Eric Burgess. London, Chapman & Hall, 1952. 235 pp., illus., $4.25.

*The science of flames and furnaces. M. W. Thring, London, Chapman & Hall, 1952. 416 pp., diagrs., $8.50.

Simplified design of roof trusses for architects and builders, 2nd ed. Harry Parker. New York, Wiley, c1953. 278 pp., illus., $4.40.

Simplified drafting practice. W. L. Healy & A. H. Rau. New York, Wiley, c1953. 156 pp., illus., $5.50.

*Sub-station practice, 2nd ed. T. H. Carr. London, Chapman & Hall, 1952. 467 pp., illus., $11.00.

*Tensors in electrical machine theory. W. J. Gibbs. London, Chapman & Hall, 1952. 238 pp., diagrs., $6.00.

The theory and practice of reinforced concrete, 2nd ed. Toronto, McGraw-Hill, c1944. 558 pp., illus., $7.80.

*Transmission lines and a.c. networks. T. F. Wall. London, George Newnes, 1953. 328 pp., diagrs., $6.00.

*Vacuum technique. A. L. Reimann. London, Chapman & Hall, 1952. 449 pp., figs., $10.00.

Wave propagation in periodic structures: electric filters and crystal lattices, 2nd ed. L. Brillouin. New York, Dover publications, c1953. 255 pp., diagrs., $1.75.

Work measurement; new principles and procedures. Adam Abruzzi. New York, Columbia university press, c1952. 290 pp., $6.00 (U.S.)

TECHNICAL BULLETINS RECEIVED

*Available in Canada through British book service.

American society for engineering education. Proceedings:

5th college-industry conference, sponsored by the Relations with industry division.

Bell telephone system. Technical publications. Monographs:

No. 1999 — A quarter century of evaluating pole preservatives, by G. Q. Lumsden. No. 2047 — Methods in electron microscopy of solids, by R. D. Heidenreich. No. 2048 — Automatic speech recognition, by W. E. Kock and others.

British productivity council. Booklets:

As the spirit moves; case studies in materials handling.

California institute of technology. Industrial relations section. Bulletins:

No. 21 — Polls of employee opinions and what to do with them, by R. D. Gray.

Canada. National research council. Canadian government specifications board. Specifications:

33-GP-2P — Interim schedule of abbreviations suggested for use in Canadian government drawing practice. 39-GP-1 — Hammers.

Great Britain. Chief inspector of factories. Annual reports:

1951 — Annual report.

National fire protection association. Standards:

NFPA no. 31 — Installation of oil burning equipments (DB pamphlet no. 31 of the Dominion board of insurance underwriters).

United States. Housing and home finance agency. Office of the administrator. Division of housing research. Housing research papers:

No. 25 — Relation of shrinkage to moisture content in concrete masonry units.

United States. Department of commerce. National Bureau of standards. Building materials and structures reports:

No. 133 — Live loads on floors in buildings.

United States. National research council. Highway research board. Bulletins:

No. 62 — Highway-materials surveys.

Vickers incorporated. Waterbury tool division. Catalogues:

Waterbury engineering data: heavy duty series.

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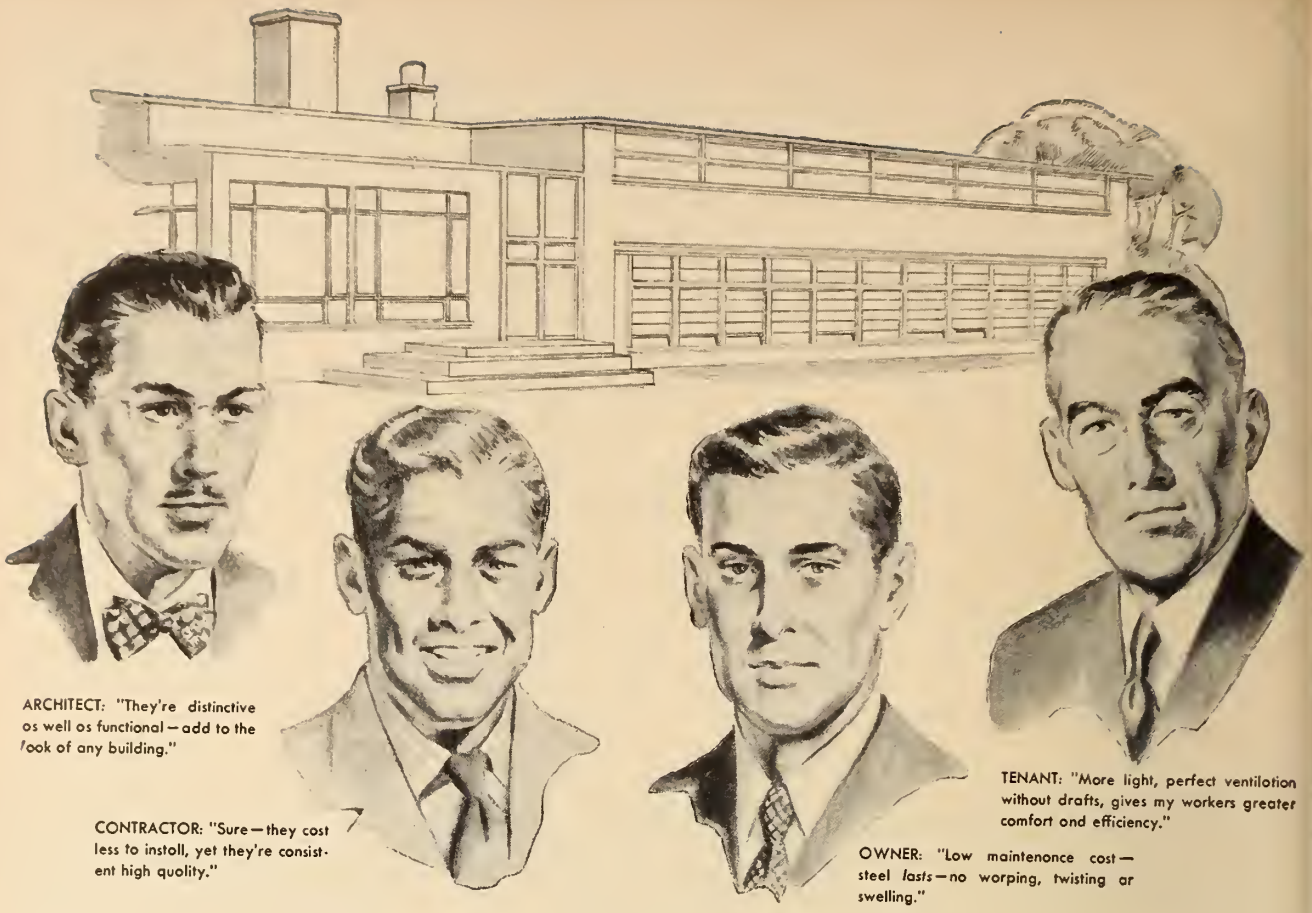

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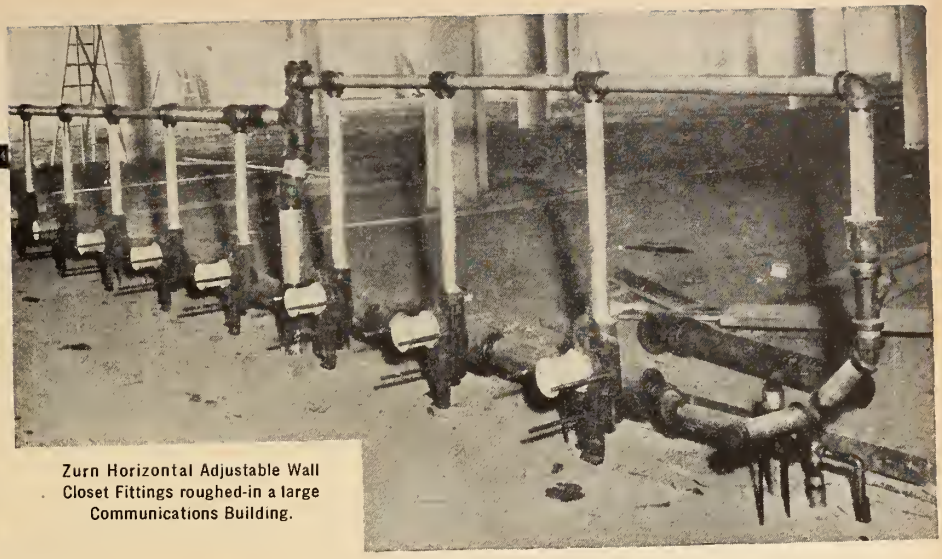
Exploded view of Zurn Wall Closet Fitting for syphon jet closet left-hand, horizontal, for soil pipe connections. Also available for threaded pipe connection.



Zurn Horizontal Adjustable Wall Closet Fittings roughed-in a large Communications Building.

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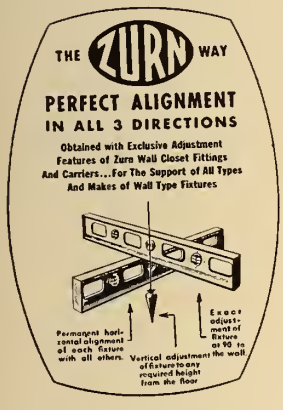

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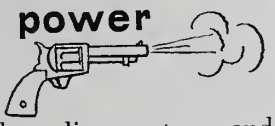

The Copco-Atlas HR4V Portable Compressor has most troublesome moving parts *eliminated*. There are no auxiliary drives, no valves, no valve gear or camshafts, no clutch . . . and you'll like this . . . no electrical system.

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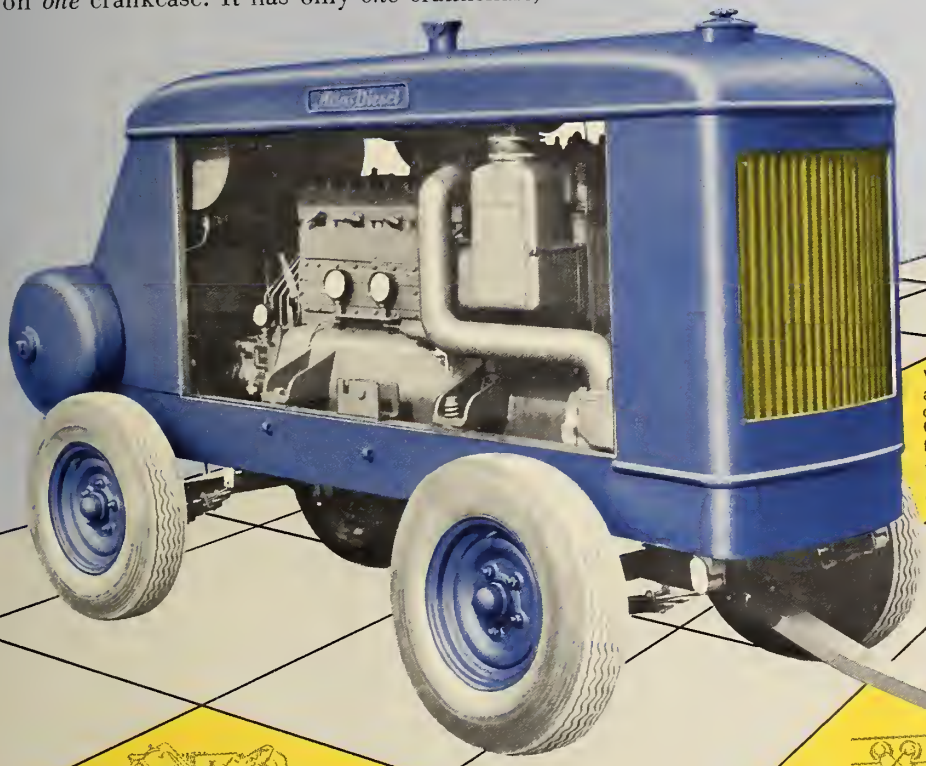

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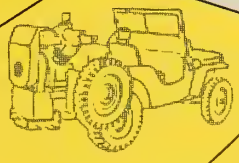
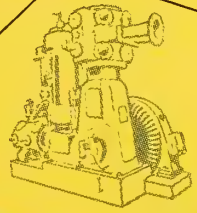
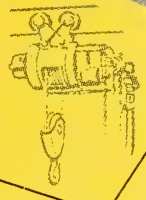


60 and 75 cfm.

13 to 46.3 cfm.



330 to 3220 cfm.



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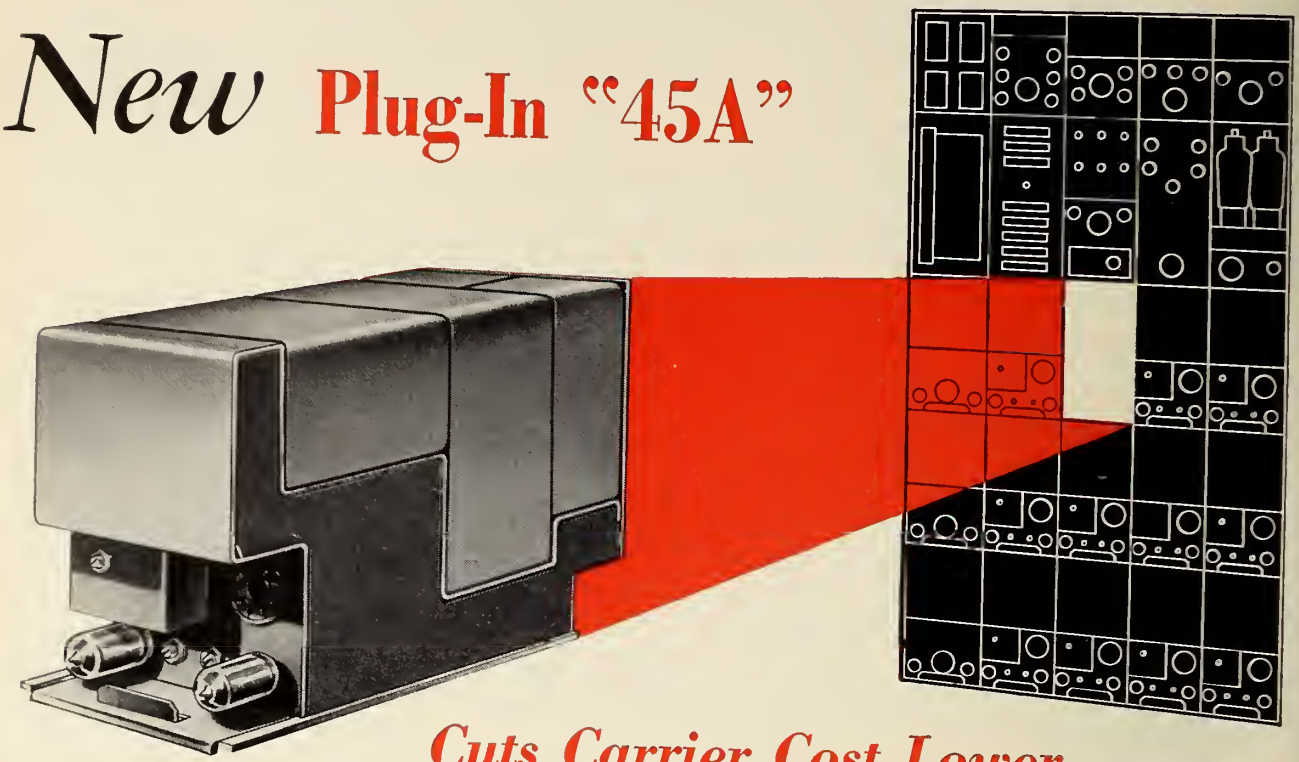

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SAVES MONEY — With simple changes, channel units ("lug-in" packages 10-1/2" x 3-1/4" x 6-3/8") can be used for **any** channel — fewer replacement units need be stocked.

Lenkurt Type 45A Wire Line Carrier Telephone System costs less to buy — less to maintain.

Components are miniaturized, standardized, "plug-in" units; complete channel assembly plugs into small space as shown above. You can order equipment to fit your needs *exactly* and add channels one at a time, as your needs increase. Maintenance is simple — takes little time, costs little because any of the "plug-in" components can be quickly and easily replaced. And Type 45A saves more than 80% on floor space; three complete 12-channel systems can be mounted on one standard rack!

Lenkurt's new Type 45A Carrier will "prove in" where carrier could not be used economically before. Even if you have never used carrier, it will pay you to get the facts on Type 45A. Write us today!

AUTOMATIC ELECTRIC

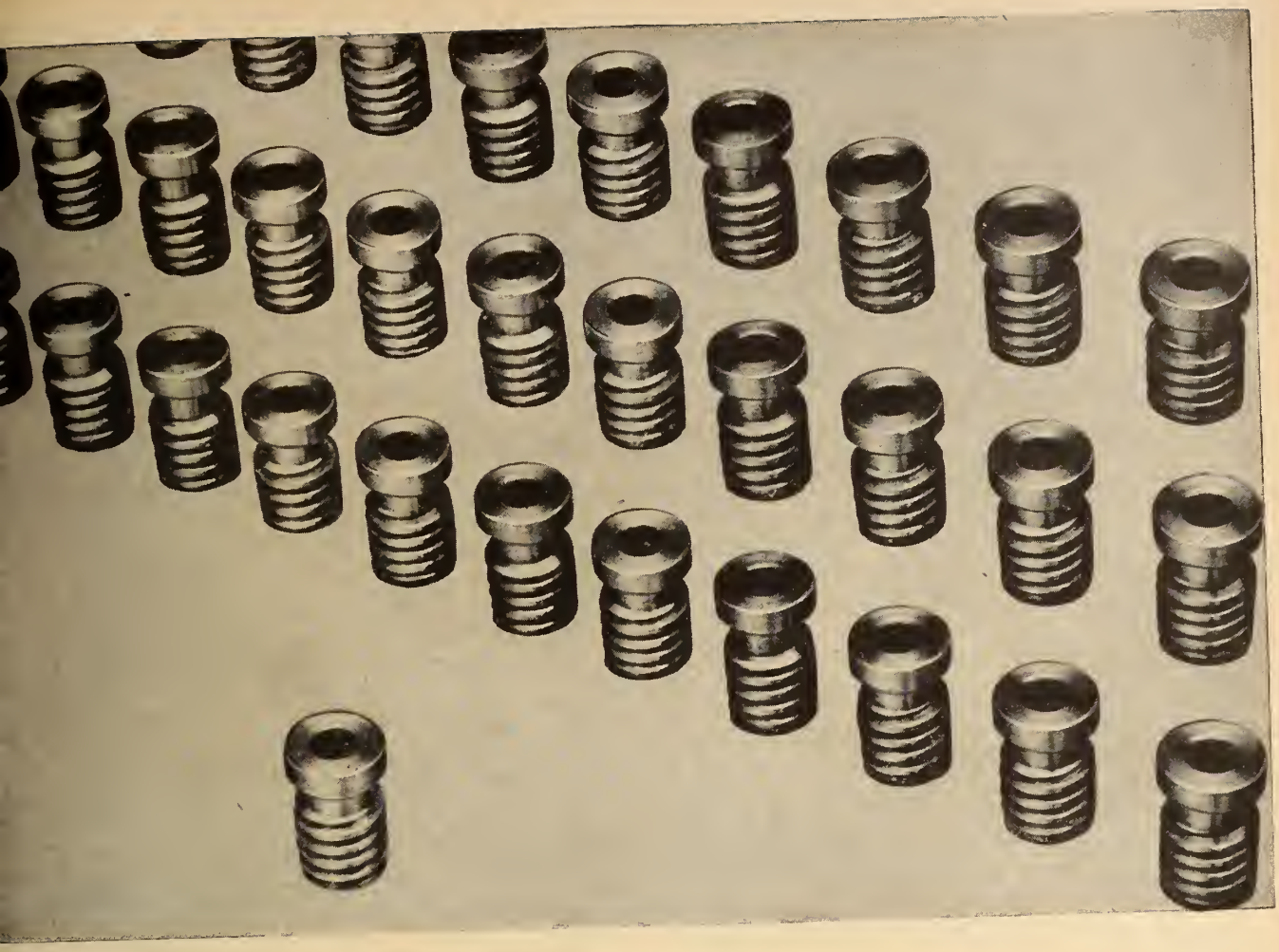
(CANADA) 1953 LIMITED

Distributor in Canada

AUTOMATIC ELECTRIC SALES (CANADA) LIMITED

Head Office 26 Hollinger Road, Toronto 13

MONTREAL • OTTAWA • BROCKVILLE • HAMILTON • WINNIPEG • REGINA • EDMONTON • VANCOUVER



"ALL PRESENT AND CORRECT, SIR!"

When the job is completed, Wallaceburg Brass Limited "call the roll".

All parts within limits specified, the desired quality maintained, quantity correct — and delivery made *on time*. "All correct" is the usual report we make to the customer. Wallaceburg Brass Limited has a growing reputation for *service* and *quality*.

How do we get it?

One reason is that we're happy to show what we can do — even on the "tough ones" — and to let you judge on the basis of performance.

With the most modern equipment available, with an experienced sales and work staff, and with a flexibility of approach, we have confidence in our ability to produce any part by the best method at a fair price.

Looking for a better source for screw machine products, sand castings, forgings or die castings? See the Wallaceburg people. Since 1905, we've had a reputation for giving customers *what* they want — *when* they want it!

DOMINION DIE CASTING LIMITED
Wallaceburg, Ont.

WALLACEBURG BRASS LIMITED
Wallaceburg, Ont.

MONTREAL, TORONTO, LONDON, CALGARY, VANCOUVER

DIE CASTINGS • SAND CASTINGS • FORGINGS
AUTOMATIC SCREW MACHINE PRODUCTS

FACTORY SERVICE

promptly available . . .

That's one of the big advantages of DH&S equipment. It can mean a lot in time and money saved.

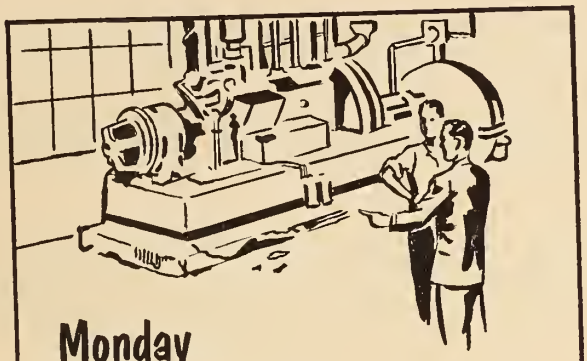
You can always count on it. When machines are delivered, factory-trained specialists go out with them to check their operation under actual working conditions, and to advise operators on the most efficient methods of handling and maintenance. Further regular checks are made from time to time by DH&S representatives. Then, when necessary, fully qualified and factory-trained service personnel are available to go to the site of the job and assure the speed and quality workmanship of any repairs.

A letter to P.O. Box 220, Montreal, will bring full information on DH&S Machines—available in a commercial range from 3/8 to 2 cubic yards dipper capacities and from 4 to 40 tons crane capacities—completely convertible (shovel, crane, dragline, clamshell, pull shovel, pile driver).

5202

DOMINION HOIST & SHOVEL
COMPANY LIMITED
MONTREAL D H&S QUE.
DIVISION OF DOMINION ENGINEERING WORKS, LTD.

"CIMENT FONDU saved us time and money!"

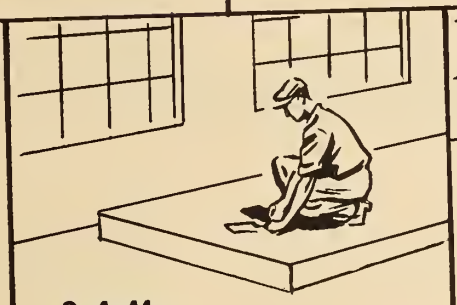


Monday

A new foundation was necessary, but it meant shutting down one department and holding up two others.

Tuesday

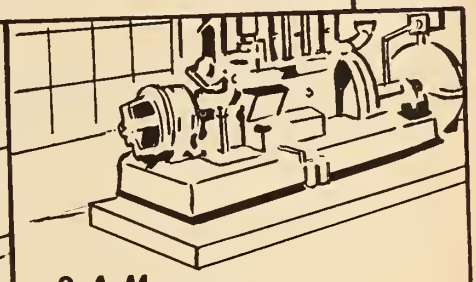
The big question was: How quickly could we do the jab. Decided to use Ciment Fondu — to get rock hard concrete in twenty-four hours. Forms were made ready to do the job.



8 A.M.

Wednesday — *Started*

Shut down the department: placed the concrete.



8 A.M.

Thursday — *Finished*

Department back in operation after a twenty-four hour shutdown. Ciment Fondu cost us $60 more than ordinary cement, but saved us at least $1,000 in production time.

Send for informative booklet on properties and uses of aluminous Ciment Fondu

ROCK-HARD IN 24 HOURS

Now, more than ever, it is essential to avoid costly production delays. Speed up concreting jobs — and make them more permanent too — by using Ciment Fondu. Ciment Fondu is the world-famous aluminous cement which attains a rock-hard strength sufficient for any purpose 24 hours after placing. No other cement approaches the speed with which Ciment Fondu gains its exceptional strength. Remember: *under no circumstances* is it necessary to allow more than 24 hours for the whole job.

Join the large companies from coast to coast and all over the world who find that the higher cost of Ciment Fondu is negligible when compared to the production time saved.

CIMENT FONDU
Reg'd Trade Mark
ALUMINOUS CEMENT

CIMENT FONDU LAFARGE (CANADA) LIMITED

Write, phone or call for FREE booklet outlining the unusual savings to be gained by using Ciment Fondu.

let our adhesive specialists solve your adhesive problems

plastic to metal

sealing

sound deadening

rubber to metal

plastic to wood

cloth to wood

packaging

Whether you make mops or airplanes, adhesive problems will crop up now and then on the production line. Some difficulties you might overcome with a little experimenting yourself. But then you'll never know for sure if you are getting the best possible results. To be really certain, turn the question over to our specialists. They'll either recommend one of our hundreds of standard adhesives or develop a brand new one especially for you. Then you'll be sure of fast, positive adhesion with consequent saving of time and expense.

1. *Sound deadening and protecting air conditioning duct work.*

2. *Sealing refrigerated display units.*

3. *Laminating plastic to wood or metal counter tops.*

Minnesota Mining & Manufacturing of Canada Limited
Att.: Technical Service, Box 757, London, Canada

Here's my problem . . . what do you suggest?

. . . . . .

. . . . . .

. . . . . .

When replying please send me the 26 page illustrated catalogue of applications and technical information on the 75 most used adhesives and coatings.

Name . . . . . Position . . . . . .

Company . . . . . .

Address . . . . . .

3M

ADHESIVES COATINGS & SEALERS

MORE THAN 1300 FORMULATIONS

MINNESOTA MINING & MANUFACTURING OF CANADA LIMITED · LONDON · CANADA

Sales Offices: Halifax Montreal Toronto Winnipeg Vancouver

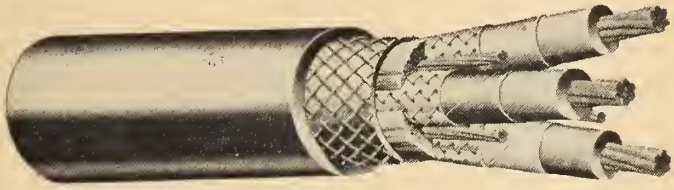
Resident Salesmen: Saint John Quebec City Ottawa Hamilton Windsor Regina Saskatoon Calgary Edmonton

Why CANADIAN GENERAL ELECTRIC uses Neoprene

These reports are from Canadian General Electric Company Limited which uses Neoprene under the trade name of "Geoprene".

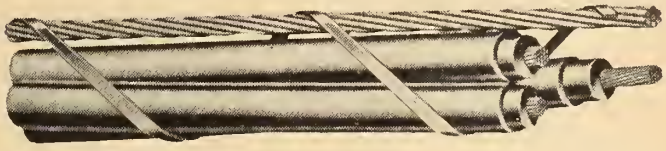
This cable is suitable for direct burial, and installation in conduits or ducts.

The neoprene jacket gives excellent resistance to oil, moisture, acids, alkalis and physical damage.



This type is designed for trailing cables for portable equipment and mine machinery on power supplies of 2000 and 5000 volts.

The neoprene jacket gives excellent resistance to abrasion and protection against physical damage.



This cable is designed for overhead distribution through heavily wooded areas, to reduce tree trimming costs and improve appearance.

The neoprene jacket resists abrasion, and the deteriorating effects of sunlight.

WIDE RANGE OF USES

Neoprene is a man-made product which resembles natural rubber but is far more resistant to heat, flame, flexing, abrasion, and to the action of gasoline, oils, grease, many acids and other chemicals, to sunlight and ozone. Therefore, Neoprene is superior to natural rubber—longer lasting, trouble-saving, money-saving—in a wide variety of applications.

C-I-L Chemicals
SERVING CANADIANS THROUGH CHEMISTRY

CH-53-38

Your rubber goods manufacturer or supplier will be glad to tell you more about the Neoprene products he supplies. Write for your free subscription to "Neoprene Notebook" which gives a wealth of technical information. Address:

CANADIAN INDUSTRIES LIMITED

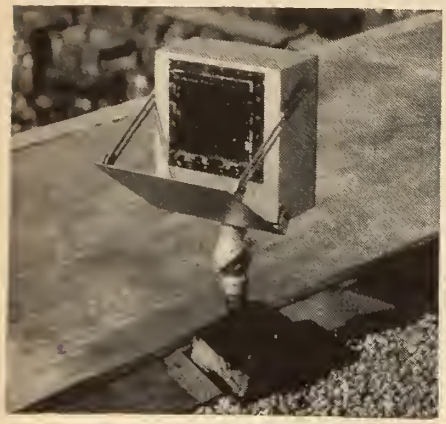
Chemicals Department, Box 10, Montreal

COMMERCIAL

Foils Foul Weather

Rain, sleet, hail, snow won't bother workers in Toronto's new Manufacturer's Life Insurance Building. Three photo-electric cells placed on the roof for West, South and East exposures measure the amount of sunlight and compensation is then made for the heat gain in the building's perimeter zones.

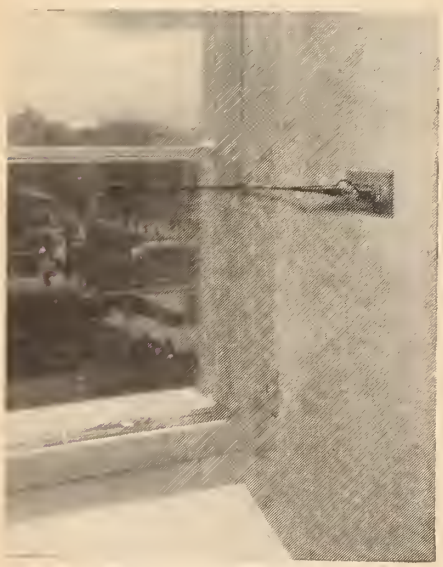
Recording and controlling the effect of cold winds on the building are the new window thermocouples. These



SUN LOAD COMPENSATOR

For sizing up the sun.

are placed in direct contact with the window-pane, one on each of the four sides of the building at the ninth floor, and signal to sensitive temperature recorders automatically calling for extra heat as soon as the temperature starts to drop on any side of the building. Perfect "indoor climate" working conditions result from this new heating and control system.



WINDOW THERMOCOUPLE

What's the wind say?

This is the first time that these two control elements . . . made by Honeywell of course . . . have ever been used in a heating system in Canada.

The designer of the heating and control system is G. Lorne Wiggs, senior partner of Wiggs, Walford, Frost and Lindsay who worked in conjunction with Charles S. Leopold head of Charles S. Leopold Associates, Philadelphia engineering firm. The architectural firm of Marani and Morris, designed the building.

INDUSTRIAL

Sticking Cigarettes

When you take the first satisfying puff of a cigarette and find your mouth full of tobacco, then that's the time to start looking around for another brand of cigarette to smoke. A prominent Canadian manufacturer had to face up to the annoying problem that his cigarettes were becoming unstuck. Notwithstanding the fact that they passed a rigid inspection . . . some faulty products were getting through.

One would hardly think that temperature control would have anything to do with cigarette manufacture. But, when it was finally traced down it was found that the glue which was being used as an adhesive was not being applied at the right temperature. Faulty adhesion was the result. The solution was quite simple, as so many of these problems are (to Honeywell). A Thermocouple was attached to the mixing paddle in the glue pot and this carefully controlled the amount of heat necessary to keep the glue at the absolutely maximum sticking temperature. Perfect smoking resulted here and similar Honeywell control is frequently used to guarantee and improve product quality.

MECHANICAL ENGINEERING

Mercury Switches Made Even Better

Honeywell Mercury Switches have hundreds of uses for circuit arrangements, various load capacity characteristics, sensitivity to tilt-angle, repeatability and resistance to high temperatures. And now they are even better! Honeywell Mercury Switches are now being cast into a solid block of plastic—no need to worry about bumps, accidental screw-driver jabs—here's a switch that can be rigidly screw-mounted to moving parts or pivoted on pins for tilt operation. For real rough service the case is metal—where damage danger is not so great moulded phenolic forms are used. There must be many uses for t new Honeywell Mercury Swi development.

Money Counting Made Easy

The perfection of a device for counti paper money was a long, difficult a costly operation. Not until the prec operation, small movement different and accurate repeat performance Honeywell Micro Switches we employed did money-counting beco easier. The use of MICRO switch made it possible to detect the presen of more than a single bill as the pap money passed through the counte MICRO'S development of a prop switch was the perfect solution. Su cessful use by many banks a financial institutions verify th complete dependability of the devic

Time after time, in everything fro great ocean liners to garbage dispos units, the use of Honeywell Mic switches is the guiding principle better design.

Get regular free copies of "MICR TIPS" the valuable idea periodic for engineers. Just write Honeywe Leaside, Toronto 17.

For Residential, Commercial, Industrial Controls

CALL AND COUNT ON

H HONEYWELL

MINNEAPOLIS Honeywell

First in Controls

LEASIDE, TORONTO 17

This advertisement is No. 4 in a series.

Galvanized wire makes it rugged . . . . *and Stelco knows all the twists.*

For exacting applications like this, Stelco produces an exclusive specialty wire known as "Zinc Tight" Electro Galvanized Wire. It will not crack, flake, or chip, even under severe bending, twisting, and crimping, and is available with a wide range of coating weights.

To illustrate the variety of galvanized wires produced by Stelco, here are some further examples: Hot Dipped Galvanized Wire, Galvanized Telephone Wire, Galvanized Rope Wire, Galvanized Wire for Stranding, and Drawn after Galvanized (D.A.G.) Wire. In addition, Stelco is regularly producing standard and custom specifications of all types of High and Low Carbon Wire for a vast number of end uses.

Stelco's immense experience with wire . . . far exceeding that of any other Canadian wire manufacturer . . . is at your disposal; and so, too, are the facilities of the three wire mills which together make Stelco the biggest wire producer in the country.

No matter how specialized your wire problem may be, it is more than likely that Stelco's Metallurgical and Engineering Service has met and solved a similar problem before. When next you need wire, call any Stelco Sales Office. You'll get complete co-operation in every way.

Stelco can solve your wire problems . . . over 5,000 case histories on record!

THE Steel Company of Canada, LIMITED

EXECUTIVE OFFICES STELCO HAMILTON - MONTREAL

53331.B.

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver, J. C. Pratt & Co. Limited, St. John's, Newfoundland

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information received by The Editor

Appointments and Transfers

New Dillon Office.—M. M. Dillon and Company, consulting engineers, 365 Richmond St., London, Ont. has opened a Toronto office. The office is located at 974 Eglinton Ave. W. It will be under the direction of Roy A. Crysler, M.E.I.C. *(See "Personals")*

●

W. A. Campbell

W. A. Campbell.—W. A. Campbell has been appointed a vice-president of Canadian Westinghouse Company Limited. Mr. Campbell's appointment to the position comes after a seven year association with the Company. He has taken a very prominent part in the expansion of the recent reorganization program carried out by the Company.

●

P. Fleming. — Paul Fleming has been appointed manager of the medical gas division of Canadian Liquid Air Company.

●

Decalcomania Changes. — F. Ralph Broad has been appointed president of Canada Decalcomania Co. Ltd. He has had over 25 years of service with the Company, starting as a sales representative in Australia. He was moved to Canada in 1931 when he joined the sales staff. He was appointed general manager in 1936 and managing director in 1938.

Harvey S. Hutcheon has been appointed sales manager. He succeeds Stuart N. Holland who has retired from active duties as the result of a serious automobile accident.

●

Petro Equipment. — Todd Engineering Co., Ltd., 2231 Bloor St. West, Toronto 9, has been appointed representative for the complete line of Petro oil and gas automatic heating and power equipment. Todd Engineering is headed by Mal Todd, formerly director of sales for Iron Fireman Manufacturing Company of Canada, Ltd.

●

Link-Belt Promotions. — Harold S. Fursman, formerly assistant general sales manager, has been appointed vice-president and general sales manager of Link-Belt. Ltd. He will make his headquarters at the Company's general offices at Scarboro, Ont. He succeeds Peter G. Welford who retired, recently. Mr. Fursman has been with the Company since 1944 when he entered the engineering department. He has had over 20 years of experience in various engineering firms in Canada and the United States. He was transferred to sales work in 1947 and served as sales manager of the Ontario division, and later, as assistant general sales manager.

●

New Brown Boveri Offices. — Brown Boveri (Canada) Limited has moved to new offices at 1015 Beaver Hall Hill. Montreal 1. New telephone number is University 6-4961. This move has been brought about by the need for space to accommodate expanding staff.

●

D. C. Olson.—D. C. Olson has been appointed representative in the Fort William and Port Arthur areas, of the automatic centrifugal clutch manufactured by BLM Automatic Clutch Corporation. Mr. Olson was formerly mechanical superintendent for the Abitibi Pulp and Paper Company Limited. His headquarters will be at 2024 Hamilton Avenue, Fort William, Ont. N. Bruce Wilson is president of the company.

●

D. C. Olson

Timber Co. Name Change. — Timber Structures Western Ltd., is the new name of the Company formerly known as Timber Structures of Canada Ltd. The address has also been changed to 400 Ewen Avenue, New Westminster. B.C. The old Company was located at 817 West Hastings St., Vancouver. B.C.

●

E. J. McDermott. — E. J. McDermott has been appointed secretary-treasurer of Railway and Power Engineering Corporation Limited and Dominion Wheel and Foundries Ltd.

●

Every rivet must do its job

Getting the rivets into the holes is a spectacular and important phase in steel erection, which requires an organization staffed by skilled and experienced personnel using the most modern equipment.

Other factors, unseen, but just as important are:

- Each riveted joint must be carefully designed to ensure adequate strength throughout the structure.
- All load transferences must be correctly made.
- Workmanship and materials must satisfy the most exacting standards.

Our reputation is based on the *unseen qualities* which are built into every project bearing the slogan:

"STEELWORK BY DOMINION BRIDGE"

Addition to new General Post Office building, Montreal.

Architect: J. J. Perrault

Contractor: Charles Duranceau Ltd.

STRUCTURAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED
Established 1882

*Other Divisions:
BOILER • MECHANICAL • PLATEWORK • WAREHOUSE

Plants at: MONTREAL, OTTAWA, TORONTO, WINNIPEG, CALGARY, VANCOUVER

Assoc. Companies: AMHERST, QUEBEC, SAULT STE. MARIE, EDMONTON,

Josam Move.—Josam Canada Limited, Howard F. Paget, managing director, has moved to new quarters. Their new premises will be known as the Josam Building and are located at 130 Bermondsey Road, Toronto 13.

●

H. G. Acres. — An interest in H. G. Acres and Company, consulting engineers, of Niagara Falls, Ont. has been acquired by the Fluor Corporation of Canada Ltd. Announcement was made by S. W. Andrews, M.E.I.C., president of the Company.

The Fluor organization is one of the world wide subsidiaries of the engineering and construction firm, The Fluor Corporation, Ltd. of Los Angeles, Cal. No change in name, policy, management or personnel of the Acres Company is contemplated.

●

Marine Industries Appointment. — Douglas O. Price has been appointed manager of the new Toronto regional office of Marine Industries, Ltd., heating division. The announcement was made by Omer E. Guevremont, manager of the division. The Toronto office will be the Ontario headquarters for distribution of Dravo Counterflo heaters, which are made in Sorel, Que.

●

Defence Production. — The following change has been made in the Department of Defence Production. R. D. Macdonald has resigned. Mr. Macdonald was one of the first representatives of Canadian industry to be assigned to duties in the Department of Defence Production. In 1949 he was assigned to duties in Washington and 1952 he returned to Ottawa as assistant director of aircraft division. Commenting on Mr. Macdonald's return to private industry the Honourable C. D. Howe, Hon. M.E.I.C., stated "during his four years with the Canadian government, Mr. Macdonald, through his knowledge of industry and experience in government work, has assisted materially in the progress that has been made in the Canadian production program".

●

Crane Changes. — James B. Flanagan has been appointed manager, wholesalers' sales, of Crane Limited and subsidiary companies.

Mr. Flanagan joined the Company in 1919 on his return from overseas service with the Canadian Army. With the exception of five years spent in business for himself, in the construction industry, he has spent the intervening years in various sales and managerial positions with Crane in the Montreal area, latterly as manager of Warden King Limited.

A city councillor, Montreal, for four years, 1940 to 1944, Mr. Flanagan has always played an active part in community affairs.

John A. Lang succeeds Mr. Flanagan as manager of Warden King Limited. J. A. Sullivan will continue as sales manager of Warden King Limited.

●

Turnbull Elevator. — M. O. Simpson, president of Combined Enterprises Limited, has announced that his Company has purchased Turnbull Elevator Co. Limited.

Mr. Simpson said that with the exception of representation on the board of directors, there will be no change in management or policy. Mr. Simpson has been elected chairman of the board and W. G. Turnbull will continue as president of Turnbull Elevator Co. Limited.

Directors of the company are: M. O. Simpson, W. G. Turnbull, M. C. Stafford, R. L. Williams, H. M. Hall, H. C. Walker, Q.C.; M. O. Simpson, Jr. The following executive positions will be held: M. C. Stafford, general manager, H. M. Hall, controller, A. E. Cutler, secretary-treasurer, M. O. Simpson, Jr., assistant secretary-treasurer.

●

Wales-Strippit Moved. — Wales-Strippit Corporation of Canada Limited, a subsidiary of Wales-Strippit Corporation of North Tonawanda, New York, has moved to 1105 Main Street east, Hamilton, Ontario. The announcement was made by J. A. Ringer, Canadian division manager. The Company was located at Bowser Building, 345 Sherman Ave. N., Hamilton, before moving to the new premises which have been acquired to "provide greater accessibility for our customers since we will be the sole occupants".

●

Dominion Bridge Contract.—Dominion Bridge Company, Limited, of Montreal has been awarded a contact for furnishing, fabricating and erecting all the structural steel for the new $20,000,000.00 "Terylene" plant at Millhaven, near Kingston, Ontario. Over $1,000,000.00 worth of steel will be required for the plant which is being constructed for Imperial Chemical Industries of Canada Limited.

●

New Perkins Diesel. — F. Perkins (Canada) Limited, has announced a new 60 h.p. Diesel engine. This engine has been designed for driving generating sets, pumps, compressed air equipment and welding sets. It can also be adapted to operate stone crushers, road rollers, graders and shovels.

Known as the Model L-4, it is a four cylinder, light-weight, high-speed engine which will develop 60 h.p. at 2,000 r.p.m.

The new engine incorporates the famous Perkins "Aeroflow" system of combustion. This system has a combination of the "direct injection" and the "indirect injection" systems. It has the advantages of cold starting and low heat losses, with good fuel consumption and excellent engine flexibility.

The new engine has a bore of a 4½", a stroke of 4¾" and a normal speed range of 1000/1800 r.p.m. It has prefinish wet cylinder liners and prefinish bearings. S.A.E. standards are incorporated throughout and 12 volt electrics provided.

●

Gold Production.—Gold brick number one thousand was poured at the Consolidated Mining & Smelting Co.'s Con Mine, Yellowknife, N.W.T. on June 19th. The event was of historic interest since a new chapter in Canadian mining was opened fifteen years ago, at the same mine, with the pouring of the first gold brick in the North West Territories.

●

Cross Channel Cable.—British Insulated Callender's Cables Limited, has been awarded the contract for the sea trials in the cross channel cable project announced recently, by the British Electricity Authority.

After extensive tests have been carried out on the cables and joints, they will be recovered from the sea bed and be returned to the works for further testing. It is expected that the final tests will be completed by the end of this year.

●

New Brockville Factory. — Automatic Electric (Canada) 1953 Limited, has announced it plans to construct a modern factory building in Brockville, Ontario. The Company has reached agreement with Brockville, Ontario, on the acquisition of twenty-three acres of land at the north-west town limits. Arrangements are being made for the construction of a siding by the Canadian Pacific Railway.

T. Pringle & Son Limited, consulting engineers, have been retained to design a modern structure of about one hundred and twenty-five thousand square feet. This will permit much needed expansion of the present manufacturing facilities.

Charles A. Funk, superintendent of telephone manufacturing operations for the organization since 1948, has been named production manager. E. R. O'Kelly, associated with the Automatic

New Equipment and Developments

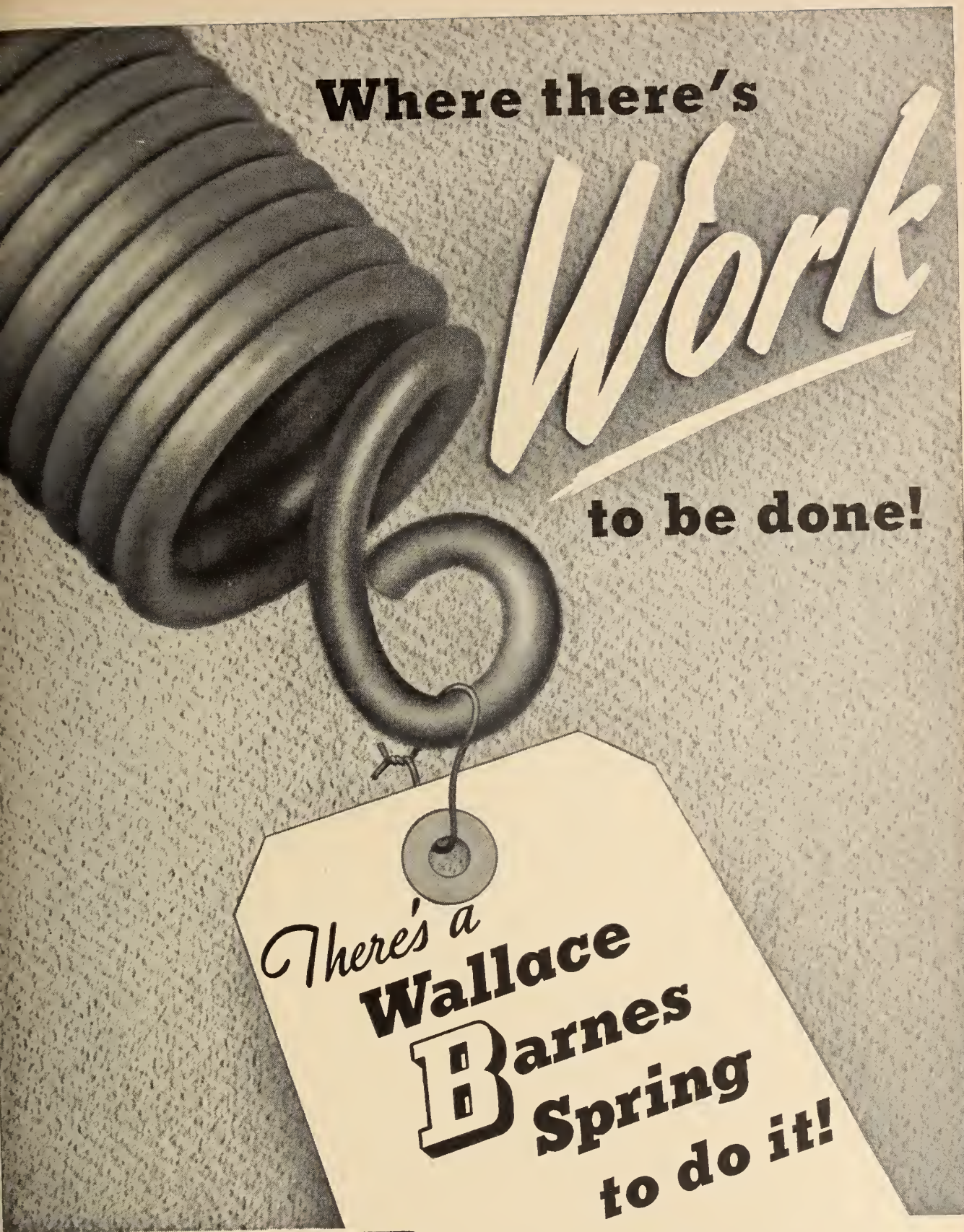
New Indicator. — The Foxboro Company, Foxboro, Mass., who are represented in Canada by Peacock Brothers Limited, have announced a new ribbon-type indicator for graphic panel use.

The indicator receives pneumatic measurements from a transmitter located at the process. This force is applied to a sensitive receiver bellows which, through a lever and stainless steel tape arrangement, rotates two lightweight drums. A brightly colored nylon tape, wound on the drums, is thus drawn behind a glass pane on which gradnations are printed. The clearly defined readings make internal illumination unnecessary, thus simplifying installation and reducing maintenance.

The indicator scale measures only ¾" by 4¼". All component parts are mounted on a removable chassis and protected by a housing which is secured to the back of the panel. The complete mechanism can be removed from its housing for service without disturbing the scale, case or panel. Zero, range and damping adjustments are also readily accessible.

The instrument is available with single or dual indicating scales and can be adjusted for direct or reverse response to measurements, as desired. Alarm contacts of the mercury switch type are optionally provided.

●



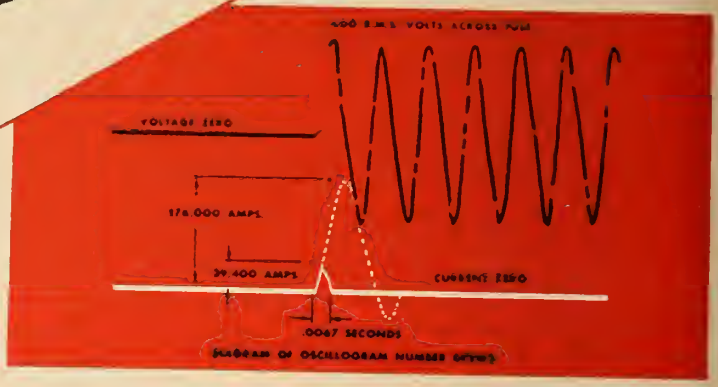
Wallace Barnes Springs

Hamilton, Ont.

The Wallace Barnes Company, Limited

Western Agent: E. A. Tipping, 957 Notre Dame Ave., Winnipeg, Man.

HIGH RUPTURING CAPACITY
Non-Deteriorating FUSEGEAR



OUTSTANDING FEATURES

- HIGH RUPTURING CAPACITY
- NON-DETERIORATING
- CURRENT LIMITING
- HIGH SPEED OF OPERATION
- ACCURATE CALIBRATION
- ACCURATE DISCRIMINATION
- LOW OPERATING TEMPERATURES
- VOLTAGE SURGE LIMITATION

The complete range from 2 to 600 amperes of English Electric 600 volt A.C., H.R.C. fuse complies with C.S.A. specification C22.2 No. 106. The test record shows that a 400 ampere fuse limited an available fault current of 176,000 amperes to 39,400 amperes on a 600 Volt A.C. system. All English Electric H.R.C. fuses are current limiters.

CSA Approval No. 12203

Write for publication A5344

'ENGLISH ELECTRIC'

Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

English Electric Company of Canada Limited — Head Office and Factory: St. Catharines, Ontario

PA5301-C

ectric organization since 1937, has en appointed secretary and treasurer d director of Automatic Electric Canada) 1953 Limited and of its sales filiate Automatic Electric (Canada) mited. Walter W. Ashforth, assistant ief telephone engineer since 1948 has en named chief engineer.

●

Vakefield Expansion.—J. A. Campbell, resident of the London, Ontario, hamber of Commerce, has announced at Wakefield Lighting Limited, has ken temporary offices at 609 Huron nd Eric Building, London, preparatory manufacturing lighting equipment a building now under construction.

The chairman of the board of the ew Company is A. F. Wakefield, presi- ent of F. W. Wakefield Brass Com- any, Vermilion, Ohio. The president of he Canadian company is T. D. Wake- eld, who is a vice-president of the . W. Wakefield Brass Company. The ice-president is Ralph A. Yates, 758 onge Street, Toronto who is in charge f administration and sales.

The Canadian company will make ll types of Wakefield equipment sup- lied throughout Canada since 1936 by he Canadian General Electric Com- any, Limited, Toronto.

●

R. H. Davis Honoured. — More than 2,000 employees of Atlas Steels Limited presented R. H. Davis, president, with a portrait plaque of himself inscribed in stainless steel to commemorate the twenty-fifth anniversary of the Company.

C. L. Bailey, vice-president, made the presentation at a mass meeting of employees.

●

New M-H Office.—Minneapolis-Honeywell Regulator Co. Ltd., recently opened its new Montreal offices at 6277 Upper Lachine Rd.

●

New Exide Plant Operating. — Manufacturing operations have begun at the recently completed Exide Batteries of Canada Limited plant on Warden Ave. in Toronto. Occupying 75,000 square feet of floor space, it is the largest and most modern plant in Canada devoted exclusively to the production of industrial storage batteries.

●

Reliance Reorganization. — Reliance Electric & Engineering (Canada) Ltd., started work at the end of June on an extensive rearrangement and modernization program scheduled for completion in September. The purpose of the program is to provide separate manufacturing areas for each of Reliance's main products — motors and transformers — by rearranging present plant equipment. Included in the program is an addition of over 10,000 square feet of space which will contain new production offices and other production facilities. In the creation of the two separate production areas, considerable new machinery will be installed. All line shafting will be eliminated and individual drives will be fitted.

In the renovation of the factory a new 1500 KVA substation is being constructed and the plant's electrical power will be changed from 25 to 60 cycles.

Vice-president and general manager is George E. Bevis, who has directed the Company since it took over operations, from the former Commonwealth Electric Corporation, in September 1950.

●

Monsanto Tape.—Leo E. Ryan, executive vice-president of Monsanto Canada Limited has announced that the Company is now producing a new high quality industrial tape made from Monsanto vinyl film. Manufactured and sold by Barringham Rubber and Plastics Limited, Oakville, Ontario, a Monsanto subsidiary, this new industrial tape will be sold for use as coil and cable insulation, in oil-filled transformers and a protection against corrosion of underground piping, weatherheads, and similar installations.

●

Aluminum Contract. — After earmarking 60% of their production for defense and government stock-piling, aluminum's Big-Three in the U.S. (Alcoa, Reynolds, Kaiser) cannot meet booming U.S. civilian demand. During the first week of June Aluminium Limited closed deals with Alcoa and Kaiser to supply them with 713,000 metric tons of aluminum during the next five years. The price is more than $300 million.

Aluminium Limited now has an assured market for the output of its Alcan subsidiary's huge $550 million Kitimat plant in northern British Columbia. In view of the new orders, Aluminium Ltd., has already authorized additional work at Kitimat to double smelting facilities.

●

B-A. Shawinigan.—On May 27th the first plant of its kind in the world—to produce phenol and acetone from petroleum, through oxidation of cumene, was opened by the B.A. Shawinigan Limited.

The new B-A. Shawinigan Company, with its $4,000,000 plant is owned jointly by Shawinigan Chemicals and British American Oil Company Limited. The plant is located in Montreal East, adjacent to a British American refinery.

●

Richard L. Hearn Plant.—The fourth unit at Ontario Hydro's Richard L. Hearn steam generating station in Toronto, largest plant of its kind in Canada is now delivering power into southern Ontario. Its operation marks the completion of the four-unit installation authorized for this station, which was officially opened in October, 1951.

The Richard L. Hearn station now has two units operating at 25 cycles and two at 60 cycles. As Hydro's frequency standardization moves forward, the 25-cycle units will eventually be converted to the higher frequency, giving the station a four-unit installed capacity, at 60 cycles, of 536,000 horsepower.

●

Water Conditioner. — The Permutit Company of Canada Ltd. has available a package water conditioner designed to remove turbidity, color, and organic matter, from water supplies, to chlorinate, to remove bad tastes and odours, to remove iron and manganese, to neutralize, to soften, to de-alkalize.

The plant supplied, a complete package, forms an extremely versatile and self-contained unit which is available in eight standard sizes ranging from 500 to 3,300 gallons per hour and flows of 12,000 to 79,200 gallons per 24 hours. Larger capacities can be furnished on request.

Each complete water conditioner consists of a precipitator with a built-in clearwell, a proportioning chemical feeder control, a coagulant feeder tank, a lime or soda ash and hypochlorite feeder tank, and inlet float control valve, Neutralite filter unit, Carbo-Dur purifier unit and a service pump.

●

Aircraft Gift. — When H.M.C.S. Magnificent arrived in Halifax recently she carried two jet engines the gift of the United Kingdom through the Ministry of Supply to the department of mechanical engineering at the University of Toronto.

The engines are two gas turbines, one of the axial flow type (a Rolls-Royce Derwent) and the other of the centrifugal type (a Metropolitan Vickers Beryl). Delivery of the gift in Toronto was taken on behalf of the University by Professor E. A. Allcut, M.E.I.C., of the department of mechanical engineering.

●

New Conveyor Belt.—A patent covering a new conveyor belt designed to carry hot materials has been issued to the B. F. Goodrich Company. Feature of the new construction is a nylon cord breaker embedded in the thick rubber cover of the belt to resist heat damage and extend the service life of the cover.

The nylon cords reinforce the rubber cover, resist formation of transverse cover cracks caused by heat and prevent the penetration of such cracks to the carcass. The extensible, heat-resistant nylon cords stretch with the rubber cover when the belt is flexed as it moves around the pulley. For further information write to the B. F. Goodrich Rubber Company of Canada, Ltd., Kitchener, Ont.

●

Fuse Links.—A complete line of the new EEI-Nema standard distribution fuse links, which are electrically and mechanically interchangeable with other makes of EEI-Nema standard fuse links, has been announced by the apparatus division of Canadian General Electric Co.

●

Dominion Oxygen Plant. — Dominion Oxygen Company Limited, has decided to build a plant on the Kaministiquia River at Fort Williams. It is their intention to erect a modern plant for the production and compressing of acetylene and oxygen. It is expected that the plant will be in operation late this year.

●

Welding Transformer. — A new 400-ampere single-phase a-c welding transformer with a 60 per cent duty cycle has been announced by Canadian General Electric Company's welding department. Designated as the G-E Type WK40K, the new welder provides a current range of 40 to 500 amperes. It can be used with a variety of electrode sizes for repair, maintenance and construction work.

The new welder is 44 inches high, 22⅝ inches in diameter and weighs 355 lbs.

●

Asbestos Ore. — The Canadian Johns-Manville Company has purchased an

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2. **POSITIVE** The element of H Error, is reduced to a minimu steel structures.

3. **UNIFORM** Every process in the ing of steel is controlled and t scientificolly.

4. **LASTING** Steel structures last definitely.

5. **ADAPTABLE** Steel structures themselves readily to quick cha in layout or design.

6. **SALVAGEABLE** Steel Structures h high salvage value with low rem cost.

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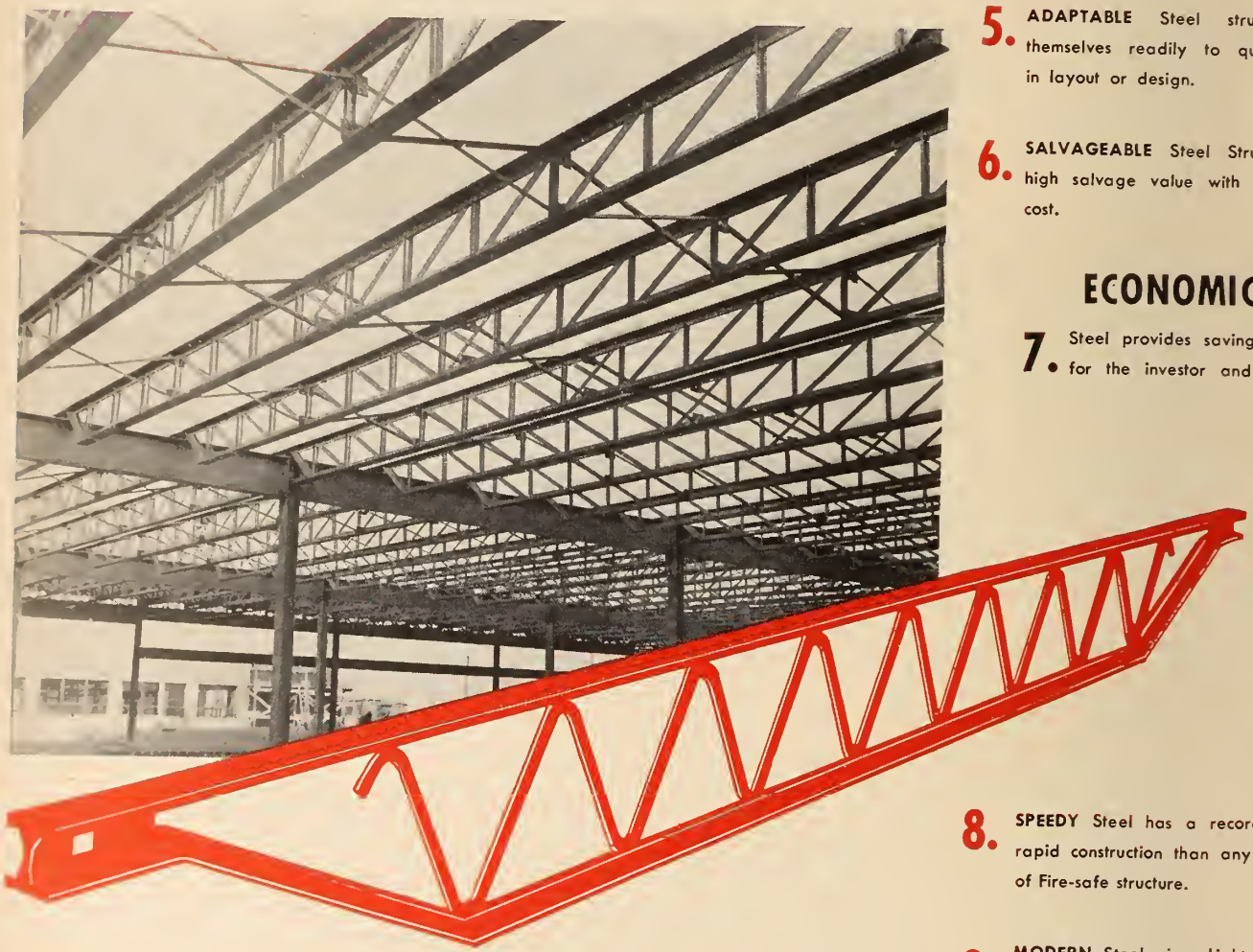

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additional asbestos ore deposit in Reeves Township, Ontario.

The property was bought from J. Courtney Bromley of Foleyet, Ontario.

Commenting on the purchase, Karl V. Lindell, vice-president and general manager of the Company's asbestos fibre division, said, "There is no need at the present time to establish production facilities at the new site because there is ample asbestos fibre production in Canada and in other areas of the world. Production of and demand for asbestos fibre are now in balance and our forecasts indicate that this situation will continue for some time. This is due primarily to the fact that other asbestos fibre producers in Canada, as well as Canadian Johns-Manville, have increased their production facilities in recent years or are currently expanding them. The purchase of the asbestos ore bodies in Reeves Township is in keeping with Canadian Johns-Manville's long range program to maintain adequate sources of asbestos ore for many years to come and to assure the free world of ample reserves of this strategic mineral.

●

Canadian Trade Fair. — Greater buyer participation was the success keynote at the Canadian International Trade Fair in Toronto. The sixth—and most successful—Fair attracted 28,179 business visitors from 59 countries. This was an increase of 3,650 over last year. The Canadian registrations at 25,394 were up 2,400 and U.S. business visitors totalled 2,182, more than double last year's number. Every province in Canada and 40 states in the United States were represented by business visitors. Public attendance on the three "open" days totalled 29,791.

Twenty-seven countries participated and there were 1,474 exhibitors in all. Canada was the major user of space, followed by England, Germany and the United States. The total space booked was 264,843 square feet as compared with 190,000 square feet in 1952. The products displayed covered 19 trade groups.

●

Garlock Packing Rings. — Back-up Rings, spirally machined of Tetrafluoroethylene have been designed by the Garlock Packing Company to prevent extrusion of "O" rings. The "Teflon" rings have a high impact strength at temperatures of from minus 100° F. to 500° F. They are non-corrosive, non-adhering, non-fraying and inert to most chemicals and self-lubricating. They are made for all "O" ring sizes to AN drawing 6227 and 6230. For further information communicate with The Garlock Packing Company of Canada Limited, Toronto, Ontario.

●

Canada and Everest. — A Canadian sleeping bag designed to beat the Arctic cold was part of the equipment of the British team that conquered Mount Everest recently. At the same time the sleeping bags which were designed by Fred van Veen of Ottawa, were being used at Mount Everest, a prototype was on exhibition at the 82nd annual general meeting of the Canadian Manufacturers' Association in Toronto. It was one of the 46 Canadian manufactured products winning this year's design merit awards to industry sponsored by the National Industrial Design Committee.

●

Printed "Wire" Circuits. — Engineers in the Appliance-Electronics Division of Canadian Westinghouse Company Limited in Hamilton have been experimenting with the new technique in "printed wiring" circuits for some months. Satisfactory tests have been concluded and the new process will be incorporated into regular fall production of receivers. These important new developments in radio and television manufacturing, the first major changes in recent years, will eliminate the human error factor from main assembly stages, and result in greatly increased production.

Hundreds of soldering operations will be eliminated by replacing the complex wiring with a pattern of thin copper foil. This is done by bonding a sheet of the metal to a plastic base and using photographic negatives and an acid etching solution to print the desired circuit on the case. Excess metal is removed by the etching method. The remaining pattern appears as a winding path of copper on a base 3/1000 of an inch in depth about 3/32nds of an inch in width.

●

New PEN-cil.—Venus Pencil Company Limited, has introduced a new product known as the Velvet Ball "PENcil". It is designed for all general office (and legal) writing. It uses a new, fully approved, permanent ink and has a precision built ball point cartridge which controls ink flow. The ink will not leak, fade, smear or flood. The new "PENcil" is available at all local dealers.

●

Huge Nickel Order.—The International Nickel Company of Canada Limited announced, on June 1st, that it had signed a contract under which the United States government has purchased for quick delivery a total of 120,000,000 pounds of metallic nickel and 100,000,000 pounds of electrolytic copper. The contract is with Defence Materials Procurement Agency.

Deliveries under the contract will start this December.

●

Dominion Tar Expansion. — Dominion Tar & Chemical Company, Limited, has announced plans for an expansion of its Fibre Conduit Plant in Cornwall, Ontario. Construction is scheduled to start in August of this year. The total expenditure will be approximately one and a half million dollars, and will result in a major increase in the production of the various types of fibre pipe.

●

Diesel Display.—A special display van, including the five engines in the new Lister "FREEDOM" Range of diesel engines, plus a thirty minute sound film in colour will make an extensive tour of Canada, the United States and later South America, South Africa and the far east. Information regarding the expected time of arrival of this special van in the various centres across Canada can be obtained from Canadian Lister-Blackstone Limited, 1510 Drummond Street, Montreal, Que.

●

C.G.E. in West. — Canadian General Electric Company, Limited has completed the purchase of a 13-acre industrial site on Broadway Avenue East, at Nootka, Vancouver. The property was owned by the Pacific Mills Limited.

Present plans call for the development of a portion of the property for warehousing purposes, the first step in a long-range program aimed at the eventual transfer of C.G.E.'s Vancouver operations to the site. It is anticipated that some of the Company's operations will be located at the new site this summer. The C.G.E. office in Vancouver will continue at their present location at 1095 Pender St. W.

●

Motor Starters. — Canadian General Electric has announced a new line of AC Magnetic Motor Starters, CEMA sizes 1 and 2, for use with motors up to 25 h.p., 600 volts.

These starters, incorporating "vertical lift" operation, have a "strongbox" coil with the coil windings completely embedded in Permafil and mounted on a phenolic spool body which gives positive protection against damage.

Arc chutes and contact blocks are of alkyd in size 1 and asbestos cement in size 2. These starters are available in all standard CEMA forms and enclosures.

●

Federal Sales Tax. — "Failure to carry out Federal policy so that all construction materials are exempt from the 10% sales tax has resulted in general confusion as well as constituting a factor in increased construction costs." This statement was made by S. D. C. Chutter of Ottawa, Manager of the Canadian Construction Association, to members of the Canadian Builders' Supply Association while gathered in Montreal on May 11, 1953.

Mr. Chutter also stated "While most of the main construction materials were freed from the tax by a 1945 Order-in-Council, hundreds of items are still subject to the tax—notably nails, electrical fixtures and wiring, structural steel in many instances, pipe and pipe fittings, many hardware and roofing materials, built-in-millwork, fixtures and mechanical installations."

Covering the increase in building cost the speaker said "It has been conservatively estimated that over 1% of the cost of an average house is due to the federal sales tax on building materials used in its construction." The total for institutional buildings is considerably higher—around 5% to 6%. Only hospitals enjoy a blanket exemption from the tax. Referring to incongruous rulings Mr. Chutter gave the following examples: Bath tubs are exempt but connecting pipes are taxable. Screen doors are exempt but screen windows are taxable. Concrete forms made on-site are exempt but if made in a mill they are taxable. Cupboards doors are exempt but complete cupboards are taxable, except in the case of sinks. Transformers used inside a power station are exempt but those used on a pole in the street are taxable. Metal roofing is exempt but asphalt roofing is taxable. Paints are exempt but waterproofing compounds are taxable. Glass is exempt in office doors but taxable in elevator doors. Steel is exempt when used in the framework of a building but taxable when used in the support of a bridge, subway or dam. Drain or weeping tile is exempt when sold to farmers but is taxable if used for housing or other building construction drainage. Parquet and asphalt flooring is exempt but clay flooring tile is taxable. Complete plumbing units are exempt but parts are taxable. Concrete hardening aggregates incorporated in floors are exempt but hardeners applied to floor surfaces are taxable. Electric lights and fixtures are exempt if part of production equipment

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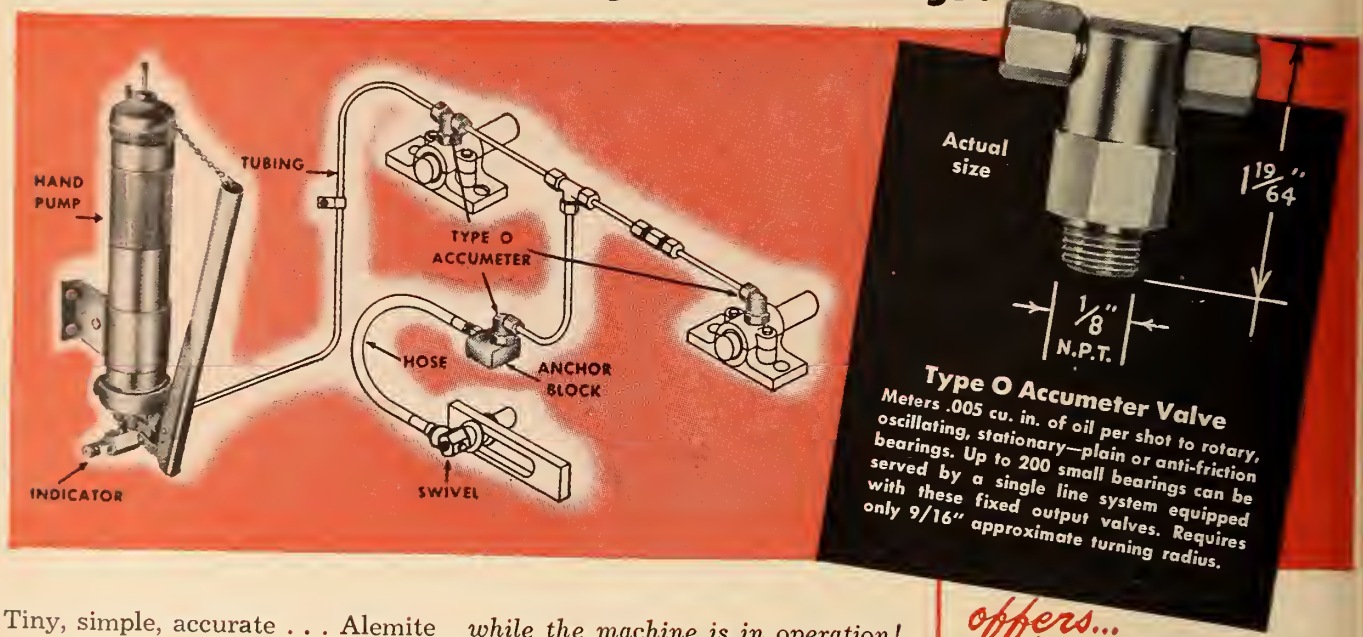

Tiny, simple, accurate . . . Alemite Accumeter Type O Valves make it easy to design low-cost centralized lubrication into small machines, precision machines, *any* machine having many small bearings concentrated in limited space!

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- Prevents beoring troubles due to neglect or use of wrong lubricont.
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Proved in the field. Exhaustive tests showed *no variation* in the amount of lubricant discharged . . . even after 73,312 lubrication cycles, *equal to 122 years of twice-a-day service.*

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ut are taxable if used for normal lighting or heating purposes.

The speaker also said "The Canadian Construction Association has urged on numerous occasions that this "nuisance tax" and its present inconsistancies and accounting headaches be eliminated. Independent studies by the Canadian Tax Foundation have made similar recommendations". Administrative difficulties over the interpretation of the regulations were such that conflicting rulings were not uncommon.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Geological Report. — The Honourable C. D. French, Minister, Quebec Department of Mines, has released a new geological report on a section of the country bordering the Gatineau Valley in the Laurentians north of Hull and Ottawa. It is designated as Geological Report No. 50, on the "Kensington Area, Gatineau and Labelle Counties". It was prepared by E. Aubert de la Rue.

The area described covers about 400 square miles and extends from the Gatineau to the Lievre river. The town of Maniwaki is in its western part. It includes the whole or parts of the townships of Kensington, Bouthillier, Aumond, Robertson, Cameron, Wabassee, Egan, Maniwaki, Bouchette and Dudley.

Copies of the report, and an accompanying geological map, may be obtained from the Department of Mines, Parliament Buildings, Quebec City.

●

Foundation Bulletin.—The Foundation Company of Canada, Limited, publish, at regular intervals a publication "Foundation Bulletin". To be placed on the mailing list for regular receipt of this publication write to the Editor, Foundation Bulletin, The Foundation Company of Canada Limited, 1900 Sherbrooke St. West, Montreal, Que.

●

Tremco Brochure. — The Tremco Manufacturing Co. (Canada) Ltd., 220 Wicksteed Ave., Leaside, Toronto 17, offer a 32 page brochure entitled "Solving Roof Problems".

●

Industrial Design. — The National Industrial Design Committee has produced a brochure to describe and illustrate the award winners in the 1953 competition. This brochure may be obtained, for ten cents, from the Design Centre, Elgin and Albert Streets, Ottawa.

●

Power Conversion.—Canadian General Electric Company, Limited, offer a new eight-page bulletin on the complete line of G.E. Metallic Rectifier Power Conversion Units. Designated as GEA-5658B the publication lists the design features, advantages, description, performance, circuits, dimensions and ratings for the complete line rated from 125 to 250 volts d-c. It is designated as the bulletin on "Metallic Rectifier Power Conversion Units". Write to the Company for copies.

●

Russel-Hipwell News.—Russell Hipwell Engines, Owen Sound, issue, at regular intervals, a publication "Russel-Hipwell News". To obtain copies write to the Company at Owen Sound.

●

Rodney Hunt Catalogue. — Rodney Hunt Machine Company, Orange, Mass., has taken over a year to produce a 250 page 8½" x 11" comprehensive catalogue showing the full scope of Rodney Hunt water control apparatus. It consists of eight sections; sluice gates, timber gates, hoists, fabricated gates, racks and rakes, valves, and gives adequate engineering data. Included are hundreds of diagrams, photographs with detailed descriptions and specifications. The catalogue is printed in colour and bound in a permanent hard cover.

To obtain copies write, on your official letterhead, to Rodney Hunt Machine Company, 7 Water Street, Orange, Mass., and ask for catalogue WCA952.

●

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When hunters, naturalists and all those who enjoy scenic beauty look for Prism Binoculars, they choose Leitz—*famous for precision for over a hundred years.*

Illustrated is the 8 x 30 "BINUXIT" Standard Glass with centre-wheel focussing. Also available: "BINUX" with separate eyepiece focussing.

Ask your dealer for Leitz Binoculars or write for illustrated literature.

Leitz by E. LEITZ-WETZLAR

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Small Motors.—Canadian Westinghouse Company, Limited, has issued a bulletin headed Westinghouse Small Motor Selector. The subtitle is "Why There Are Different Types — What They Are — How To Select The Right One For The Job". To obtain copies communicate with the Canadian Westinghouse Company Limited, Apparatus Advertising and Sales Promotion Department, Hamilton, Ontario; ask for Bulletin No. BH 7140 (Filing No. H-2800).

●

Power Notes.—To obtain copies of the publication "Power Notes", which is produced by the Diamond Power Specialty Corporation, Lancaster, Ohio, communicate with the company.

●

Soil Testing. — A new 72 page catalogue recently published by Soiltest, Inc., describes and illustrates over 800 items of apparatus for engineering tests of soils, concrete and bituminous materials.

The extensive soil testing equipment section of the catalogue presents information on triaxial, consolidation, California bearing ratio, compaction, pore pressure, and all of the standard apparatus for field and laboratory engineering tests of soils. A special section is devoted to apparatus for chemical and agricultural tests of soils.

Write for Catalogue No. 53 and address requests to Soiltest, Inc., 4520 W. North Avenue, Chicago 30, Illinois.

●

Hico.—Hico, a new type of auxiliary support for construction of reinforced concrete or brickwork floor and ceiling structures, is described in a bulletin which may be obtained from W. V. Heyden, Atlantic Trading Company, 7576 Durocher Street, Montreal.

●

Control Apparatus. — Minneapolis-Honeywell Regulator Company, Limited, Leaside, Ontario, has just released an excellent publication covering the company's activities and describing its ever widening range of products. This 48 page booklet is profusely illustrated and gives, in very easily followed form, information which will be extremely useful to the engineer who is interested in control apparatus. To obtain copies communicate with the Company and ask for "Emphasis On Research".

●

"Vermiculite". — The Vermiculite Institute of Chicago has just issued a new 16 page booklet which presents all the recommendations covering proper requirements for vermiculite products. The title is "Recommended Building Code Requirements for Vermiculite Plastering, Acoustical Plastic, Fireproofing and Concrete".

These recommendations are based on standards of the American Standards Association, American Society for Testing Materials, and Vermiculite Institute. To obtain copies write to the Vermiculite Institute, 208 South LaSalle St., Chicago 4, Illinois.

●

Carrier Brochures.—The Carrier Corporation, 300 South Geddes Street, Syracuse 1, N.Y., have an extensive range of brochures designed to give the

engineer up-to-date information on their products. Write to the Company, stating your interest, to obtain copies.

●

Instrument Data. — The Minneapolis-Honeywell Regulator Company, Limited, Leaside, Toronto 17, has just released an instrumentation data sheet 10, 3-6, which describes the system for the measurement of the flow of molten metals such as sodium, lead bismuth and sodium potassium alloys utilizing a General Electric magnetic flow meter and the Brown Electronik recorder. To obtain copies write to the Company. Ask for Bulletin No. 10, 3-6 Unit Measuring System.

●

Iron Fireman Catalogue. — Iron Fireman Manufacturing Company, Canada Limited, 80 Ward Street, Toronto, Ontario, offer a 12-page catalogue in four colours which contains full information on Iron Fireman pneumatic spreader stokers, for bituminous, sub-bituminous, high fusion ash and lignite coals. To obtain copies write to the Company.

●

Novel Level Finder. — Foam Rubber Products Limited, 5465 Decarie Blvd., Montreal are Canadian distributors of an instrument known as the "Levelall". The instrument operates on the principle that water always seeks its own level. It consists basically of a sturdy flexible plastic tube containing a special freeze resistant fluid. When one end of the tube is applied at the required height, the instrument naturally registers when a similar height is attained at the other extremity. The tube being 75-feet long and very flexible allows effective use over rough and uneven ground such as might be encountered when levelling batter boards or preliminary survey stakes. For checking the level of concrete sills, floors and fills, the new level is unusually handy. The equipment is described in an excellent little four page bulletin which may be obtained by writing to the "Levelall", 1072 St. Lawrence Blvd., Montreal.

●

Hamilton Gear Data.—Hamilton Gear and Machine Company Limited, 950 Dupont Street, Toronto, have released a technical data sheet covering spur gears —internals or racks. To obtain copies of this, and other technical data sheets, simply send your name and address to the Company and ask to be placed on the mailing list for all releases.

●

Ciment Fondu Distributors.—A list of distributors of Ciment Fondu in Canada may be obtained by writing to Ciment Fondu Lafarge (Canada) Limited, Marine Building, 1405 Peel Street, Montreal 2, Quebec.

●

C.I.L. Documentary Film. — Canadian Industries Limited, Box 10, Montreal, have released a film which shows how Canadian chemists and engineers took waste smelter fumes and converted them into a product important to industry. The film is titled "The Stone That Burns".

Produced for Canadian Industries Limited the 20 minute "movie" deals with production at Copper Cliff, Ontario, of liquid sulphur dioxide. Such everyday items as matches, rubber, paper, rayon, pesticides, fertilizers, "Cellophane" cellulose film, cellulose sponges, coated fabrics, commercial explosives, sporting ammunition, petroleum products and sulpha drugs owe their origin, in part, to sulphur or its compounds.

The film points out that Canada has no sulphur deposits and that most of its sulphur has to be imported. The pulp and paper industry alone consumes 60 per cent of the imported sulphur which has to be converted into sulphur dioxide before it can be used. Nevertheless, there was enough sulphur, in the form of sulphur dioxide, pouring out of the stacks of Canadian smelters to meet the entire needs of Canadian industry. The film is available for showing. Requests should be directed to the Motion Picture Section of C.I.L. at the address given above.

●

Supplementary Lighting.—The Recommended Practice for Supplementary Lighting, to be used with the recently published Industrial Lighting Standard, has just been released by the Illuminating Engineering Society, 1860 Broadway, New York 23. The new recommended practice deals, primarily, with the many critical seeing tasks involved in fabrication and inspection for manufacturing processes and recommends lighting which supplements the general lighting systems. Copies, at fifty cents each, may be obtained from the Society.

●

Foster-Wheeler Boilers.—Foster Wheeler Limited, St. Catharines, Ontario, has issued an excellent Bulletin number CB 53-2 which describes their SA type steam generating units. Printed in two colours this fourty-two page publication gives a complete description of the SA boiler. All the important features are graphically illustrated. Also shown in the publication are typical installations in Canada. This booklet should be extremely useful to the engineer who is interested in boilers and their operation. For copies communicate with the Company at the address given above.

●

Street Lighting. — Canadian General Electric Company, Limited, 212 King Street West, Toronto, has produced a new two colour booklet describing the complete line of pendent type luminaires for modern street lighting. This thirty-two page Bulletin — GEC-936, describes design, construction, performance, applications and advantages of the G.E. line. It contains information on the G.E. Forms 45H7, 46, 72, 79, 101, 107, 108, 109 luminaires, and the Form 110 photo-electric units. Copies may be obtained by communicating with the Company.

●

Velan Catalogues.—Velan Engineering Limited, 6585 Jeanne Mance Street, Montreal, has issued two new general catalogues, No. 500 and No. 610. Catalogue No. 500 covers the Velan Universal Trap, and No. 610 shows the streamlined flow and capacity traps for the various types of patented Universal Velan steam traps. To obtain copies communicate with the Company.

●

Wild-Barfield Furnaces.—Wild-Barfield Electric Furnaces Limited, 72 Grenville Street, Toronto has recently produced a new catalogue on heat treatment furnaces. Wild-Barfield furnaces have been in use throughout the world for many years and constantly kept up-to-date by the introduction of the latest developments and techniques. Used universally for general tempering, secondary hardening of high speed steel, non-ferrous annealing and the heat-treatment of light alloys, Wild-Barfield furnaces provide precision heat treatment, and give efficient performance with minimum maintenance. To obtain copies of the brochure write to the Company.

●

C.L.M. Catalogue.—Canadian Line Materials Limited, Toronto 13, has recently issued a new catalogue No. 53-4, covering power connectors. This excellent publication — consisting of 88 pages — shows, in a concise form, the various power connectors made by the Company for cable, tube, for tube to cable, for bar, for expansion connections, for multiple connections, for grounding, and a section on "everdur" hardware is included. To obtain copies communicate with the Company.

●

Four Language Publications.—A new house magazine in four languages, for export use, was launched by Atlas Steels Limited early in June with several thousand copies made available at the International Trade Fair.

The rest of the first mailing of "Atlas Steel Topics", in French, English, German and Spanish have been sent to Atlas customers and prospects overseas.

Printed in two colours, 16 pages, 8 x 10, the text is handled by printing all four languages on the same page with one set of illustrations. The first article starts in German, the second in Spanish, the third in English and the fourth in French. This method of rotating languages is followed throughout the magazine to give each equal prominence.

To obtain specimen copies communicate with the Atlas Steels Limited, Welland, Ontario.

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Forano News.—Forano Limited, Plessisville, Quebec, issue, at intervals, a publication known as Forano Machinery News. A special edition was published for use at the Canadian International Trade Fair. The publication lists the various products manufactured by the Company and should be a helpful guide to prospective purchasers. To obtain copies communicate with the Company at the address given above.

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Fine New Film. — The International Harvester Company of Canada, Limited, 208 Hillyard Street, Hamilton, has recently sponsored an excellent documentary, all-colour film "Man With A Thousand Hands".

Produced by the Company as a tribute to the men of the construction field the film is Canada's story—a pictorial report of the Aluminum Company of Canada's mammoth British Columbia hydro-electric development programme.

The narrator is Raymond Massey.

The Company has announced that the film will be placed in general release within the next few months. *Journal* readers who are interested in seeing the picture are advised to communicate with the Company with a view to arranging for a showing.

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Treasure Under the Atlantic

by

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Sydney, N.S.

A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 20th, 1953.

Until quite recently the recovery of iron ore from known deposits and the discovery of new deposits was of interest only to those directly connected with steel-making. The general public was unconcerned—not interested. Iron ore had relatively little news value.

World War II, and developments since, have revealed to the public at large the important role played by steel-making in our mode of living. Today it is evident to all that our civilization rests on steel supply, and, inasmuch as the basic raw material from which steel is produced is iron ore, the public is now vitally conscious of this raw material, and acutely interested in where it comes from and how it is recovered.

Partly due to the probable immensity of the deposits, and to their being so far off the beaten track, the recent discovery of vast deposits of iron ore in Canada's Labrador has a dramatic appeal to all. This discovery in almost virgin territory, inclines one to overlook the fact that Canada already had within its confines one of the largest iron ore deposits in the world.

Even Labrador will have to prove up far more ore than thus far revealed before it begins to approach in immensity the deposit under the ocean off Canada's most eastern shores. Here is a deposit which has been worked for the past fifty-five years. The dramatic appeal of newer discoveries is at least matched by the glamour of a deposit hidden under the bed of the Atlantic, yet discovered by man and being worked by man.

Dosco's Wabana Mines in Newfoundland are the world's only submarine iron ore mines. They contain close to 4 billion tons of mineable ore, far exceeding iron resources yet found in Labrador.

First opened in 1895, slopes were driven under the ocean in 1910, revealing so vast a tonnage that a second pair of slopes were driven and completed in 1919. Modernization and electrification in prewar years raised capacity to 1.68 million tons yearly, but in 1949 full mechanization and a modern transportation system was commenced which, when completed, will raise the output to 3 million tons per year. In this paper the authors describe the new program in detail.

The deposit referred to is the Wabana Iron Ore Mines of the Dominion Steel & Coal Corporation, Limited. These mines are the largest and, insofar as we are aware, the only submarine iron ore mines in the world. They are located in Conception Bay, Newfoundland, and are mined from tiny Bell Island within that Bay, some 400 sea miles from the Dominion Steel & Coal Corporation's primary steel industry at Sydney, Nova Scotia, some 1,000 miles from Eastern United States seaboard, 1,900 miles from United Kingdom ports, and 2,240 miles from Rotterdam.

Here today, some 1,500 men are working, up to three miles offshore, 1,350 feet below steamers passing overhead. The roof over their heads is the ocean bed, and above that some 340 vertical feet of salt water. They work in temperatures which are equable and uniform the year 'round —recovering hidden treasure from under the Atlantic.

Geological Occurrence

The deposit occurs as a series of beds in the upper 1,200 feet of the exposed sedimentary sandstones and shales of the lower Ordovician. It overlays the Cambrian strata exposed on the shores of Conception Bay, and is contained in an area of 132 square miles controlled by the Corporation.

The ore is reddish brown in colour and classed as Hematite. The ore beds are primary sediments, probably derived from the weathering of earlier Pre-Cambrian and Cambrian sedimentary and crystalline rock, the particles being carried by streams and deposited on the floor of a calm, shallow marine sea.

The field has been badly faulted. Within the two major fault systems

lies a rectangular area adjacent to Bell Island, of some 70 square miles in extent. The effect of this faulting is evident in the ore itself, as it breaks readily into rhomboidal shaped blocks on lines parallel to the major faults and the bedding plane.

The analysis of the ore varies. Each bed has its own characteristics. Even different areas in the same bed show differences in iron and silica content, but the analysis of the mixture of ore extracted is very even. A typical analysis of the ore shipped to date is as follows:

Iron (metallic)	51.26%
Silica	11.46
Phosphorus	0.82
Sulphur	0.04
Lime	3.13
Alumina	4.93
Manganese Oxide	0.17
Magnesia	0.61
Titanic Oxide	0.37
Carbon Dioxide	2.18
Combined Water	2.52

Of the 12 or more distinct ore beds which make up the deposit, three, called the Dominion or Lower bed, the Scotia or Middle bed, and the Upper bed, are of workable height. They outcropped for a distance of approximately 3 miles on the northern side of the Island, dipping approximately 8° towards the north-west and extending under the floor of Conception Bay.

The lowest of these three beds, or the Dominion, varies from 5 to 30 feet in height, while the Scotia bed, lying 240 feet above, and the Upper bed, 60 feet above the latter, each carry workable ore varying from 5 to 13 feet in thickness.

As the deposit is almost entirely submarine, it is difficult to forecast the extent of recovery even within the boundaries of the major fault system. However, from time to time estimates have been made by consulting geologists as well as our own engineers. From all the available data, indications are that the workable beds contain from 3½ to 4 billion tons within 5 miles of the Island.

Early History

The mining of ore started on Bell Island in 1895, and was confined then and for a number of years thereafter to open pit mining from a series of pits along the outcrops of the three seams. At first the drilling was done with heavy reciprocating steam drills on tripods, blasted with straight 50 per cent nitro glycerine dynamite. The ore was sized and loaded by hand into 2 ton, 2 foot gauge cars. The cars were hoisted by small steam driven hoists out of the pit and delivered to an endless rope tramway paralleling the outcrop.

These tramways conveyed the cars to three gathering points spaced along the outcrops, where they were again transferred to three main endless rope tramways leading direct to the shipping piers, 1½ to 2 miles distant on the southern side of the Island. There the cars were dumped individually by gravity tipples, into storage bins excavated out of the 230 foot high cliffs.

From these storage bins the ore was run through chutes in the roof of a tunnel underneath the ore pile to an endless bucket conveyor. This conveyed it, as required, to a loading tower on the face of the pier, from which it ran through a long adjustable chute to the holds of the steamers. Stripping of the overburden at the surface pits was done by hand-loading into wheel barrows, horse drawn dumps carts and side dump track cars, and transferred to adjacent dumps.

As the overburden became too heavy for economical operation, it was necessary to resort to underground mining and the use of compressed air for drilling and pumping. Five pairs of slopes were driven on the dip of the Dominion bed and numbered 1 to 5 from east to west, while two pairs of slopes were driven in the Scotia bed and numbered Scotia 1 and Scotia 2, from west to east.

Each of these slopes was equipped with a wooden deckhead containing a gravity tipple, crusher and picking belt system, as well as a hoisting plant. Centrally located compressor plants were established for each of the two beds, and pipe lines extended to the surface pits and underground workings. All of this equipment was steam driven.

From each of the above slopes, levels were driven at convenient intervals, running east and west at a slight angle with the strike. From these levels a room and pillar system of mining was developed, which permitted an extraction of approximately 80 per cent.

Submarine Development Considered 1905

Due to continually increasing demands of the Sydney Steel Plant and the outside markets, it became apparent that the ore in the land areas would soon become exhausted, and in 1905 preparations were made to tap the submarine areas.

The Scotia No. 2 Slope, having sufficient cover at the shore line to permit of safe entry under the sea, was selected as a prospect slope to be extended in the bed. Here it would provide data relative to faulting, water conditions, etc., as well as thickness of ore in that bed and in the Dominion and Upper beds by diamond drilling.

The driving of this slope was continued in the ore until, at a point 6,100 feet from the shore line, diamond drill holes revealed that the Dominion bed, 240 ft. below, had thickened to approximately 25 ft. The driving grade of the slope was then increased and the slope continued across the rock measures to reach that bed.

This was accomplished towards the end of 1910, when the Dominion bed was reached at a point 6,750 feet from the shore line, or approximately 8,500 feet from the deckhead, which was then considered to be nearing the maximum distance possible for single stage hoisting. Driving of levels going east and west was then started and a room and pillar system of mining, permitting an extraction of 30 per cent developed.

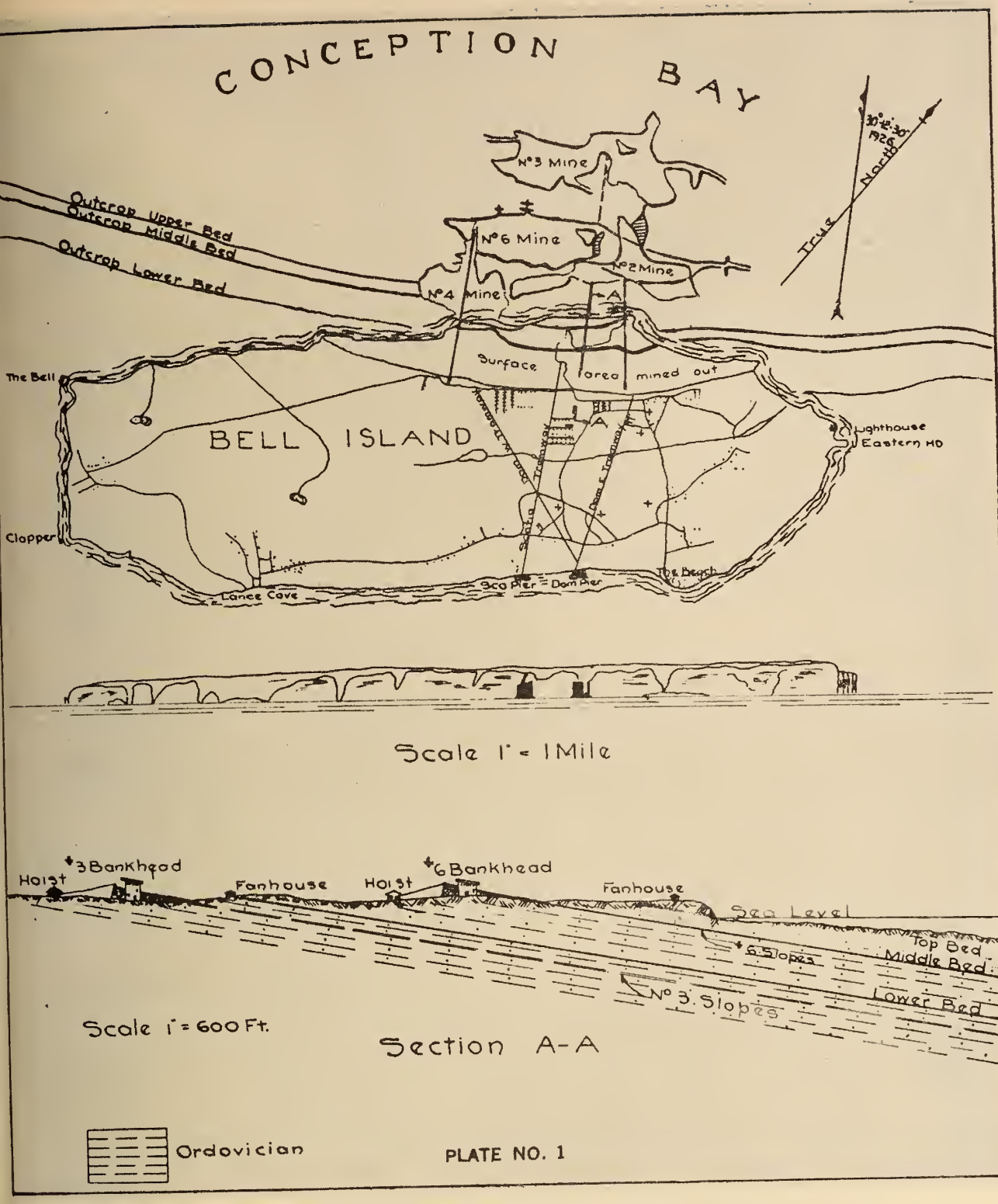
As the slope progressed seawards, it became evident that there was an enormous tonnage of mineable ore available. Steps were taken to provide a more adequate supply of power. A steam driven electric generator plant, with a capacity of 1,000 kw. was built at the Scotia Pier and a 6,600 volt transmission line extended across the Island to the mining district. The compressor capacity was augmented with the erection of a 3,000 c.f.m. steam driven plant at the mines.

A large twin drum balanced steam hoist, capable of hoisting 20 tons of ore at 30 m.p.h. was installed at the prospect slope. High tension cables were laid in the prospect slope, delivering current to the mine workings at 6,600 volts, electrically driven pumps were installed, the small hoists underground electrified, and a start made on the mechanization of the mine with the installation of a 35 hp., ⅝ yard electric shovel.

More Slopes Operating in 1919

Mining from the Dominion bed under the sea was carried on through the prospect slope for several years. Due to the numerous faults, varying from a few inches to one hundred feet, the slope grade was very uneven. Hoisting conditions were difficult, particularly at the lower end.

To eliminate the heavy uneven slope grades, provide adequate cross-



Plan of Bell Island and Conception Bay.

section slope area, as well as to fulfil certain other mining obligations, the driving of a second pair of slopes was started 2,000 feet south of the collar of the prospecting slope. This new slope was driven through the rock strata below the Dominion bed to tap the mine then being developed through the prospecting slope. These slopes were completed and hoisting started in 1919.

During the period 1914-1919, Dominion No. 1, No. 3 and No. 5, as well as Scotia No. 1 and No. 2, had practically exhausted the ore available in the surface areas. However, Dominion No. 2 and No. 4 had extended their slopes into the submarine areas in the Dominion bed. A start was made on the development of a submarine mine in the Scotia and Upper beds, utilizing the upper part of the original prospect slope as the entry.

This then gave four operating slopes, 3 on the Dominion bed and 1 on the Scotia bed. Number 2

slope was the submarine extension of the original Dominion No. 2 Mine, and tapped the Dominion bed towards the east of the property. No. 3 Slope was that recently driven to tap the northern outlying areas of the Dominion bed. No. 4 was the submarine extension of the original Dominion No. 4 Slope, and No. 6 Slope tapped the submarine areas of the Scotia and Upper beds.

The same period saw marked changes in equipment. A second electric power plant of 2,500 kw. was built at the Dominion Pier; an electrically driven compressor plant erected adjacent to No. 4 Slope; 500 hp. main hoists installed at Nos. 2 and 4 Mines, all main pumps and underground hoists were electrified.

Further steps were taken towards mechanization of the mines by the installation of three additional shovels in No. 3 Mine, and experiments with two types of shovels were made in Nos. 2 and 3 Mines. All mines were fully equipped with the latest type of hammer drills.

The occurrence of World War I caused a complete loss of the export market. For four years ore shipments were confined solely to the Sydney Steel Plant. During the period 1920 to 1939 export markets were re-developed, but shipments were curtailed during the recession of 1921-1923, and the depression of 1931-1934. However, shipments started to increase in 1934 and were built up to practically full mine capacity by 1937, and continued at capacity until the early forties.

Prewar Modernization and Electrification

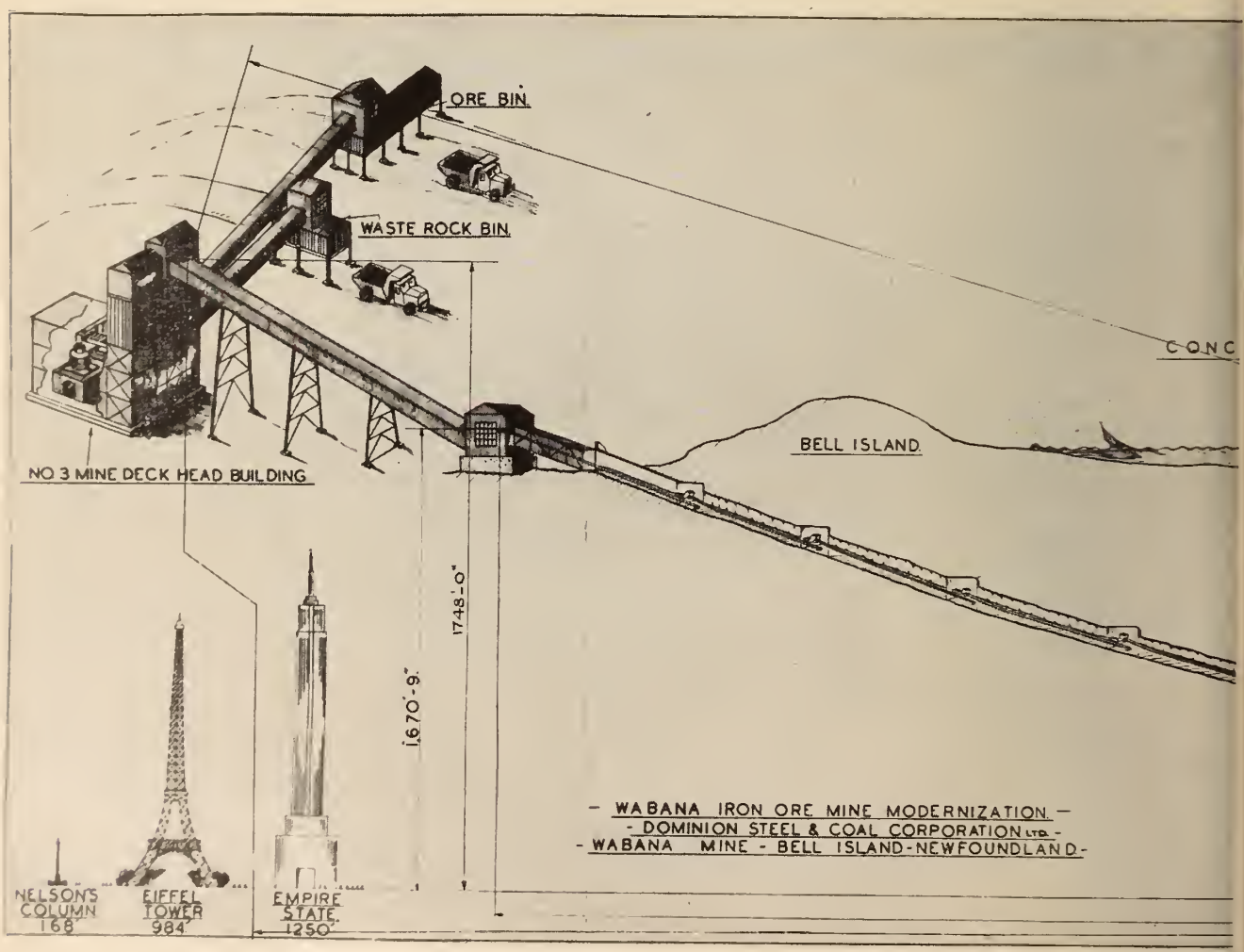
The prewar period saw a continuation of improvements in mining practices, all tending towards increased production. A new modern steel deckhead was built at No. 6 Mine, and an 825 hp. electric main hoist installed. This was capable of hoisting 20 tons of ore per trip at a rope speed of 2,700 f.p.m. No. 6 Mine tracks were changed from 2 ft. to 3 ft. gauge and 5 ton cars replaced the 1.8 ton cars originally used.

At No. 3 Mine a 1,350 hp. twin-drum balanced hoist was installed hoisting a distance of over 12,000 feet. The original 1.9 ton cars were replaced by 5 ton cars of the same design as those in No. 6 Mine. Electric locomotive haulage was installed in both No. 3 and No. 6 Mines. The out-of-date compressed air system was replaced by four compound compressors in the mines under the sea, each having a capacity of 2,800 feet per minute at 100 lb. pressure, and driven by 6,600 volt synchronous motors.

Necessary ventilation for Nos. 2, 4 and 6 Mines was provided by the installation of 100,000 cu. ft. per minute electrically driven fans, installed in concrete fireproof buildings at each mine.

The three endless rope tramways connecting the mines with the shipping piers were also electrified, and the wooden shipping conveyor at the Scotia Pier replaced with steel. Mechanization was continued with the introduction of 60 hp. scraper hoists in No. 6 Mine, and the addition of a shovel in No. 3 Mine.

This electrification and modern-



Sectional elevation showing

ıtion called for much more power an was available from the two eam generator plants on the land, and a contract was entered to with the Newfoundland Light ıd Power Company, whereby they ould supply a demand of 6,000 va. This involved the development additional hydro plants, some) miles of transmission line, and ıe laying of two 5,000 kva., 3,200 volt 3 core steel armoured ables under Conception Bay, be- veen St. Phillips, on the mainland, ıd Bell Island. Each cable is 3½ iles long.

World War II caused a complete ss of the substantial German ıarket. Shipments were confined to ıe requirements of the Sydney teel Plant, and such tonnages as ould be shipped to the developing ıarkets in the United Kingdom.

Problem of Increasing Capacity

Shortly after the end of World Var II conditions started to im- prove. By 1949 it became evident hat steps would have to be taken o increase production so as to be in a position to meet a proportion of the increasing demands for iron ore, caused by an ever increasing world consumption of steel.

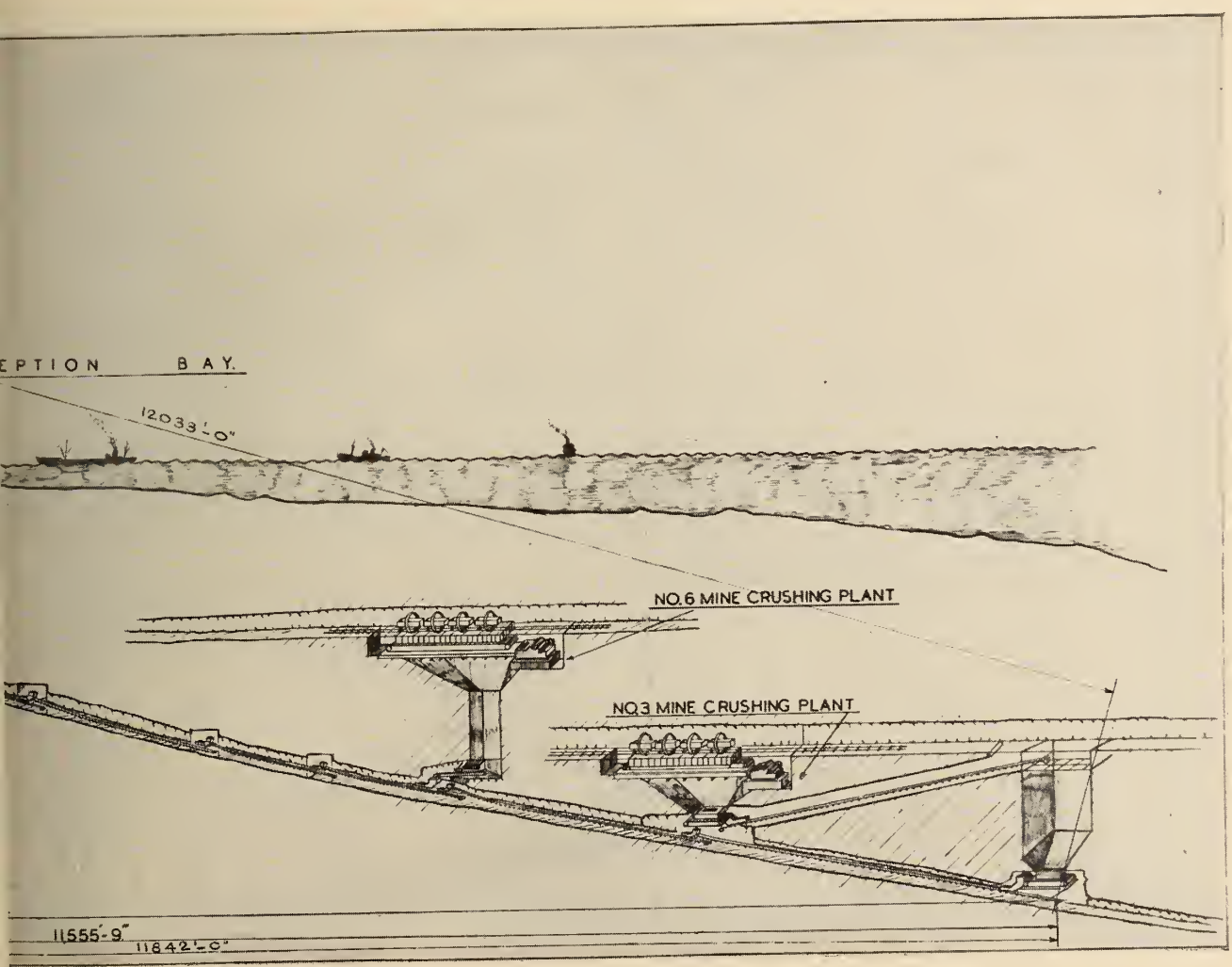
The situation was carefully studied, and it was decided that an increase over the then maximum annual output of 1,680,000 net tons required additional drilling, loading and transportation equipment underground, and the installation of a new system of transporting ore to the surface and across the surface to the shipping piers.

The obsolete, man eating endless rope tramways, a bottle neck as far as shipping was concerned, were scrapped. Two and one half miles of heavy duty rock and gravel road were built, and fourteen 22-ton end dump, diesel driven trucks now transport the ore from deckheads to the piers.

To increase mine production it was necessary to fully mechanize all mines and provide additional working faces and headways. This involved a large amount of development work, and the revamping of the underground track system. Three 300 hp. additional headway hoists, additional tending hoists, two 600 hp. compressors, two 600 hp. motor generator sets were installed.

Five 26 ton electric haulage locomotives, three loading units, five shovels, thirty-six 50 hp. 3-drum scraper hoists, and one 125 hp. scraper hoist were added. Additional mine track, power and telephone cables, pipe lines, transformers, etc., as well as drilling equipment were provided to increase production up to 12,000 net tons per working day, or 3,000,000 net tons annually.

The problem of transporting this ore to the surface was solved by making a complete change in the slope haulage system. The mines in the Dominion bed were connected, and all ore mined in that bed is picked up and transported by the usual method of tending and headway hoists to the main levels in No. 3 Mine. Along these levels it is hauled by electrically operated trolley locomotives, in trips of up to 24 cars, to a central gathering point directly over No. 3 Slope.



modernization of ore conveying system.

A loader delivering ore into shuttle car.

Similarly, all the ore mined in the Scotia and Upper beds is gathered and transported over the main levels of No. 6 Mine to a second central gathering point, again located over No. 3 Slope.

The gathering point for the Dominion bed is located at the bottom of No. 3 Slope, approximately 12,000 feet horizontally north of the slope collar. The gathering point for the Scotia and Upper bed is 9,000 feet north of the slope collar, approximately 3,000 feet distant. At these gathering points excavations have been made in the rock to accommodate handling and crushing equipment, and for storage and disposal purposes.

The excavations or pockets have been completely lined with reinforced concrete to provide strength and safe operation under the severe conditions to which they are subjected. These pockets form the start of a modern ore processing and slope transportation system recently installed at Wabana. This system consists essentially of car dumping and primary crushing equipment at each of the ore gathering points; a belt conveyor system and a modern deckhead containing screening, picking and secondary crushing equipment which, for descriptive purposes, is divided into four main groups, as follows:

Group 1—No. 3 Mine primary crushing and storing equipment.

Group 2—No. 6 Mine primary crushing and storing equipment.

Group 3—Main slope transportation system to deckhead.

Group 4—Deckhead screening, picking and secondary crushing equipment.

Group 1 - No. 3 Mine Primary Crushing Equipment

The ore from the working faces, transported by electric locomotive haulage, arrives at the gathering point in trips made up of multiples of four 5-ton gondola type mine cars. Just ahead of this point and directly over the crushing pocket is a rotary car tipple which dumps four cars at a time.

The base of rail in this tipple is at an elevation of minus 1,332 ft., whereas the base of the crushing pocket is minus 1,383 ft., or a total depth of 51 ft. Due to this restricted height between the haulage drift and the main No. 3 Slope, the ore is transported an additional 230 ft. down the slope to obtain a storage pocket with a live capacity of 1,000 tons.

This storage is necessary to ensure continuous loading of the main transportation system while in operation. This equipment lies 1,380 feet below sea level, 2½ miles out from the nearest land. Above it there is about 1,000 ft. of roof to ocean floor, which is over 300 ft. deep at that point.

For the tipple, a car locking device is provided. When the four cars have been spotted, prior to dumping, the operator engages the car lock and presses his control button. The angle of tipple rotation is controlled by a heavy duty cam limit switch, which can be set to provide complete dumping at 180°.

Since Wabana ore is comparatively free flowing, this limit switch is presently set for 135°. The tipple is driven by a 25 hp. motor, which automatically reverses after a slight delay at end of dumping and returns the tipple to its original position. The complete dumping cycle presently requires 18 seconds.

This tipple is 44 ft. long between end rings, and immediately below is a stationary bar grizzly of the same length. The grizzly consists of I beams with heavy manganese steel caps, which vary in width in order to provide a smaller opening at the top of the grizzly than at the bottom. This tapered opening tends to ensure a clear grizzly at all times.

At the commencement of operations the grizzly bars were set to give a 6 in. opening at the top and 10 in. at the bottom. Due to the slabby nature of the ore, however, pieces as large as 10 in. by 24 in. by 30 in. pass through the system. Since the ore weighs approximately 140 lb. per cu. ft., it may be seen that pieces of that size would be detrimental to the continued and successful operation of the entire slope transportation system.

Consequently the grizzly bars were adjusted to give a 7 in. opening at the bottom. The minus 7 in. ore passes through the grizzly directly into the crushing pocket. The plus size rides over the grizzly and falls onto a primary manganese steel apron feeder installed at the lower end of the grizzly.

The primary manganese steel feeder under the grizzly is 48 in. wide by 54 ft. centres, and is driven by a 20 hp. motor. The total drop from the dumping position of the bottom of the cars and the top of this feeder is approximately 18 ft. The feeder pans are supported underneath by chains and pins riding on rollers, all of manganese steel construction, spaced every 2 ft.

In addition, the centres of the pans are provided with pads, which contact supporting rails to prevent deformation of the pans under the impact of the oversize lumps. This feeder operates at fifteen feet per minute, and drops the ore over the head end into a stone box over the primary crusher.

This crusher is of the jaw type, having a receiving opening of 36 in. by 48 in. It is driven by a 150 hp. motor through a V-belt drive. The crusher is provided with automatic lubrication throughout; water cooled bearings and manganese steel jaw and check plates are easily removable. The crusher discharge opening is adjustable between 5 inches minimum and 10 inches maximum opening.

The swing jaw of this crusher is operated by a toggle plate at the lower end of the jaw, which latter is moved back and forth by a pitman mounted on the eccentric shaft of

crusher. The swing jaw, in turn, mounted on its independent ft. The discharge from this sher falls into the crushing cket, and mingles with the ore ich is passed through the sta- nary grizzly above.

Handling and Storing the Ore

The ore is withdrawn from this shing pocket by means of a nganese steel feeder, which is also in. wide, but the centres are only ft. The construction of this der is identical with the primary der ahead of the crusher, and is iven by a 10 hp. motor.

The ore is transported from the shing pocket to the storage cket by means of a 36 in. wide bber belt conveyor inclined at proximately 15° from the hori- ntal, total lift 56 ft., operating at speed of 400 ft. per minute. It is iven by a 100 hp. motor. The ore fed directly onto this conveyor om the manganese steel feeder der the crushing pocket.

The ore drops directly over the ead pulley of this conveyor into e storage pocket. The elevation this pulley is minus 1,336 ft., hile the elevation at the bottom of e storage pocket is minus 1,406 ft., a vertical depth of 70 ft. Imme- iately below the storage pocket is cated an additional manganese eel feeder of identical construction the feeder under the crushing ocket, except that it is driven by four speed motor.

The operating speed of the feeder nder the crushing pocket is 26 ft. er minute, whereas this latter eeder under the storage pocket perates at speeds varying from 9 ft. o 27 ft. per minute. The purpose of he various speeds will be explained n conjunction with the main trans- ortation system.

Depending on the efficiency of the perators, and the rate of delivery f ore cars to the tipple, the capa- ity of these machines ranges from 00 to 1,000 tons per hour. With the resent method of drilling and lasting 70 per cent of the ore ined is less than 10 in.

The primary manganese steel eeder ahead of the crusher has a ated capacity of 300 tons per hour, while the primary crusher is rated at rom 300 to 500 tons per hour when crushing to minus 10 in. A 300 kva. ransformer is installed in the haul- ge drift, which serves all the motors in the crusher and storage ocket.

The feeders under the crushing ocket and under the storage pocket re rated at 1,050 tons per hour, as is also the belt conveyor between crushing and storage pockets. The whole system is designed to handle ore at the rate of 1,000 tons per hour.

Group 2 - No. 6 Mine Primary Crushing and Storing Equipment

Whereas No. 3 crushing and storage pockets are located directly over the main No. 3 Slope, No. 6 crushing and storage pocket is located on the back slope 67 ft. east of No. 3 main slope, and approximately 3,000 ft. south, or up the main slope, from the centreline of No. 3 storage pocket.

Also, due to the difference in depth between No. 3 Mine and No. 6 Mine, the vertical distance between this haulage drift and the main slope provides plenty of storage directly under the crushing pocket. Number 6 pocket is therefore a combination crushing and storage pocket.

The elevation of the base of rail in the locomotive haulage drift is minus 610 ft., and the elevation at the base of the pocket is minus 1,046 ft., or a vertical depth of 436 ft., the lower 374 ft. of which is a 9-ft. dia. vertical raise, providing an ore storage pocket of more than ample capacity to maintain efficiency of operations.

The tipple, stationary grizzly, primary feeder and crusher are arranged in an identical manner to that already described in No. 3 crushing pocket. At the bottom of this pocket is located an identical manganese steel feeder to that located under No. 3 storage pocket, with four speed drive motor.

The ore is transported west to the main No. 3 transportation system by means of a 36 in. wide horizontal belt conveyor, 73-ft. centres, driven by a 15 hp. motor. The rubber belt for this conveyor is of 6 ply, 36 oz. duck construction.

Group 3 - Main Slope Transportation System to Deckhead

Ore from all mines will be transported to the surface through No. 3 Mine main haulage slope. This transportation system consists of a series of rubber belt conveyors. The main haulage slope runs approximately north and south, with the entrance located at the south end.

The back, or ventilation slope, is located 67 ft. east of the main haulage slope, and parallel to it. The grade of the main slope varies from 20 per cent near the surface to 12 per cent at the bottom, which corresponds to approximately 11° 19 minutes at the upper end, and 7° at the lower end.

After considerable investigation in regard to the economics of the design of this conveyor system, and in common with the general trend in the iron mining industry to wider belts, it was decided that a 36 in. wide belt should be used. Previously the standard width in the Mesabi range and Canadian mines was 30 in. However, with this width, belt life was unsatisfactory, and demanded continuous housekeeping due to spillage and overloading.

It was desirable to minimize the number of individual flights, and thus the number of transfer points, all possible. However, Wabana ore, being comparatively free-flowing, can be transferred from one conveyor to the other with less trouble than has been encountered in other ore mines in Canada and the U.S., which contain a large percentage of wet muck, tending to build up and plug transfers.

A rubber belt was selected which had a tension rating of 575 lb. per inch of width. This belt consists of a series of cotton cords approximately $\frac{3}{16}$ in. in diameter laid side by side. Three plies of ordinary cotton duck are also included in this belt, to provide lateral stiffness with one ply coarsely woven breaker strip over the carcass, to prevent damage to the latter. The rubber cover over the carcass is $\frac{1}{4}$ in. thick, and the breaker strip is installed in this cover. The rubber back is $\frac{1}{16}$ in. thick.

Since conveyor operating speeds of 500 ft. to 600 ft. have become quite common in the iron ore industry, an operating speed of 575 ft. per minute was selected for this system. It was then found that we could establish ten conveyor flights to transport the ore from the lowest point, or the bottom of No. 3 storage pocket, to the mine collar.

The total horizontal projected centres of these ten belt conveyor flights is 11,556 ft.; total terminal centres 11,733 ft., and the total lift is 1,670 ft. 9 in. From the centreline of No. 3 ore storage pocket to the top of the ore surge bin in the deckhead, the horizontal projected centres is 11,842 ft., terminal centres 12,033 ft., and the total lift is 1,748 ft. This constitutes the longest slope belt conveyor system in the world.

Due to the variation in the grade of the main haulage slope, the lengths of each individual flight vary in accordance with the lift, in order to standardize on the drives for these flights. It was not possible to have all ten flights arranged

Self-propelled driller at the face.

Shuttle car delivering ore into five-ton mine car in No. 3 mine, Wabana.

with equal power requirements, since the distance between No. 3 storage pocket and the line at which the ore from No. 6 Mine is to be introduced to the transportation system was definitely established.

It was preferable to introduce No. 6 ore at a common point with the transfer of No. 3 ore from one belt to another. This dictated the lengths of the first two flights at the bottom. The flights are numbered from 1 to 10 from the bottom up. The system is located on the east side of the slope. Formerly ore was raised to the surface by means of large hoists, with 20 ton cars operating on double tracks laid in the haulage slope. The west track has been retained for transporting men and materials into, and out of, the mine.

Nos. 1 and 2 flights have centres of approximately 1,420 ft. each, while the remaining eight flights vary from 1,350 ft. to 1,035 ft. depending on the lift of each conveyor. The full load rated horsepower at the headshaft of flights 1 and 2 is 275, whereas flights 3-10 are 258 hp. each.

The drive for No. 10 flight is contained in a fabricated steel transfer house outside the mine collar, while the remaining 9 drives are accommodated in rooms driven into the east side of the main slope. All drives consist of 300 hp., wound rotor motors direct-connected to the conveyor headshaft, or drive shaft, through double helical gear speed reducers.

At each drive is located a 300-kva. transformer serving each motor, and the controls consist of primary magnetic starters in conjunction with liquid starters. These liquid starters provide a smooth gradual acceleration when starting each conveyor. They are motor operated and adjustable in order to control the acceleration of the conveyors.

Conveyors

The full load working tension in the conveyor belts is 550 lb. per inch of width, and in order to limit the tension in the belts to not exceed 140 per cent of rated tension under full load start, an acceleration period of 28 seconds is required from the time the headshaft starts to rotate until the conveyor is at full speed.

With the liquid starters as they are now set, and the conveyor fully loaded, 15 seconds elapse from the time the start button is pressed until the motor builds up sufficient torque to break the mass of the load, and the conveyor headshaft begins to rotate. A further period of 38 seconds is provided before the conveyor is up to full speed. In this manner the full load starting tension in the conveyor belts does not exceed 120 per cent of rated working tension.

The liquid starters also prevent the stepped starts secured when utilizing magnetic starters having 6-8 accelerating contacts. They thus should provide increased belt life, through elimination of undue tensions in the belt carcass. The combination of liquid starters and wound rotor motor is more economical than other types of high tension conveyor driving equipment, which includes squirrel cage motors used in conjunction with fluid drives.

Originally the entire transportation system was designed to be interlocked by means of centrifugal switches installed on the conveyors. However, it was found that the very gradual accelerations did not permit the centrifugal switches to make a sufficiently firm contact at the point of closing. It was necessary to install time delay relays for purposes of interlock. Centrifugal switches are now utilized only for stopping the preceding conveyor belts, should any belt in the system start to slip.

Due to the very abrasive character of the ore, it is necessary to protect the belts at the loading point. For this purpose stone boxes are supplied, wherein the ore being discharged over the head pulley strikes on a small body of ore contained in the upper half of the transfer chute. The fines are immediately deflected onto the sloping bottom plate of the chute, and thence onto the conveyor belt.

The lumps have a tendency to move outwards towards the edge of the chute from underneath the impact of the incoming load, and are deflected by concentrators on both sides to the centre of the belt. A bed of fines is placed on the belt before the lumps. The belt is thus protected from direct impact of the ore. All transfer chutes and sloping back plates are lined with ¾-in. manganese steel liners.

At the loading point we have further protected the conveyor belt, by installing impact carriers, which consist of six 16-in. diameter rubber tires, 4-in. diam. in cross section, mounted on six anti-friction bearings. Three of these impact carriers are installed at each loading point.

As previously mentioned, the transportation system is installed on the east side of the main slope. This slope is 8 ft. high by 15 ft. wide inside timbers. Where the slope passes through ore, which is self-supporting, no timbers are rerequired, and thus greater clearance is provided.

Thus, the conveyor is installed over the east track of the old haulage system, and the stringer tables which support the belt idlers are bolted directly to the two rails of this east track at 15-ft. intervals.

The conveyor head frames and tail frames are supported on concrete piers, which have been embedded below the ballast and on solid rock in the slope foot wall.

he rails have also been provided ith head and tail anchor piers, to revent any end movement of the ails.

At each drive, room over head rolley beams has been provided, nd sufficient height allowed so that ny part of the electrical equipment r reducer can be removed from the rive rooms, without interfering ith the conveyor set-up. Trolley hain hoists mounted on the above eams can transfer this equipment irectly over the west track, for emoval to the surface or for instal- ation when replacements are re- uired.

The stretch in the conveyor belt s taken care of by horizontal ravity take-ups on the tail end of he conveyor. In order to provide lack side, or driving tension in he belt, the tail take-up frame s counterweighted. This counter- veight totals approximately 7,300 b. and is installed in a tension raise driven in the east side of the slope, nd is connected to the tail frame by 7/8-in. diam. wire rope. .

A total travel of 22 ft. for the take-up is provided on each con- veyor equalling 44 ft. of conveyor belt. This will provide more than sufficient room for belt stretch during the life of the belt. Since the tension in the belt increases gradu- ally from the tail end towards the head end, the supporting idlers under the belt are installed at graduated spaces, beginning with approximately 2 ft. 6 in. at the tail end to 6 ft. at the head end.

Capacity

The rated capacity of this belt conveyor system is 1,050 net tons per hour of iron ore, weighing 140 lb. per cu. ft. Under full-load the belt will be loaded to only 49 per cent of its cross-sectional capacity. The system has not yet been under full load but is operating at approxi- mately 850 tons per hour.

At this loading we find that the motors are drawing approximately 216 amps, and when starting under this load they draw 300 amps. Since the motors will draw 283 amps at their full rated load, we find that our horsepower calculations have been conservative.

As No. 4 Mine will be connected up with No. 3 Mine, and all ore from No. 4 will pass through No. 3 crushing and storage pocket, it follows that under full production approximately 700 tons per hour will pass through No. 3 pocket, and 350 tons per hour through No. 6 pocket.

The feeders under No. 3 storage pocket and No. 6 storage pocket, having four speeds, will permit the operator to regulate the amount of ore drawn from each pocket. Amp- meters from No. 1 flight motor are installed at No. 3 storage pocket feeder, so that the operator at this feeder can determine the quantity of ore which he is loading from No. 3 pocket.

Similarly, ampmeters from No. 3 flight motor are installed within sight of the operator at No. 6 pocket feeder. He can then gauge the quantity of ore he must load to maintain full rated production. The quantities from the two pockets may also have to be varied, should difficulties arise in either of the mines, or it is found that the quantity of ore being withdrawn from any one pocket is not sufficient to prevent these pockets from be- coming filled due to increased pro- duction from its corresponding mine.

Both of these operators can com- municate with each other by tele- phone when additional ore is re- quired from either, or, should a complete shut-down in any one mine occur, full production can be withdrawn from either of the pockets.

Group 4 - Deckhead Screening, Picking and Secondary Crushing Equipment

Wabana ore contains approxi- mately 5 per cent waste rock when it is loaded at the faces. As much as possible of this rock must be picked out when the ore has reached the surface. This is done by hand picking.

For this reason the primary crushing underground is limited to reducing the ore as mined to lumps of a maximum size as can be hand- led efficiently in the transportation system. After picking, secondary crushing reduces the ore to all minus 4 in. for shipment to markets.

The equipment for picking and secondary crushing is contained in what is termed the "deckhead building", located approximately 325 ft. from the No. 3 Mine collar. From the transfer house at the head end of the slope conveyor, ore is transported by a 36 in. wide belt conveyor inclined at 18°, and at an angle of 125° to the centre- line of the slope conveyor system.

The ground slopes gradually up- ward from No. 3 Mine collar and the top of the foundation of the deckhead building is at elevation plus 251.5 ft. The elevation of the tail and working point of this for- ward conveyor is plus 241 ft. From the top of the deckhead foundation to the top of the head pulley of the forwarding conveyor is 80 ft. The vertical lift is 90 ft. with terminal centres of 301 ft.

This conveyor is driven by an 150 hp. motor, direct-connected to the headshaft by double reduction, double helical gear speed reducer, in a manner similar to the drives of the slope conveyor system, with the exception that ordinary magnetic starters are utilized for this unit.

Electric locomotive hauling ore train along the main level.

Slusher hoist delivering ore into five-ton mining car.

The conveyor belt is of cord construction similar to the transportation system in the main slope.

The conveyor is enclosed in a gallery having a walkway one side with asbestos roofing and siding. Due to the angularity of this conveyor with the slope system the transfer chute from No. 10 conveyor is of the double stone box type, the upper half identical with the chutes in the slope system, while the lower half has an additional stone box in a line with the forwarding conveyor.

This conveyor operates at 400 ft. per minute which is, of course, less than the speeds of the slope system. This change of speed has been made to increase the loading on the belt, so that lumps will embed themselves in the fines sufficiently to prevent roll back on this steeper slope.

At the top of the deckhead building a surge bin is provided having a live capacity of approximately 1,000 tons. This surge bin is provided to smooth out the operation in the deckhead building, since there will be times when stoppage will occur in the feed to the transportation system, and vice versa, to permit continuous operation of the main slope transportation system during temporary stoppages in the deckhead.

The surge bin is 21 ft. wide by 24 ft. deep by 40 ft. long. To distribute the ore uniformly in this bin, a self-propelled reversible shuttle belt conveyor is installed over the bin. This conveyor is 42 in. wide by 14 ft. centres, operates at a speed of 275 ft. per minute. It is driven by a 10 hp. motor. A 2 hp. motor traverses the self-contained unit.

When ore is being delivered to either end of the surge bin, and it is desired to load the opposite end of the bin, the shuttle is traversed out from under the transfer chute from the incoming conveyor. The ore then drops directly from this transfer chute into the centre of the surge bin.

The belt can then be reversed and again run under the transfer chute, which prevents overloading when it is necessary to change direction of flow. Both the head and tail pulleys on this conveyor have a ¾-in. thick grooved rubber lagging. The belt itself is of 6 ply, 32 oz. duck construction, with three breaker strips in the ½-in. thick rubber cover. A ⅛-in. thick rubber back is also provided.

Ore Withdrawal

The deckhead building is 54 ft. wide by 77 ft. long. The surge bin is located in the north end of this building. Under the surge bin four manganese steel feeders are installed, to withdraw the ore from the bin.

These feeders are similar in construction to the underground feeders, except that they are 36 in. wide with 11-ft. centres, driven by four speed motors whose hp. ratings are 10, 6.67, 5 and 3.33. Operating speeds are 1,800, 1,200, 900 and 600 r.p.m. respectively. Each feeder has a capacity of 520 tons per hour at maximum speed.

The feeders deliver the ore onto four 42-in. wide by 5-ft. vibrating bar grizzly screens, driven by 7½ hp. motors. All minus 4-in. ore is removed, and the oversize is carried over to the primary picking tables. These tables are flat surface steel pan conveyors, 48 in. wide by 23 ft. centres, with ½-in. mild steel pans. They operate at speeds of either 80 ft. or 40 ft. per minute, and are driven by two speed motors, 10 and 5 hp., 1,800 and 900 r.p.m.

The tables are arranged so that three men can pick on each side of each table. The number of pickers is, of course, governed by the quantity of stone encountered in the ore, which is governed by the particular ore body from which it is mined. Numerous collecting chutes are installed on both sides of all four primary picking tables, with enlarged openings at the upper end for the pickers to drop in the waste stone.

The primary picking tables discharge direct into two 5½-ft. standard cone secondary crushers, which reduce the ore to minus 4 in. These crushers are each driven by a 200 hp. motor, through a V-belt drive to the countershaft. These cone crushers operate on the gyratory principle with the lower half of the main vertical shaft being mounted in an eccentric bearing.

The main shaft is driven by bevel gears from the horizontal countershaft. They are automatically lubricated by motor driven oil pumps. Both crushers discharge directly onto a common collecting belt conveyor. In turn, this conveyor delivers the ore to an ore bin arranged for loading trucks.

This conveyor has terminal centres of 223 ft., and has a capacity of 1,300 net tons per hour of ore operating at a speed of 400 ft. per minute. It is driven by a 100 hp. motor through double reduction double helical gear speed reducer, direct-connected to the conveyor headshaft. The conveyor has a lift of 40 ft.

The minus 4-in. iron ore which passes through the vibrating bar grizzly screens is directed by chutes to two secondary picking tables, the material from two screens being directed onto one table. These tables are identical in construction and operation to the four primary picking tables, and discharge onto a 36-in. wide ore collecting conveyor with 40-ft. centres.

This conveyor operating at 300 ft. per minute, is driven by a 7½ hp. motor, and discharges directly onto the ore collecting conveyor previously mentioned carrying the ore from the crushers to the truck loading bin. The belt for this conveyor is 6 ply, 32 oz. duck construction, whereas the belt for the main ore collecting belt is 6 ply, 42-oz. duck construction.

The rock collecting chutes from all of these picking tables discharge on to a 36-in. wide waste rock gathering belt conveyor. This conveyor has 100-ft. terminal centres with a lift of 26 ft. and is driven by a 7½ hp. motor. The conveyor discharges directly into a waste rock bin 16 ft. wide by 21 ft. long by 11 ft. deep arranged for loading into twenty ton trucks, and has facilities for loading one truck only at a time. The belt is of 6 ply, 36-oz. duck construction.

The main truck loading ore bin is 12 ft. wide by 11 ft. deep by 64 ft. long, and is arranged to load four twenty ton trucks at any one time. Ore is distributed over this bin in exactly the same manner as for the surge bin at the top of the deckhead building, i.e., a reversible, self-propelled shuttle conveyor constructed exactly as previously mentioned, except that the centres are 26 ft. 0 in.

The arrangement under both ore and waste rock bins for loading trucks consists in each case of three undercut air-operated gates, 27 in. wide by 33 in. long. These gates are manganese steel lined throughout, with 6-in. diam. low-pressure air cylinders for operation of the swinging cut-off sections. The cylinders operate at an air pressure of 80 lb. per sq. in. All three gates are operated through one valve.

All conveyor galleries, deckhead building, upper part of truck loading stone and ore bins are of structural steel frame, covered with asbestos roofing and siding. All the deckhead equipment is interlocked so that the conveyor to the ore bin must first be operating, after which the crusher, tables, screens and feeders will automatically start in sequence.

The deckhead has also been interlocked in such a manner that one half can be operated. This means that at one crusher, two primary belts, one secondary table, two vibrating grizzly screens and two feeders can be operated independent of the other half.

All units in the deckhead, slope transportation system, and underground crushing plants can be manually operated merely by changing a switch in the control panels from automatic to manual. Furthermore, each unit has lockout push button stations, so units can be locked to prevent starting of the unit, should maintenance men be working on the unit.

The entire controls for the deckhead equipment are contained in a single cabinet on the lower floor of the deckhead building. Three 300-kva. transformers are provided in the deckhead building for operation of all of the equipment above ground. Since all transformers underground and on the surface are identical, it is possible to operate the deckhead with two of the above-mentioned transformers, and the other can be utilized at any location, should transformer trouble occur.

Mine Capacity Almost Doubled

It is interesting to note that, with the main slope belt conveyor system empty of all ore, from the time the feeder under No. 3 storage pocket begins to discharge ore onto the system, until it reaches the deckhead ore surge bin, twenty-two minutes have elapsed.

The total connected power load for the ore processing and transportation system, exclusive of underground mining equipment and electric railways, is 4,364 hp. The total estimated power requirements with all of this system in operation under full load is 3,600 hp. The total connected load for the transportation system in No. 3 slope is 3,195 hp. The estimated power required for this system is 2,900 hp.

All conveyor belts are installed with vulcanized splices, to develop the full design tension rating of the belt. Two splices are required for each slope belt, since it was impossible to handle these belts in one piece for each conveyor.

When belt replacements are required, it is anticipated that the rolls will be taken into the mine down No. 4 Mine main haulage slope, since this will connect into the lower end of No. 3 slope. The belts can then be set up at the lower end and by using the conveyor system the belt can be threaded up to where it is required.

Heretofore the output was limited to 1,680,000 tons annually. Three slopes, each with hoist and deckhead, were in use. The new installation is planned to meet an immediate annual output of at least 3,000,000 tons, and has capacity to handle a much larger output should it be required. All ore is delivered through one slope, treated and shipped at one deckhead.

The overland trucking system, by the simple addition of more trucks, can handle any desired quantity. Mining operations underground are completely mechanized. Equipment used for drilling and loading is varied to get the highest efficiency under the different conditions met in the separate seams and working places. Underground transportation is most modern.

Acknowledgements

The general plan of mechanization and change in transportation, both underground and on the surface, is the result of studies made by the Corporation's own officials, checked and approved by one of the most outstanding consulting engineers.

It is impossible to mention the names of all the firms who have contributed in one way or another to the completion of this program, but to all the Corporation expresses its gratitude for the services rendered.

The Corporation's operating officials at Wabana had before them the problem of continuing mining operations to the fullest possible extent, and at the same time the conversion from the old facilities to the new installation.

At the same time development work had to be accelerated to provide the so greatly increased production expected after the new facilities went into operation. This they accomplished to a creditable degree. It is gratifying to report that the installation went into operation with a minimum of teething troubles.

Finally, it is of interest to note that the entire project was planned, designed and installed by Canadian firms on a property situated in Canada, owned by the largest industrial enterprise in Canada, the Dominion Steel & Coal Corporation, Limited, a Canadian company whose shares are 82 per cent owned in Canada, and which is operated by Canadians. √

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Precast Concrete Bridges in Alberta

by

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A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 22, 1953.

Alberta's oil boom has not been a wholly unalloyed blessing. For one thing, it has brought unexpected loads onto the Province's highway system: by 1965 half its road bridges will have to be replaced. This paper describes Alberta's development of short-span precast concrete units, which have proved entirely successful from the technical point of view and which bid fair to be economical in maintenance.

Alberta probably has more small bridges per capita than any other province. This is due to the many irrigation canals and foothill streams and to the grid system of land subdivision. Inspections in 1946 showed that 1,000 bridges needed urgent replacement, a further 1,500 bridges would require replacement by 1955 and an additional 2,000 would need replacement by 1965. These 4,500 bridges represent approximately half of the Province's total, exclusive of bridges over irrigation canals and bridges at new locations. Alberta's problem is further aggravated by the rapid development of the Province following the discovery of oil. Heavy trucks used in the oil industry not only overtax existing main highway bridges, but regularly travel the most outlying districts. This has made it necessary to replace bridges which normally would have served rural traffic for several years.

In 1946 over 90 per cent of Alberta's bridges were built of timber, with timber wearing surfaces which required constant maintenance. It was obvious that if the limited resources available were to be used to the best advantage, a type of structure free from maintenance would have to be constructed.

Choice of Bridge Type

Bridge engineers agree that the design and construction of economical small bridges presents a bigger problem than do large bridge structures. The small bridge does not warrant the detailed foundation investigation, the careful design and the use of heavy construction equipment and construction materials that a major structure does.

It was necessary to develop for Alberta a standardized type of bridge which could be built quickly and cheaply at widely scattered points with a minimum of skilled labour and engineering supervision. It was also necessary to utilize existing bridge crews and equipment, set up to build small timber bridges. There

ere 15 of these eight- to ten-man ews; each crew was equipped with boom truck used for pile driving nd for the erection of members hose weight did not exceed 10,000 ounds.

The treated timber bridge with a mber wearing surface was not the olution, since it did not eliminate ne maintenance problem. The prouction of asphalt plank in Alberta nd its use as a wearing surface as resulted in a timber bridge hich is economical and quickly onstructed, but does not have the ng life of a concrete structure. Ioreover, a treated timber bridge s only a 35 per cent Alberta roduct compared to 95 per cent for reinforced concrete structure.

A poured-in-place reinforced conrete bridge requires little or no naintenance, but has the disadantage of high cost, slow construcion and no salvage value. The bsence of good concrete aggregate n many parts of the Province rules ut poured-in-place structures in hese areas.

The logical solution to the probem of an extensive program of small ridge construction seemed to be he use of precast concrete.

Execution of the Precast Program

In 1950 several companies were approached regarding the possibilities of mass producing precast stringer units. The Alberta Transit Mix Co. of Calgary offered plant production of such units at a price that would be competitive with treated timber. Before production of precast units began, a study was made of the type and methods used in Pennsylvania and West Virginia. The program of precasting was then promptly set in operation. The first units were ready for delivery six weeks after the idea was first conceived, and at eight weeks the plant was producing a single-span bridge each day.

Calgary was the logical location for the plant, since good aggregate was cheap, cement is produced at nearby Exshaw, and the relative cost of transporting precast units from the plant to the various bridge sites is not excessive. Cost studies showed that bridges to be constructed within fifty miles of Calgary could best be transported by truck, and others by rail. If transportation were the only variable, comparative costs of completed bridges for various distances would be: $6.00 per sq. ft. of deck within 30 miles of Calgary, $6.35 per sq. ft. within 100 miles of Calgary, $6.50 per sq. ft. 300 miles from the plant, and for the most remote point in the Peace River district, 600 miles from the plant, the cost would be $6.60 per sq. ft.

One of the first stringers produced, a channel section designated as "Type A", was subjected to a load test. A static load of three times the design load caused 5/8 in. deflection and only fine hair cracks. The stringer recovered completely when the load was removed. Subsequently, two more stringers were tested, one produced from standard 5,000 lb. per sq. in. concrete and one from light weight concrete. These were loaded to one and one-half design load and left for six weeks' observation. These stringers deflected 1/4 in., but no cracks appeared. The stringers recovered completely on removal of the load.

Development of Suitable Precast Units

The channel section for the stringer units was selected as most suitable for short spans. It results in a bridge with a minimum number of precast parts. Units are easily handled on rail cars or trucks. They are speedily erected and require a minimum of field grouting or field bolting. The bridge crews have built a complete single-span bridge in two days and a three-span bridge in one week.

The first year of the precast program was limited to the erection of precast deck units on treated timber substructures. Spans were standardized at 20 and 28 ft. The production of an economical, quickly constructed, maintenance-free bridge was thus achieved. However, the shortage of timber, the rising

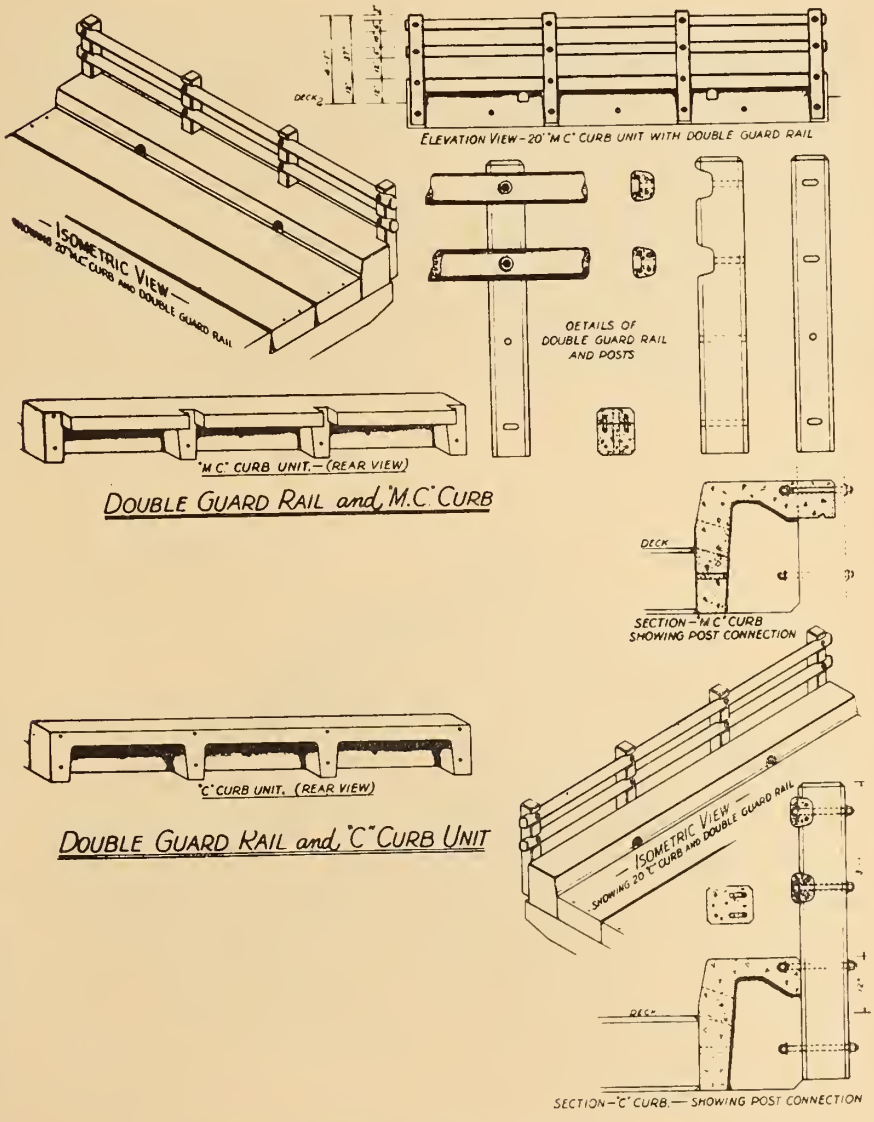


Fig. 1. Details of curbs and guard rails.

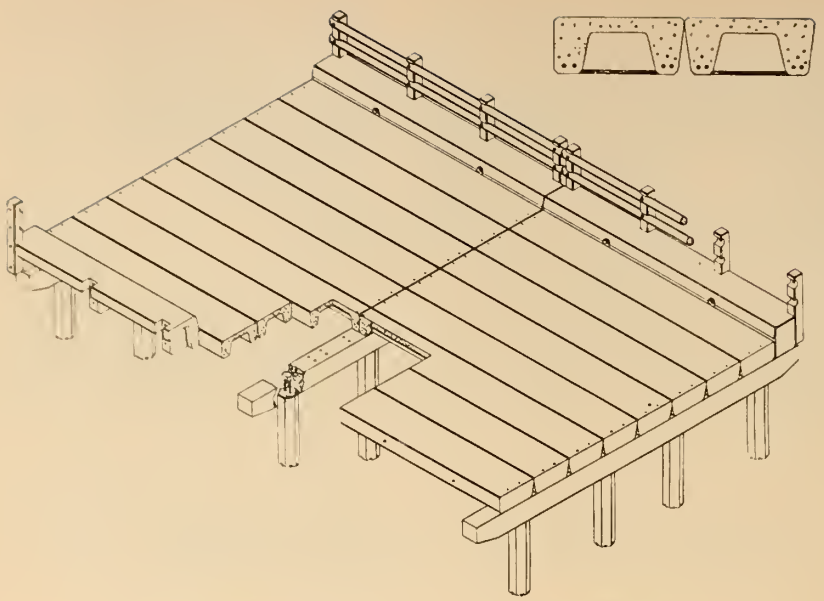


Fig. 2. Isometric view of Type G stringer assembly.

cost of treated timber, and aesthetics prompted the development of an entirely precast bridge. Many bridges are now being constructed with precast piles, caps, stringers, curbs, railposts and handrail. (See Fig. 1). The precast concrete piles are dowelled after cutoff into grout holes in the precast concrete caps.

Since the first Type A units were designed and produced, considerable study has been given to all aspects of the program and modifications are continually being made. On a mass production basis a small saving in each unit in materials, casting time or erection becomes a significant amount in the overall picture. The original Type A units are still being used for special circumstances, such as in skewed bridges and in those with odd span lengths. This type has disadvantages in that it requires field bolting from below the deck and considerable field grouting.

Three types of deck units were evolved from the original design:

(1) A "Type G" stringer unit for use on side roads or in locations where the alignment or grade line might be revised. Each individual stringer of this type is designed to carry the total H20 S16 wheel loading, since there is no grouting nor bolting to the adjacent stringer. A general assembly of a Type G bridge is illustrated in Fig. 2. This stringer requires more material, both concrete and steel, and is heavier than Type A, but it allows for quick erection, ease of salvage and greater strength for handling.

(2) A "Type E" unit was designed for permanent bridge locations. The stringer section is economical because it provides for a positive means of load distribution. This positive connection is achieved by the use of interlocking hooked reinforcement in a field-grouted connection. A general assembly of a Type E bridge is illustrated in Fig. 3.

(3) The "Type D" bridge is used where spans greater than 28 feet are required. A separate slab-and-stringer construction is used to keep handling weights below permissible limits. This type is now being used for 40-foot spans, but with light weight aggregate will probably be used for spans up to 50 feet. A general assembly of a Type D bridge is illustrated in Fig. 4.

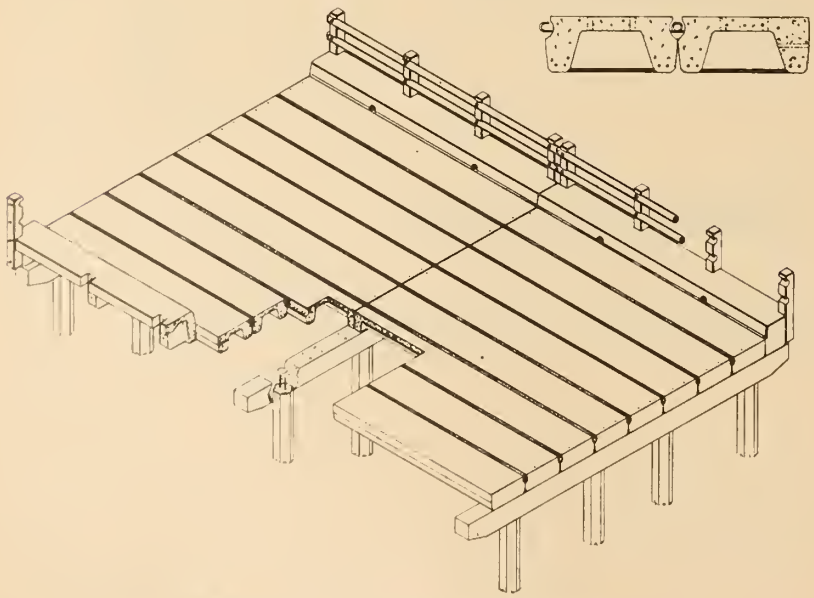


Fig. 3. Isometric view of Type E stringer assembly.

A further development in precast concrete in Alberta has been the use of precast deck slabs for steel bridges. This permits winter construction of a concrete deck and minimizes traffic interruption. The precast deck weighs only 45 lb. per sq. ft. as compared to the conventional concrete slab deck which weighs 75 to 95 lb. per sq. ft.

The cost of a completed precast deck at a point 100 miles from Edmonton was $2.20 per sq. ft., compared to a recent contract price of $2.06 per sq. ft. for a poured-in-place deck in the city of Edmonton.

Alberta's Precast Bridge Program

Since 1951, 200 precast concrete bridges have been built in Alberta. These vary in length from a single span to 10 spans per bridge. They represent a total deck area of 254,000 sq. ft., built at an average cost of $6.96 per sq. ft. This cost figure includes substructure, curbs, handrail, channel diversions, detours, approach fills, etc.,—the complete

ridge. Thirty precast bridges have been constructed to date on the Alberta section of the Trans-Canada Highway. One of these is a railway overpass with 32-foot spans on a 32° skew. A three-span Type D bridge is now under construction on the Trans-Canada Highway. Alberta's 1953 bridge construction program includes 130 precast concrete bridges at an estimated cost of $1,500,000.

Production of precast concrete stringer units of light weight aggregate will soon begin in an Edmonton plant. This will reduce handling weights by one-third and result in a saving in freight, trucking and erection.

The mounting interest in prestressed concrete in North America has turned Alberta's attention to the possibilities of precast post-tensioned bridges. There would seem to be no economy in prestressing 20-, 28- and 40-ft. sections. Plans are being prepared for 50-ft. and 70-ft. girders to be precast in short segments and connected in the field with prestressing reinforcement. This will allow the construction of long spans made up of concrete units that can be handled with present equipment.

Alberta did not originate precast highway bridges; many of the States have for years been building multi-span trestles using precast sections. There has, however, been a great deal of original thought given to the design, the casting technique, the transportation and erection of precast bridges in Alberta, to adapt this type of construction to local conditions.

The Alberta plant has supplied a product that met all requirements of tolerances and quality at all times. It is to its credit that few units have required adjustment or replacement in spite of the volume, the many types and the orders for varied skews and span lengths. Experience gained to date has proven the merit of manufacturing bridges in a central precasting plant. Now that the initial trial and error period and the setting-up costs are over, the real economies of precasting highway bridges will become more and more evident.

The majority of the precast bridge units used were produced to the specifications of the Alberta Bridge Branch by the Precast Concrete Co. Ltd., Calgary. Design and details were worked out by Structural Engineering Services, Ltd., working in co-operation with the Alberta Bridge Branch.

Design

The design of precast concrete bridges requires special consideration, since standard specifications covering this type of structure are not generally available. The Alberta Bridge Branch designs reinforced concrete bridges under the provisions of the American Association of State Highway Officials (A.A.S.H.O.) Standard Specifications for Highway Bridges. In order to cover the unique problems involved in the design, fabrication, handling and erection of precast units, an addendum to this specification has been prepared for use in Alberta. In the future it is hoped to extend this addendum to cover light-weight aggregate and precast-prestressed designs.

General Design Provisions

Handling

The Alberta Bridge Branch has specified a maximum handling weight per unit of 10,000 lb. To achieve this it has been necessary to reduce the normal minimum bar cover and spacing requirements. All concrete used in the fabrication of precast concrete bridge units is to have a compressive strength at 28 days of 5,000 lb. per sq. in.

All reinforcement is to be intermediate grade billet steel or cold-drawn wire, and reinforcing units are to be fabricated into welded cages and held accurately in the forms. High strength concrete allows a minimum of retention time in the forms and permits (because of high durability) less protective covering over the reinforcement. The accurate caging and placing of reinforcement permits a reduction in the minimum bar spacing requirements.

Concrete

The choice of a particular strength of concrete and type of reinforcement permits design values to be specified numerically rather than by the usual fractions of concrete strength. Values have been chosen on the conservative side, since field experience with the performance of high-strength concrete is limited. It is expected that some of the more severe restrictions may be relaxed and greater advantage taken of the high quality of materials and workmanship, when sufficient time has elapsed to evaluate the performance of existing precast concrete bridges. The following values govern the design of all precast concrete bridge units in Alberta.

1. Flexure—the maximum compressive stress in the concrete due to flexure shall not exceed 1,800 lb. per sq. in.
2. Shear—The maximum unit shearing stress, as computed on the width of the stem and the effective depth of the member, shall not exceed 300 lb. per sq. in. The maximum unit shearing stress taken by the concrete alone shall not exceed 100 lb. per sq. in.
3. Bond and anchorage—The maximum permissible bond stress for deformed bars satisfying the A.S.T.M. 305-50T specification shall be 325 lb. per sq. in. Bond

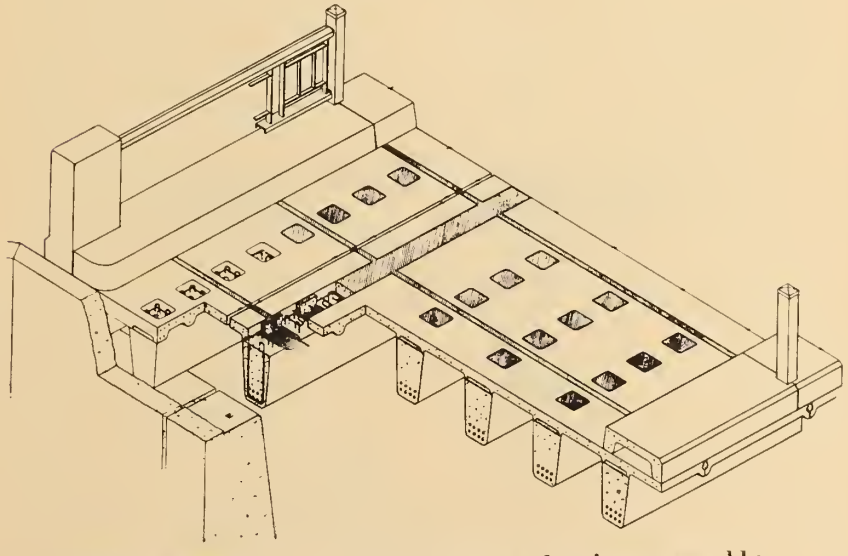
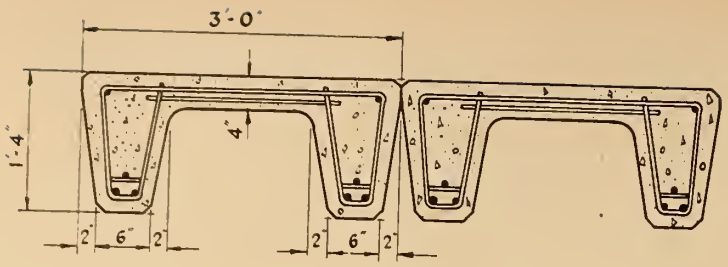
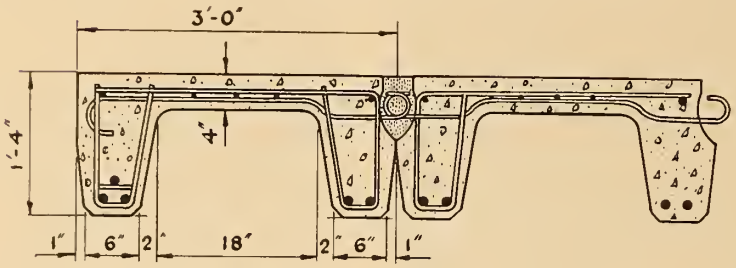


Fig. 4. Isometric view of Type D slag-and-stringer assembly.



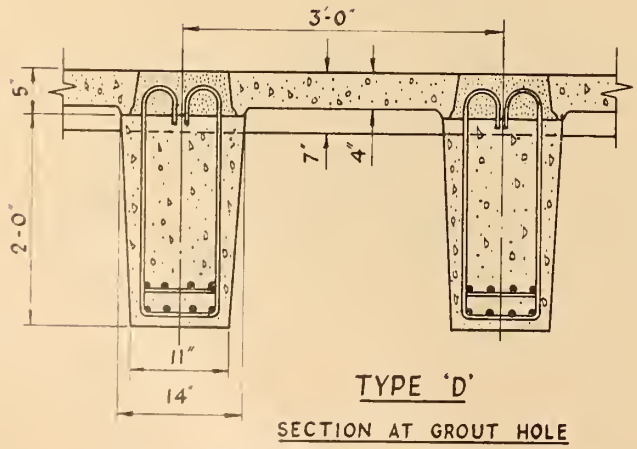
TYPE 'G'

Fig. 5. Type G Unit.



TYPE 'E'

Fig. 6. Type E Unit.



TYPE 'D'

SECTION AT GROUT HOLE

Fig. 7. Type D Unit.

stresses on all other types of reinforcement shall be a maximum of 225 lb. per sq. in. All principal beam reinforcing bars are to be carried to the end of the beam and hooked, unless they are bent up into the compression zone and anchored.

Reinforcement

1. Principal reinforcement — The maximum unit stress in tension in all main reinforcement shall not exceed 20,000 lb. per sq. in. or 25,000 lb. per sq. in. in the case of cold drawn wire.
2. Web reinforcement—The maximum unit stress in web reinforcement shall not exceed 16,000 lb. per sq. in. In no case is the web reinforcement to be spaced further apart than the effective depth of the member, nor is there to be less web reinforcement than a minimum permissible ratio of 0.001.
3. Temperature, shrinkage, distribution and handling reinforcement — Reinforcement placed specifically for the purpose of resisting handling stresses may be stressed to a maximum of 30,000 lb. per sq. in. under shock loading.

   The same specifications for temperature, shrinkage, and distribution reinforcement apply to precast concrete bridges as in normal construction. Most of the bridge types designed so far have required more reinforcement for handling than the amount specified for shrinkage temperature or load distribution. In no case is such reinforcement to be spaced further apart than three times the slab thickness or 21 in.
4. Outside cover on reinforcement—The minimum protective covering on reinforcement shall be 1½ in. for principal reinforcement in stringers and 1 in. on all reinforcement in slabs. Secondary or web reinforcement in the stringers is permitted a minimum protective covering of 1 in.
5. Bar spacing—The minimum clearance between parallel reinforcing bars shall be 1 in. or one and one-quarter times the maximum size of aggregate used in the mix. The maximum spacing of principal slab reinforcement shall not exceed two and one-half times the effective depth of the slab.

Loading

1. Live loads—The live loads and impact forces used for design pur-

poses shall be those prescribed by the A.A.S.H.O.

Handling loads—The individual units shall be designed for a handling load in either direction of double the dead weight of the unit supported at the positions of the handling devices.

Load distribution—slabs—Distribution of wheel loads in a direction perpendicular to the principal slab reinforcement shall be in accordance with the A.A.S.H.O. specifications. Wheel load distribution shall not be assumed at discontinuous edges of the slabs unless a satisfactory field connection is established between adjacent edges of adjacent slab units. Such a connection shall be capable of establishing the continuity of the reinforcement and of resisting the shear in the slab.

Load distribution—stringers—No distribution of wheel loads perpendicular to the direction of the stringer span shall be assumed unless a satisfactory field connection is established between adjacent legs of adjacent stringers. Such a connection shall be capable of establishing the continuity of the slab reinforcement, so that the positive moment and shear over the connected stringer legs necessary for the assumed distribution can be developed. The assumed lateral distribution of wheel load must be consistent with the positive moment which can be developed over the stringer legs by the slab, its reinforcement, and its curvature as governed by the stringer deflection. In no case shall the live load concentration at any point of the combined stringer legs be assumed less than S/5 of a wheel load, in which S is the average spacing of the stringers in feet.

Types of Bridges

Up to now three principal types of bridge units have been designed and constructed for various spans and field conditions. These have been designated Type G, Type E and Type D, and each involves at least one principle of design different from the others.

Design of the Type G Bridge Unit

This type was developed for short span bridges where simplicity of erection and salvageability were prime requirements. The section shown in Fig. 5 was designed on the assumption that each leg of each unit would carry 50 per cent of all the wheels of an H20 S16 truck that could come on the unit.

Fig. 8. Underside of Type A bridge deck.

(a) Stringers—No continuity is established between adjacent legs of adjacent stringer units in the field. For the design of this unit it was assumed that the wheel loads would come on the unit in symmetrical fashion.

(b) Slab—The slab, poured monolithically with the stringer legs, is reinforced perpendicular to traffic and longitudinal distribution of wheel load is assumed. The total moment designed for is based on the clear span of the slab and split, two-thirds positive and one-third negative. The greater portion of the reinforcement is positive steel with the intention of keeping leg torsion to a minimum.
The amount of longitudinal slab reinforcement for this type is determined by the handling requirement.

Design of the Type E Bridge Unit

This type was developed for permanent crossings with spans up to 28 feet and every effort was made to combine the material economy of a cast-in-place bridge with the placing economy of precast units. The deck was designed taking full advantage of the wheel load distributions permissible with continuity in every direction. The individual units are channel-shaped and lateral continuity is obtained by means of the field grouted connection illustrated in Fig. 6.

(a) Stringer—The A.A.S.H.O. specification for monolithic concrete bridges permits each interior stringer to be designed for S/5 of the wheel loads that can come on the stringer, in which S is the average spacing of the stringers in feet. If adjacent legs of adjacent stringers act together it can be seen that each individual leg can then be designed for 30 per cent of a wheel load where the width of the individual unit is 3 ft. A simple analysis from the point of view of statics alone will show that such lateral distribution of wheel load is impossible unless the slab can develop a positive moment over the stringer. Furthermore, the wheel must be far enough from the stringer support so that the deflection of the stringer is sufficient for the required curvature of the slab to develop. Thus the reduction in design load is a function of the spacing of the stringer legs; the necessary positive moment in the slab over the stringer is a function of both this reduction and the spacing of the stringer legs; and the position at which the load may reach full reduction is a function of the relative stiffnesses of the

slab and of the stringer. In the analyses of the cases under consideration it has been found that the position of the load for full reduction is in general about one-quarter of the span from the end of the unit. This will vary for different spans of the same type of unit.

The combined interior stringer legs of Type E bridges are then designed to support 60 per cent of the wheel load over approximately the centre half of the span and this is increased to 100 per cent of the wheel load at the end of the span. The design for shear follows the same general rule.

The necessary positive slab moment over the combined stringer legs is provided for by extending the positive reinforcement from the slab into a field grouted joint between adjacent legs of adjacent units. This grouting is not difficult since it can all be done from the top of the deck. Since the grout joint is considerably deeper than the slab itself, this same steel can, when necessary, resist negative moment over the stringer.

The fact that this reinforcement projects through the edge of the stringer and is hooked has not given any trouble to date in field placement. This is a tribute to the high calibre of the manufacture since it is not difficult to see that this reinforcement could cause trouble if care is not taken, particularly in skewed spans. For exterior stringers the same criterion is applied as in the design of the Type G bridge where no lateral continuity exists between stringer units. Thus the outside stringer leg is designed on the assumption that it can be required to carry 50 per cent of all the wheel loads that can come on the unit.

(b) Slab—The principal reinforcement in the slab of the individual stringer units is designed for the same total moment as in the case of the Type G bridge. The split in moment from negative to positive is reversed, however, because lateral continuity is established between adjacent legs of adjacent stringers, thus reducing the chance of torsion in the legs.

Design of the Type D Bridge

This bridge type was developed to permit the economical extension of precast spans beyond 28 feet without increasing the handling weights of individual units above the desirable limit. The stringers and slabs are cast separately and field assembled to act as a unit as illustrated in Fig. 7.

(a) Slab—The transverse precast deck slabs are continuous with 7-in legs spaced 18-in on centres and poured monolithically with a 4-in. slab. The legs are primarily required to give rigidity for handling, but also permit a grout joint in which the distribution reinforcement can be lapped. Since these slab legs are stiff compared to the slab itself, they are designed to carry all of the moment and the shear for the span between the stringers. The handling reinforcement is sufficient in every case to supply the requirements of principal slab reinforcement when the bridge is assembled. Transverse slab units are generally cast in widths of 4 ft. 6 in. and lengths up to 24 ft.

Grout pockets in the slab are located to receive the stirrups from the stringers and also to permit the slab legs to be grouted to matching notches in the stringers. Thus, when assembled and grouted the slab and stringers act together with T-action.

(b) Stringers—The stringers are designed to carry the dead and erection stresses without the benefit of T-action, but are considered to act with T-action under live loads. Wheel load distribution is assumed as if the bridge were cast monolithically.

This type of structure has aroused considerable interest because of the complicated nature of the formwork. The first few Type D bridges have been erected with a minimum of trouble in the field. Where multiple use of forms is possible, it seems good economy to permit complicated form work if it will simplify field erection.

Design of Structure and Miscellaneous Units

Turning now from the bridge deck to the substructure, precast concrete piles and precast concrete caps have been designed, fabricated, and erected. The problems of analysis in this case are not particularly complicated; it is rather a problem of detail design for ease of casting, handling and erection.

The piles are designed with the reinforcement necessary for handling and for the pile to act as a column when in place. The bridge erector is furnished with information for each particular bridge which tells him the maximum eccentricity of connection that is permitted according to the unsupported length of the pile. This hexagonal precast concrete pile has been one of the greatest successes of all the bridge units from the point of view of mass production. A trapezoidal or triangular pile was originally attempted because it was thought to be cheapest to cast. However, the hexagonal pile was developed from this original idea and has proven as easy and as cheap to cast as the triangular one. Symmetry makes it easy to drive in the field and its appearance is not harmed by the rotation of the pile during driving.

The principal problems which arose in the design of the caps were mostly in the nature of details for casting and erection. The handling reinforcement had to be located so that it would resist all handling stresses, and all reinforcement had to clear the necessary holes for connections to the piles and to the stringers. Permissible tolerances in this type of construction are much smaller than in the case where the stringer is simply drifted to a timber cap and the cap in turn drifted to timber piles. However, about 50 precast concrete bridges have been erected on precast concrete substructures and since the first half dozen most of the difficulties have been eliminated.

Precast concrete curbs, rail posts and guard rails have all been designed for loads in accordance with the specifications of the A.A.S.H.O. They give a pleasing appearance, which blends with the remainder of the concrete bridge, and their design does not require any special explanation. Precast concrete posts have also been adapted to support steel handrail where this is desired for aesthetic or other reasons.

Prestressed Design

Some preliminary designs for precast-prestressed bridges in Alberta have been prepared and others are being considered. The type eventually chosen must balance the limitations of the construction forces available against the possible economy of materials.

In general, it may be said that the principles of positive end anchorage of the prestressed reinforcement, and a minimum factor of safety for the structure compatible with good practise, will be governing features of the design. √

Future Supplies of Power

by

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A paper presented before the Mechanical Section of the Montreal Branch of The Engineering Institute of Canada, June 9, 1953, to which all A.S.M.E. members in the Montreal area were invited.

Predicting a fourfold increase in demand for power by 1975, with capital outlays of $91 billions for the U.S.A. and $17 billions for Canada, the author shows that Canada's available hydro power resources must be supplemented by some 7 million kilowatts of standby power other than hydro, to meet a 1975 demand of some 40 million kilowatts.

Discussing current trends in steam plant design, improvements are cited that are bringing substantial savings. The value of diesel engines, gas turbines and atomic energy are assessed as alternatives to steam.

Warning that the two most pressing needs in power development today, are greater efficiency and more economic distribution, he expresses confidence that Canadian engineers will meet this challenge.

Engineers deal with problems involved in the design, construction and operation of power machinery and energy distribution. The first electric central station about 70 years ago ushered in an era of development in industry, the farm and the home.

Electricity has become an indispensable factor in commercial and domestic affairs. It lights our streets, runs our factories, serves our farms, provides means for transportation, and supplies home services. Modern life would become chaotic if suddenly deprived of electricity. The assurance of ample supplies of electrical energy during the coming years is, therefore, one of the important obligations of engineers.

A. G. Christie, M.E.I.C.

This future supply involves problems that require forethought and serious consideration. Studies of the growth of power systems indicate that peak loads have increased, over long periods, at an average cumulative rate between 6 and 7 per cent per year. Thus, peak loads double in about 11 years.

There is little evidence that load saturation is near at hand. New uses for electricity are constantly developing on the farm, in homes, at factories, for electro-chemical processes, etc. These will probably maintain the present rates of load growth for many years, provided no wars or economic disturbances intervene. This rate of increase until 1975 will lead to peak loads that are four times present demands.

The seriousness of the problem of future supplies becomes apparent from the need for the construction of power generating plants and distribution facilities by 1975. These will have capacities four times the total capacity of all present generating stations. One has only to consider the present generating capacity in electric control stations of approximately 80 million kw. in the United States and of about 9.9 million kw. in Canada, to realize the vast increases in generating plants and distribution systems that must be in operation by 1975.

Approximately seven million kilowatts of new capacity were added to the power systems of the United States in 1952, at a cost of $3,700 millions. In Canada about 840,000 kw. were added in 1952 at a cost of $538 millions. Plans call for the addition of 11.8 million kilowatts of capacity in the U.S. this year and additions of 665,000 kw. are said to be contemplated in Canada.

While 97 per cent of the homes in the U.S. are electrified, the average home use is only 2,175 kwh. per year, which is considerably below the Canadian average. A factor in the increasing use in the home is the steady decrease in the average cost of service, in spite of higher fuel and labor costs in production. In the U.S. this average cost decreased from 4.3 cents per kwh. in 1937 to 2.76 cents in 1952. Farm electrification is a load of increasing importance, with an average use of 3,075 kwh. in the U.S. last year.

Future Power Expensive

The provision of increased capacity involves financial as well as engineering problems. The average cost of new generating plants and distribution systems in the U.S. over the last three years was about $380 per kw. of capacity. At this rate the cost of necessary additional capacity by 1975 in the U.S. would be about $91 billions.

If the same rate is assumed for Canadian steam and hydro-electric plants noted later, and totalling 46,667,000 kw., these additions will cost $17.7 billions by 1975. Where are these large sums of money to be found? How can such extensions be financed without causing economic disturbances? These money problems must be solved jointly by engineers and financiers.

Some may question the high cost of future capacity. Low-cost hydro-electric sites near power-consuming centres have already been developed. The more distant sites will be expensive to exploit, and will require costly transmission lines. The cost of steam stations has increased over 60 per cent during the last 20 years, in spite of the use of large units, and will probably continue to increase. Hence, the costs mentioned above can be reasonably assumed for estimating purposes.

Engineers face difficult problems in the determination of the best and most economical means to provide for these increasing power demands. Foresight is needed to estimate what sources of power may be made available, what locations should be reserved for future power sites and what distribution and interconnected systems should be planned.

Steps should be taken at once to secure sites needed for future generating plants, before urban development or other commercial uses prevent the acquisition of the desired areas, even though the property may not be used for some years. The art of power development is changing rapidly. All plans must provide for adjustment to such changes. It is evident that engineering statesmanship is needed to guide discussions on these developments.

The Canadian Situation

Canada's industrial growth over the last decade has been amazing. The rich natural resources of the North and West are being utilized to an increasing extent. Manufacturing has become of increasing importance. Both population and industry may be expected to grow at an increasing rate. For these reasons, electrical demands may expand more rapidly than in the U.S. and the problems of future supplies of power in Canada would then become more pressing than now appears.

Canada's development of power in central electric stations has been principally at water power plants. Fortunately large capacities of hydro-electric energy are available in those sections deficient in fuel supplies. Undeveloped sites lie in general at increasing distances from consuming centres. Transmission systems at higher voltages than now in use, can make this energy available where needed. However, construction costs will be high for these more distant plants with long transmission lines.

Exact data on Canadian central stations were not available to the writer. The following estimates are based on information from several sources. The Department of Resources and Development at Ottawa has published Annual Bulletins on Canadian Hydro-Electric Progress and Water Power Resources. It is stated in these publications that the installed capacity in hydro-electric central stations in Canada in 1952 was 12,859,956 horse power.

Allowing for generator efficiency of 96 per cent, this represents about 9,210,000 kw. capacity. Steam plant capacity estimated about 700,000 kw., increases total central station availability to 9,910,000 kw. If it is assumed that this capacity approximates present peak demands plus reserve, then 39,640,000 kw. capacity will be needed by 1975.

The Department's publications also state that the total estimated hydro capacity in Canada at ordinary minimum flow is 29,207,000 horse power or about 20,917,000 kw. At ordinary 6 months' flow, possible turbine installations of 66,000,000 horse power or about 47,267,000 kw. are possible. Ten per cent of this capacity will probably be used by pulp and paper mills, aluminum works, mines and other industries.

Also a considerable proportion of these capacities, about 10 per cent, is in northern British Columbia, northern Quebec, Newfoundland and the Northwest Territories. One may assume that only 80 per cent of these potential powers will be economically available for electric stations by 1975. Hence, possible economic hydro sites may provide by 1975, capacity at ordinary minimum flow of 16,734,000 kw., and at ordinary 6 months' flow of 37,814,000 kw.

The difference between these two figures of 21,080,000 kw. represents capacity available for 6 months only. The difference between the estimated demand in 1975 of 39,640,000 kw. and the capacity available at ordinary 6 months' flow of 37,814,000 kw. amounts to 1,826,000 kw. This would have to be supplied from other power sources.

Experience has shown that central electrical systems cannot render continued service based on capacities of 6 months' flow only. In U.S., the Tennessee Valley Authority, the City of Los Angeles, the Pacific Gas and Electric Co., and power systems in the Southern States, have found it necessary to supplement their hydro-capacity by large steam plants. The Bonneville Power Authority is said to be considering the acquisition of coal fields in Canada to supply steam plants that must be added to their hydro-electric system to provide for low-water periods.

Hence, it is reasonable to assume that some of the 21,000,000 kw. available for 6 months only, will require supplementing by other power plants. If it is assumed that one-third of this capacity must have stand-by plant, an additional capacity of 7,027,000 kw. must be provided by other than hydro.

These estimates indicate that, besides the capacity of 37,814,000 kw. in hydro-electric plants, a total of (1,826,000+7,027,000) 8,853,000 kw. capacity must be provided in other plants, the majority of which now appear to be steam plants. The enormity of Canadian power developments becomes apparent from these capacities.

Steam Power

Regarding Canadian fuel supplies, the coal fields of the Maritime Provinces can care for that area

d also for a portion of Quebec. ıe Prairie Provinces have large posits of coal, petroleum and tural gas. The two latter can made available to Ontario and uebec by pipe lines. British Columa also has large supplies of ineral fuels.

Ontario and Quebec must depend ı coal supplies from outside sours, and principally from the U.S. he opening of the St. Lawrence eaway will make coal cheaper than present at many points in these rovinces, as iron ore carriers will ek cargoes of coal on their down ips to Seven Islands.

District heating merits attention ı connection with fuel-burning lants in Canadian cities. Winters ı northern latitudes are long and old. Older sections of cities have eteriorated as living quarters and ome are becoming slums. Reconruction of these areas with busiess establishments and apartment uildings would provide a favorable ituation for district heating. Air ollution would be lessened, fuel eliveries kept off the streets. Usable reas in buildings would be increased by the elimination of individual heating plants.

As a combined result of these gains, real estate values would increase, thereby increasing the city's axable basis. The heating steam equired could be generated in entral electric plants at high pressures, and passed through steam urbines as reducing valves into listributing pipes. The seasonal lectrical energy thus developed ould be delivered to the power distribution system when and as available. Such kilowatt-hours would be developed at low fuel cost.

Natural gas is a premium fuel. Its greatest utility is for domestic use, certain industrial processes, and petro-chemical manufacture. While now used in steam power plants, from the standpoint of national economy it should be reserved for other purposes. In the U.S. the well head price of natural gas has increased steadily, and it will become too costly to use for steam generation. One can expect the same cost trend in Canada during future years.

Fuel oil will become available at many centres, through pipe lines from Western Canada, and by tankers. Its continued use for power generation depends upon its cost, which will probably increase. Where fuel oil will presently be used in steam stations, the boiler furnaces are being designed for the later use of coal.

Trends in Design

Foresight and boldness are necessary in planning future fuel-burning plants. The art of steam power production is changing rapidly. Only the installation of large modern high pressure, high temperature units will avoid early obsolescence. Low unit costs, long service life and high efficiency are best assured by such large units, and by employing what may appear, at the moment, to be extreme steam conditions. Interconnections justify the addition of unit capacities that may appear disproportionate in size to other units on the local system.

Certain aspects of steam plant design warrant consideration. The operating availability of steam generators, turbine-generators, and their several auxiliaries has increased. Power plants are now built on the unit system of "one boiler-one turbine", even in the largest sizes. Each unit has its own set of auxiliaries, and there is no interconnection between units except on the out-going electrical feeders. This design saves costly valves and piping, simplifies operation especially where reheat is used and lowers installation cost.

Certain "Preferred Standards" for 60-cycle turbine-generators have been adopted in the U.S. These cover units ranging from 12,630 kw. to 150,000 kw. in capacity. Non-standard single units up to 250,000 kw. capacity have been purchased, while units up to 500,000 kw. are under discussion. All electric generators 16,500 kw. and larger are hydrogen cooled at hydrogen pressures up to 30 lb. per sq. in.

While most of these larger units are single shaft machines operating at 3,600 r.p.m., some of the largest sets have two shafts with a 3,600 r.p.m. high-pressure unit, and a low pressure 1,800 r.p.m. turbine to provide sufficient exhaust areas.

Steam pressures up to 2,300 lb. per sq. in gauge are in use, and pressures up to 4,500 lb. per sq. in. gauge are under discussion. Steam temperatures are limited to about 1150°F. by the metals at present available for superheater tubes. New metals are under development, and increases in temperature may be expected. Substantial gains in fuel efficiency can be secured by employing reheat at these high pressures. The majority of large installations now have one stage of reheat.

Improvements Bring Savings

Thermal efficiencies of steam stations have steadily improved. The average coal consumption in all utility plants in the U.S., which was 1.38 lb. per kwh. in 1938, decreased to 1.1 lb. per kwh. in 1952. Many new plants use only 0.75 lb. of coal or 10,000 B.t.u. per kwh. A recent estimate for a future plant with 3,200 lb. per sq. in. gauge, 1,150°F. followed by two stages of reheat to 1,100°F., is 8,650 B.t.u. per kwh., or about 2/3 lb. of coal of 13,300 B.t.u. per kwh.

Piping systems are simplified by the unit design. Steam headers and feed water headers are eliminated, saving many valves. Valves between superheater outlet and turbine stop valves are left out in many cases. Piping is welded throughout.

Steam generators are of radiant-heat type, with large furnaces having heat release rates of the order of 18,000 B.t.u. per cu. ft. when fired with pulverized coal. Units developing 800,000 lb. per hour of steam and larger, may have divided furnaces or intermediate platten groups of tubes in the upper furnace. Coal is usually burned in pulverized form. Cyclone furnaces are used with coals having low-fusing ash. Pressurized furnaces permit omission of induced draft fans. Forced circulation will probably be employed on steam generators with pressures above 2,500 lb. per sq. in. gauge.

Boiler drums are all welded, and connecting tubes will probably be welded also to drums on future units. About half the heat added to the steam is absorbed in the superheaters, which are generally built in two sections. Superheat control is important at high pressures and temperatures, and may be secured by attemperators, spray desuperheaters, flue gas recirculation or burner control. Besides economizers, air preheaters are added to provide air to the furnace at temperatures up to 700°F.

Available coals are becoming higher in ash content. Ash disposal areas of ample size should be provided adjacent to new plants. The public has become aware of air pollution. Hence fuel-burning plants must be provided with mechanical or electrostatic dust catchers or both, to lessen the discharge of dust from chimneys. Sulphur cannot be removed at present from fuel or flue gases by any economic method. Increased demands for sulphur for industrial use may lead to the development of means to remove it, either from the raw fuel or from the chimney gases.

Substantial savings in total plant

cost have been made in southern sections of the U.S. by the elimination of building structures. Some northern plants have parts of the steam generator and its auxiliaries outdoors. It would seem more desirable to totally enclose Canadian plants. Such enclosed plants in the U.S. now cost from $160 to $180 per kw. capacity. Lower-priced building materials are desired to lessen the cost of station structure.

Increased instrumentation is an outstanding development in steam plants. Practically all equipment is operated from a single control board, or at most from two control boards. The operator secures high efficiency by interpretation of the instruments on these boards. This centralization has decreased the number of plant operators.

Working Fluids other than Steam

Studies have been made of the possibilities of using other working fluids than steam in power plants. The conclusion was reached that only mercury appeared promising.

A number of plants have been built in the U.S. to use the mercury-steam process. Good thermal performances have been secured, the highest being about 9,400 B.t.u. per kwh. The mercury plant is expensive to build and, as its thermal performance is being approached by steam, it has not enjoyed wide popularity.

Diesel engines have exceptional thermal efficiencies, in the smaller sizes performances from 10,000 to 12,000 B.t.u. per kwh. when in good operating condition. These engines burn natural gas or fuel oil in commercial sizes up to about 3,000 kw. Maintenance becomes high when low grade fuels are used, or with the employment of high brake MEP.

The engineers of the Rural Electrification Administration of the U.S. recently decided that Diesel engines were best suited to plants of 10,000 kw. or less in capacity. Diesels will be used largely in small isolated plants or for peak purposes at the ends of long transmission lines as well as on the railroads.

Gas Turbines

European builders have constructed the larger gas turbine sizes to date, although higher gas temperatures are used in American units than in Europe. Theoretical cycles offer some interesting possibilities. However, practical difficulties with metals that must stand high temperatures, erosion by ash particles and particularly by vanadium in the ash, and the construction of heat exchangers, have slowed development.

This promising machine will eventually find a place on power systems, either alone or in combination with steam generators, particularly for pipe line operation and for the smaller electric stations. Since the gas turbine gives best performance with low intake air temperatures, it should be particularly suitable for northern Canada.

Atomic Energy

Power production from atomic energy has been demonstrated on a laboratory scale. As now conceived, the nuclear reactor will take the place of the boiler and furnace for the generation of steam for turbine-generators. Military secrecy has prevented dissemination of information on reactor performance, and no data are available. Some time may elapse before the possibilities of atomic energy for central station service can be properly appraised.

It appears from general discussions of power plants to use atomic energy, that initial investment will be high. Operating costs may exceed those in present coal-fired plants if the uranium is entirely consumed, but may be relatively low with breeder-type reactors, or where radio-active by-products may be sold at a profit. Some electric generating stations using atomic energy may be expected to be in service before 1975. These may influence later programs of Canadian power development.

Two Pressing Needs

It would have been impossible twenty-five years ago to predict the progress in science and engineering that are today's achievements. One is equally at a loss to predict what may occur between now and 1975. However, the importance of power in the daily life of the nation makes it obligatory upon engineers to keep abreast of all developments in science, and to apply these where possible.

One may ask, "What pressing needs in power development demand early satisfaction?" Two appear of major importance:

(a) Greater thermal efficiency in power production.

(b) More economic means of delivering energy to users.

Regarding thermal efficiency, while station heat rates have been reduced from 23,000 B.t.u. per kwh. in 1914 to 9,400 B.t.u. per kwh. today, the best overall thermal efficiency is still only 36.3 per cent. This is largely due to the complicated cycle of burning fuel, generating steam, expanding it in a turbine, and wasting much of the total heat of the fuel to the condenser cooling water.

What is needed is a method to produce electrical energy directly from the combustion of the fuel by the absorption and conversion of the radiant heat and light rays emitted in the furnace. The means to effect this transformation are not known now but when discovered, will revolutionize power development.

Concerning the second need, the expense of transmitting and distributing electrical energy is increasing. This is particularly true of those transmission lines at high voltage that will be needed to reach distant power sources, and to provide system interconnections. Small amounts of energy have been sent short distances by wireless. Possibly directional devices of a radar nature may eventually supercede towers, insulators and transmission lines to distribute energy without wires and at lesser cost.

The importance of the human element in future developments cannot be overlooked. Advances in design result from the imagination and resourcefulness of engineers. Large steam power stations with automatic controls require the use of brains rather than strong backs to achieve high efficiency. The careful training of operators for such plants becomes a major consideration. College-trained men are finding increasing opportunities in the management of such stations.

Conclusions

The preceding paragraphs have presented some views on the growth of electrical loads in Canada, and of the steps necessary to meet their rapidly increasing demands. Canadian engineers must design and build large steam stations in addition to many hydro-electric plants to care for load growth. Great sums of money will be required to build the necessary generating plants and distribution systems. Many more highly-trained operators will be required in new plants.

The task ahead is a formidable one, and presents a challenge to the engineering profession of Canada. However, in view of previous accomplishments, Canadian citizens may rest assured that their engineers will provide for these future power requirements, with competent means that will yield efficient results. √

Fig. 1. The completed bridge

Design of a Prestressed Concrete Bridge

by

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A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 22, 1953.

Early in the Spring of 1952 a meeting took place between officials of the Department of Public Works of British Columbia, representatives of a Vancouver contracting firm and the author. At this meeting it was agreed that the Department would consider on its merits a proposal for the construction of what is believed to be the first prestressed concrete bridge in Canada. The author contributed the experience in prestressed concrete bridge design he had gained in France, mainly with the Société Technique pour l'Utilisation de la Précontrainte (S.T.U.P.).

The specifications of the Department called for a span of 60 ft., to carry its standard H-20 S-16 loading on a 48-ft. wide deck and on two 5-ft. wide sidewalks. The location is the crossing of Marine Drive over Mosquito Creek in North Vancouver. Figure 1 shows the finished bridge.

Unfortunately, there are no standard specifications governing the design of prestressed concrete structures, either in Europe or on this continent. It was, therefore, decided to comply with the French usage of allowing as design stresses in the concrete 28% of the strength of a cube 90 days old. Actually, this rule was drawn from the old reinforced concrete design code.

The selection of 2,000 p.s.i. as a working stress forced the contractor to supply concrete with a cube strength of 7,150 p.s.i. at 90 days, roughly equivalent to a cylinder strength of 5,400 p.s.i. at 28 days, a specification he met with no great difficulty. The working stress selected for the 5 mm. high-tensile steel wires was 120,000 p.s.i. The Blaton-Magnel stressing and anchoring method was used as may be seen on Figures 2 and 3. The steel wire was procured from Belgium.

European practice would have a bridge of this class poured in place as a slab and then stressed. In this country, however, as the cost of labour is high as compared to the cost of materials, it was felt that only a "plant made", i.e. precast-structure could meet the competition of either steel or reinforced concrete. In fact, 90 per cent of this bridge was poured at the contractor's yard and the rest in the field.

The general features of design may be seen from Figures 4, 5 and 6. The bridge consists of 20 identical

This is a step by step account of the design and construction of what is thought to be Canada's first prestressed concrete bridge. The paper is the more useful because it includes the results of destructive test of one girder and some data on the comparative economy of the structure.

Fig. 2. Grout pipe and sandwich plates at end of girder. Shows also roller supports for testing. *B.C. Government photo.*

Fig. 3. Stressing the wires.

stringers of 62 ft. overall length, each prestressed by three cables. Each stringer has triangular wings or brackets at its third points (see Section AA, Figure 6) linking top and bottom flanges and acting as stiffeners and also as starters for the ultimate completion of the two diaphragms necessary.

The girders, the weight of which was 13 tons each, were transported to the site by road and then placed on their supports 37 in. on centers, thus leaving 4 in. between the top flanges. Ducts to receive the transverse cables were provided in the top flanges and also in the wings (see Figures 4 and 6). After threading these transverse cables the spaces between top flanges and wings were concreted, care being taken that no bond developed between the cables and the concrete. Once the concrete had cured, all cables were stressed, forming a rigid and almost monolithic deck. The setting of curbs, slabs, and fence posts, for which dowels had been provided, finished the job.

The stringers are 2 ft. 6 in. deep and consist of a 4.5 by 33-in. top flange and a 5 by 15-in. bottom flange, connected by a 5-in-thick web. Each spans 60 ft. from center to center of supports and has on each end a cantilever of one foot. (See Fig. 4).

Three 2 by 2-in ducts are placed in the bottom flange, containing the three stressing cables, two of 20 wires each and one of 24 wires of 5 mm. (0.197 in.) diameter. All cables are held in place by spacers in a metallic sheath. After stressing they are grouted in, thus preventing corrosion and also developing bond with the concrete girder body.

At seven feet from the supports the web begins to increase to 12 in. thickness, which provides more sectional area to meet the heavy shear stresses near the ends. This also permits two cables to be bent up; hence the resulting pressure line is raised to cross the centroid plane of the beam section.

We have thus obtained a perfectly balanced system dealing with the critical positive moments at midspan and shear at the ends and also with the small negative moments in the projecting end cantilevers.

This system, though highly economical so far as material is concerned, can be used only with the post-tension method of prestressing or in the few processes which pretension wires having directional changes. In Europe bridges are often built by simply pretensioning straight wires; it is claimed that savings in labour make up for the less economical use of building materials.

All girders were poured, vibrated, cured, stressed and grouted at the contractor's construction yard. Stressing took place after the concrete had reached 4,000 p.s.i. strength and grouting was done immediately afterward. The ducts for the transverse cables (see Figure 3, left beam) were formed with wooden wedges which were removed an hour after pouring.

The Department of Public Works assisted in designing the concrete mix. For the first eight beams the concrete strength was no more than the 5,400 p.s.i. specified, but the contractor and the resident engineer made changes that greatly improved the concrete. Toward the end of the job concrete tests were very uniform and considerably above specifications. Concrete poured on site, for instance, tested up to 9,000 p.s.i. at 28 days with high-early strength cement.

Under certain conditions it is economical to precast two "end plates" of, say, 10 in. thickness of high grade concrete. These end plates are shaped to fit the form and thus to act as the ends of it. It is then easy to embed the anchors at the correct angle. After setting the cables, the girder proper is poured between these end plates, which are adequate to take the thrust of the anchors and to spread it over the section.

Rocker plates designed by the

Table I — *Stresses developed at various stages of Construction*

	Pre-stressing	Beam weight	Placing	Field concrete	Deck	Sidewalk	Total dead load	Live load	Total full load
Top fiber.....	− 514	+ 662	+ 148	+ 79	+ 227	+ 221	+ 448	+ 607	+1055
Bottom fiber...	+2655	−1047	+1608	− 126	+1482	− 369	+1113	−1018	+ 95

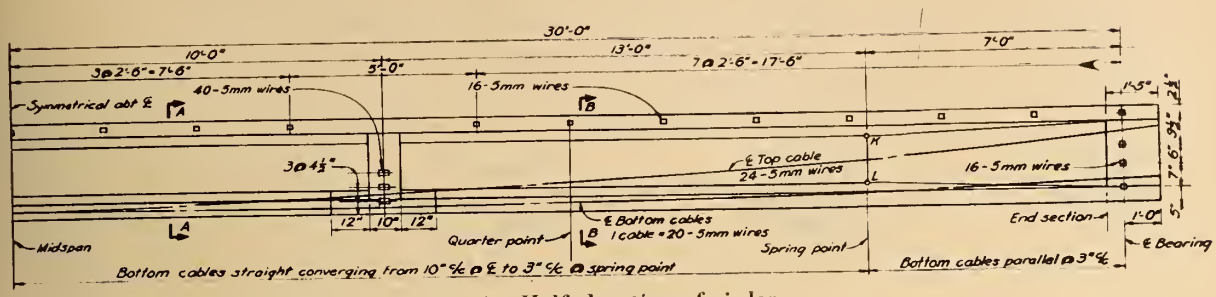

Fig. 4. Half elevation of girder

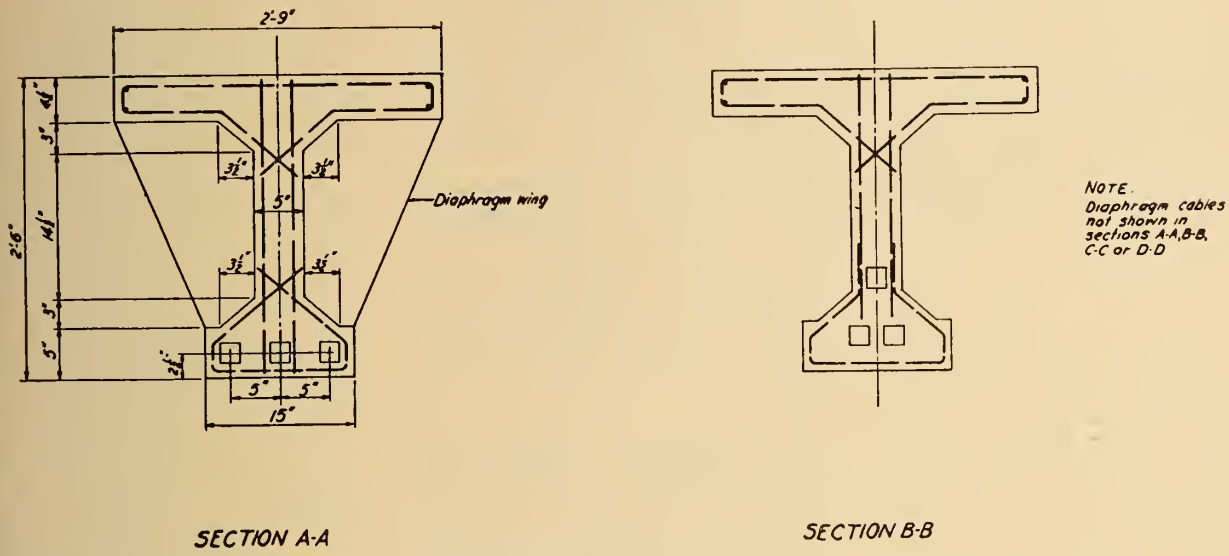

Fig. 5. Cross sections of girder

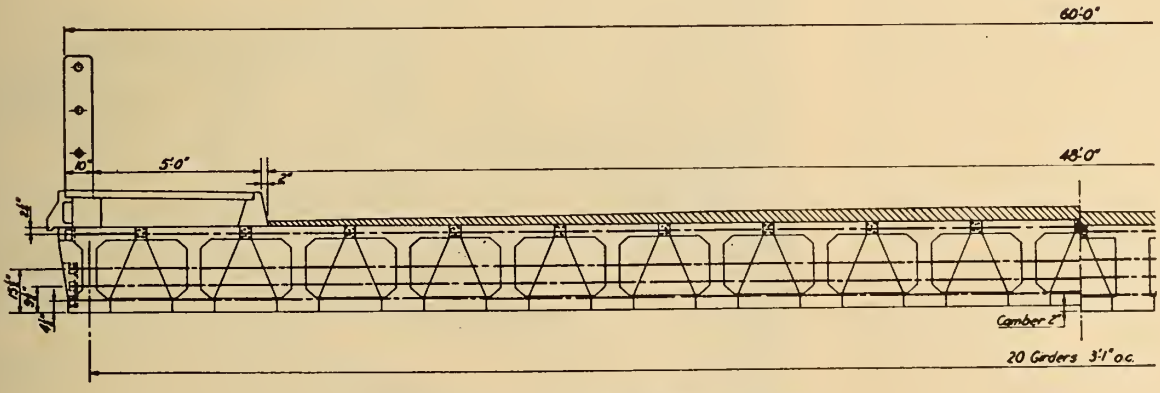

Fig. 6. Half-section of bridge at mid-span.

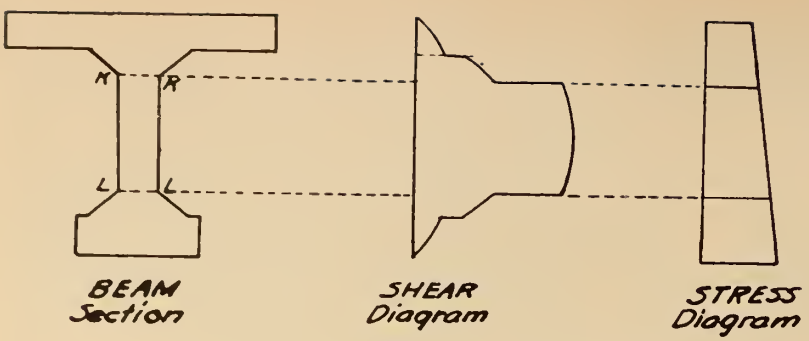

Fig. 7

Department were embedded in the bottom of each beam, one at each end. On future jobs the rocker plates should be anchored to the concrete; on this job most of them moved in the form, causing considerable delay.

These girders, after having been hauled to site, were placed on the abutments by two cranes. The abutments were built by the Department's own forces. Once the girders were in place, it was the contractor's responsibility to thread the transverse cables in the deck and diaphragms, 16-wire cables in the former and three 40-wire ones in each of the latter. All that was left now as field work was to concrete the trapezoidal blocks between the third-point-wings and the 4-in. gaps between the top flanges, the cables being kept separated from the concrete by metal sheaths. After four days' curing, when the concrete had a strength of 4,000 p.s.i., these cables were stressed and grouted.

The sidewalks, curbs, railing posts and fascia strips were supplied by the contractor and were pre-cast. A layer of asphalt with a 3-in. crown prepared the bridge for traffic.

In design particular care is to be taken that under no circumstances, be it either with the individual girder unloaded while under shipment or with the bridge fully loaded, do tension stresses develop in the concrete. Inspection of Table I, in which the stresses occurring under the various stages from assembly to the ultimate loaded condition are recorded, shows that care was taken to keep them all positive—i.e. compressive—and well above zero. On the other hand they do not reach the design limit. This table applies to the midspan section, but three more sections between the midsection and the abutment were also checked for bending moment stresses.

Then the various sections of the stringer were checked for shear. Here the ascending cables help to resist shear stresses, as the vertical component of the stress in them partly balances the shearing forces, which are perhaps the greatest worry in concrete structures. This feature is an important one in favour of prestressed structures. In this design almost all shear reinforcement was eliminated, with considerable saving in material and labour. Actually the stirrups used are not required by design, but serve only for more accurate positioning of the rising cable and as a measure of protection against mishandling. Shrinkage steel is superfluous altogether, all concrete being constantly under compression.

The diagrams for shear and axial stresses of Figure 7 make it clear that the sections at the top (K-K) and the base (L-L) of the web are the critical ones for shear. Although unit shear is maximum at the centroid of the sections, there is always sufficient compressive stress there to reduce the resulting diagonal tension to a safe value. As shown in this sketch Section K-K is obviously critical.

Assembled and prestressed as this deck is, the 4.5 by 4-in. section of the gap fillers may be added to that of the stringer top flange, for an appreciable increase in the moment of inertia of the deck.

Transverse prestressing is necessary for strength in the deck. The 37-in. span between girders has to carry the maximum wheel loads required by the Department's specifications. Load spreading computations, similar to those described in Reynolds' handbook were applied and checked by Westergaard's theories. The results required sixteen 5-mm. wires at 2 ft. 6 in. spacing.

All wires in the third-point diaphragms are straight. Unlike the girders, the diaphragms have to carry both positive and negative moments, depending on whether vehicles are in outer lanes only or in inner lanes. In a bridge of this kind where the width equals the span, design of the diaphragm requires many hours of computation. In this case the diaphragm section needed a heavy bottom flange. Precast concrete blocks, weighing about 100 lb. each, were therefore inserted on both sides of the web. They are held in place by the pressure imposed by the prestressing cables. These diaphragms are the only parts of the bridge where the concrete stress is expected to rise to 2,000 p.s.i., i.e., to the maximum working stress. This is usually not the case where the

Fig. 8. Girder after failure under test. ***B.C. Government photo.***

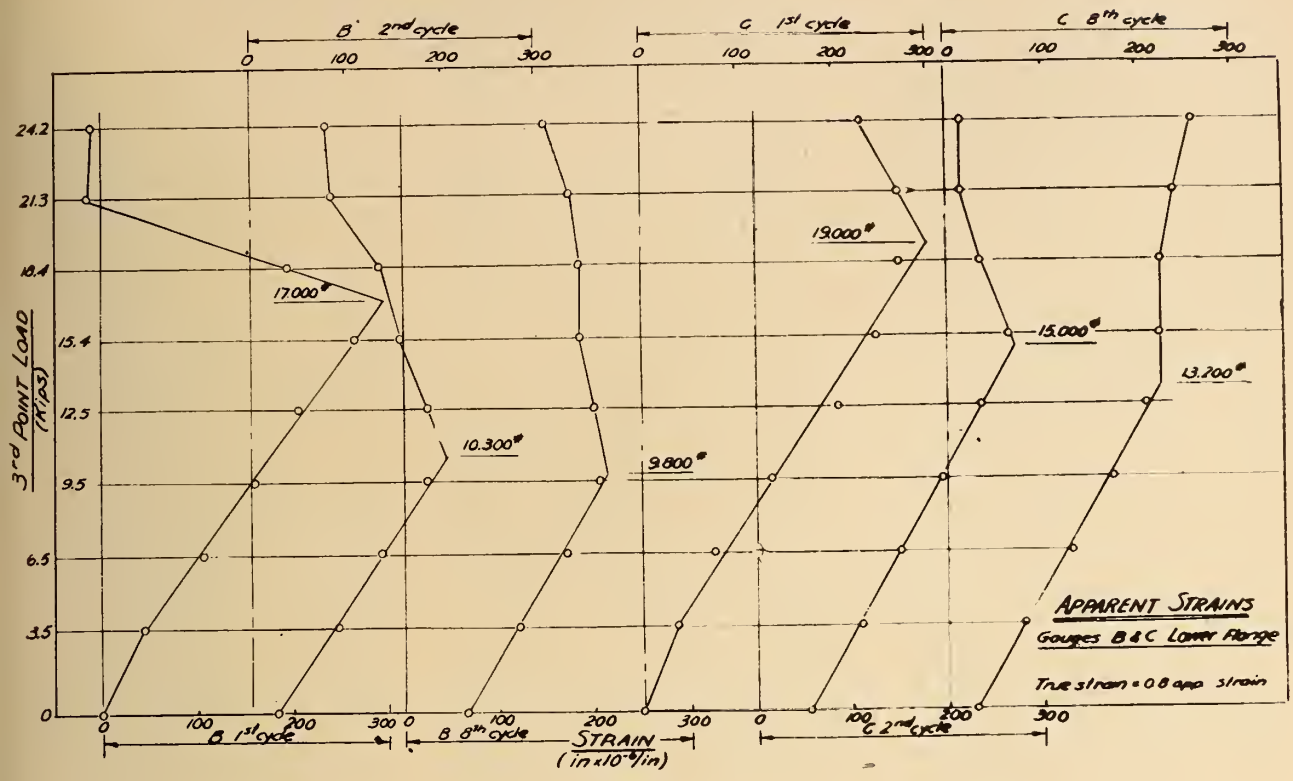
B 2nd cycle
C 1st cycle
C 8th cycle
3rd POINT LOAD (Kips)
24.2
21.3
18.4
15.4
12.5
9.5
6.5
3.5
0
17.000#
10.300#
19.000#
9.800#
15.000#
13.200#
APPARENT STRAINS
Gauges B & C Lower Flange
True strain = 0.8 app. strain
B 1st cycle
B 8th cycle
C 2nd cycle
STRAIN (in x 10⁻⁶/in)

Fig. 9

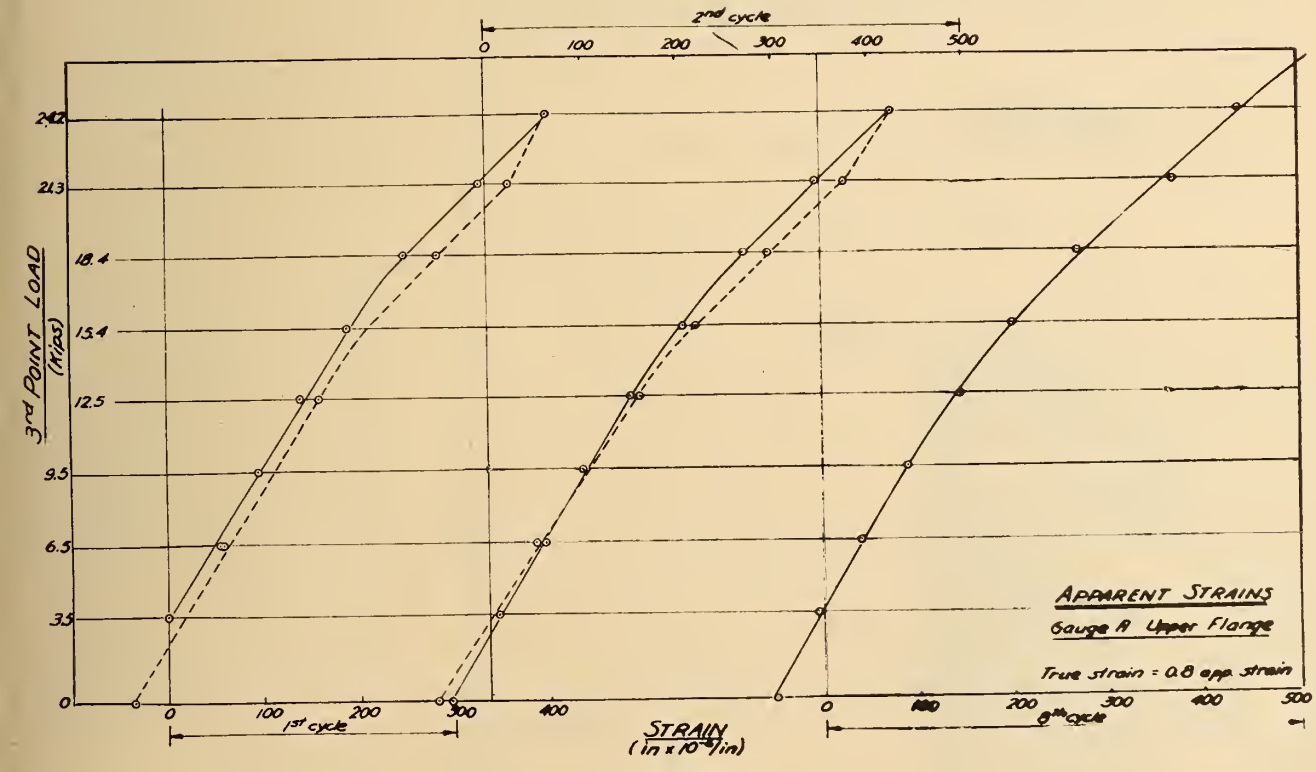
2nd cycle
3rd POINT LOAD (Kips)
24.2
21.3
18.4
15.4
12.5
9.5
6.5
3.5
0
APPARENT STRAINS
Gauge A Upper Flange
True strain = 0.8 app. strain
1st cycle
8th cycle
STRAIN (in x 10⁻⁶/in)

Fig. 10.

bridge is longer than it is wide.

The design being approved by the Department of Public Works, the contract required that an acceptance test be carried out with one beam. The test was conducted by the British Columbia Research Council in September, 1952. The beam failed when the test load equalled dead load plus 5¼ times the maximum live load. This result was mainly owing to the excellent bond between the cable and the mass of concrete through grout and sheath. Figure 8 shows the broken girder. The near end of the far broken section gives an almost true idea of the deflection just before failure.

The acceptance test was to consist of at least five loading cycles, in which the girder was to be subjected to the equivalent of dead load plus three times live load and impact, and it was required that after the removal of this load, the girder should return to zero level and thus prove that it was not damaged. In fact, seven loading cycles were imposed and then the girder was loaded to failure.

In the course of the first two cycles the load was increased by intervals of about 3,050 lb. and subsequently released. Then five times this load was applied and released as quickly as possible. The loss of camber after the seventh cycle was 0.17 in., half of which occurred in the course of the first loading. Recovery always seemed almost complete.

Finally, the load was again increased until under a load of 82,000 lb. the girder collapsed due to shear failure at one of the loading points. The deflection was then 21¾ in., a satisfactory result for a girder the reinforcement of which was as low as 0.57 per cent.

For the test the girder was placed on two concrete piers. It rested at one end on a steel plate and at the other on four steel rollers (see Figure 2). Two steel frames straddling the girder at its third points were tied to sills resting on the ground These sills were loaded with 60 tons of cement in bags. Figure 8 shows the arrangement. Two pairs of hydraulic jacks were interposed between the frame cross beams and the girder, their plungers pushing against the crossbeam above and thus transmitting load into the beam. The two jacks at each loading point were interconnected in parallel.

Deflection was measured by a number of water levels all connected to a reservoir and to a datum level station, the latter well away from the test set-up.

Deformations were measured by strain gauges, one of which was placed at midspan on each edge of the lower flange at the same elevation as the cable centerline. The third was also at midspan but on the longitudinal axis of the top surface of the upper flange. A dummy gauge used for eliminating errors of temperature, etc., was placed beside each of these active gauges. All strain gauges were installed the day after steam curing was finished.

Mr. A. B. Sanderson, assistant bridge engineer for the British Columbia Public Works Department, prepared a report, based on the results of the tests, and with conclusions which give clearer insight into some features of prestressing. In Europe, engineers are inclined to connect the bridge safety factor with the load causing failure, but it is Mr. Sanderson's view that in this country the load that will cause permanent damage to the bridge if repeated is the important consideration. The reason for this opinion is that specification loading in Europe is generally heavy, though such loading occurs infrequently. In this country where specification loads are likely to be exceeded frequently during the life of the bridge, e.g., by logging trucks, it is only realistic to investigate behaviour under repeated overload.

It was concluded that in spite of the fact that these repeated overloads of the tests stressed the bottom fibres of the girder beyond their tensile capacity—which was found to be 155 p.s.i.—the elastic properties of the girder were not impaired.

The value of EI was established in three different ways:

1. By recording the period of vibration.
2. By measuring deflection under load.
3. By measuring strain under load.

The following formulae were used, respectively:

1. $EI = \dfrac{4f^2L^4W}{g}$

   where f = period of vibration
   L = span
   W = unit weight of beam

2. $EI = \dfrac{46}{1296}\dfrac{WL^3}{D}$

   where W = applied load
   L = span
   D = deflection

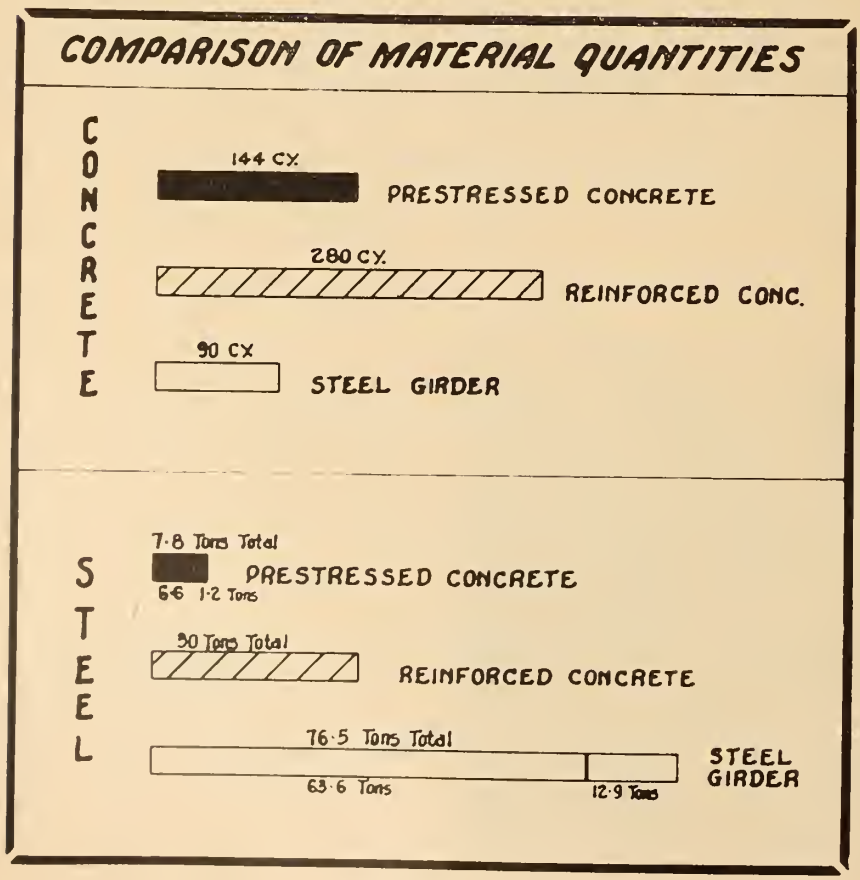

Fig. 11.

$$EI = \frac{Md}{E_1 + E_2} = \frac{Ld}{3\left(\frac{E_1}{W} + \frac{E_2}{W}\right)}$$

where M = moment
L = span
d = distance between top and bottom gauges
W = applied load
E_1 and E_2 = strains as measured

The mean value found in each se was

24.4×10^{10}
24.3×10^{10}
34.7×10^{10} or an average of
$EI = 24.5 \times 10^{10}$

The value of E deduced from the above average is

$E = 6.6 \times 10^6$ p.s.i.

Figure 9 shows that cracking at ne side of the lower flange occurred t a load of 17,000 lb. and at the ther side at 19,000 lb. Correcting or the dummy-gauge readings in oth cases, the value of the ultimate ositive strain is obtained. The cor-esponding maximum tensile stress s then found by multiplying by , or (6.6×10^6), and is 155 p.s.i. Note, in Figure 10, how the cracking oad affects the strain curve of the op flange.

Useful for further investigation is he knowledge of the actual pre-tressing force at midspan. This can e calculated by marking the zero tress point at cable elevation. When tresses are zero at that point, the ressure line from prestressing must coincide with the top of the kern of he section above the cables. This kern being known, the lever arm is known. By dividing the applied moment by the lever arm the force exerted by the cables is obtained, in this case 218,000 lb.

This force is not to be considered as being developed by prestressing only. The cables were tensioned when there was no exterior force other than the weight of the girder. The fibres of the girder at cable elevation were then under compression. Now the cables were grouted in and to bring the stresses back to zero the beam was loaded, hence a decompression of the concrete and an elongation of the grout fibres occurred, and this elongation was imparted to the cables. Thus the resulting force due to prestressing was $218{,}000 - 11{,}700 = 206{,}300$ lb.

As compared to the design load (238,000 lb.), there was a greater loss after initial stressing of the cables than had been expected. The reasons are not clear. One explanation may be that the design stress was never developed in the center section because of excessive friction, perhaps at the spacers. Against this idea is the uniformity of deflection and of cracking during the test. However, the discrepancy has not seriously impaired the ultimate strength nor the performance of the girder.

In reviewing this project—building a prestressed concrete bridge with crews having no special training whatever, the results may be called encouraging, in spite of the "teething troubles" the contractors had to face during the job.

It may be stated that prestressing requires initiative and investment. Once one has trained crews, there is considerable saving because of simplicity of design. Engineers, draughtsmen and workmen have to develop special skills, but a prestressed concrete plant requires relatively little in all categories.

One needs high grade steel and first-class concrete, but quantities are so reduced that costs compare favourably with those of other methods of construction. The bridge engineer for whom the Mosquito Creek Bridge was built has reported that although his department spent $4,000 on testing and experimenting, yet the job showed a worthwhile saving.

The total area of the deck was 3761.5 sq. ft. and the unit volumes used were:

Mild steel:

$$\frac{2400}{3761.5} = 0.64 \text{ lb./sq. ft.}$$

High tensile steel:

$$\frac{13140}{3761.5} = 3.5 \text{ lb./sq. ft.}$$

Concrete (except for precast sidewalk and diaphragm blocks):

$$\frac{144}{3761.5} = 0.038 \text{ cu. yd./sq. ft.}$$

Figure 11 shows graphically the actual quantities used in the Mosquito Creek Bridge as compared to estimated quantities for conventional reinforced concrete and structural steel designs. The savings are apparent.

Figures on labour costs are not available at the time of writing. The designer's time was not recorded, but 17 hours sufficed for a good draughtsman to make a presentation drawing which helped to get the job. More draughting hours in the bridge engineer's office were spent for detailing.

In this case, some of the general advantages were:

No severe winter season would have stopped construction.

The small depth of the girders saved a considerable approach grading at both ends of the span.

No maintenance is needed.

Neither moisture nor fire much affect prestressed structures, all concrete being normally under compression.

It is clear that prestressing has a promising future in spite of the high cost of labour here. This fact is perhaps in favour of prestressing, once it has become a common operation. It is a good thing to prepare now for the time when the national economy will demand serious efforts at saving materials and when a real start is made to provide Canada's ever-increasing population with comfortable, light buildings and less inflammable homes. √

New Braille Telephone Switchboard

Through the co-operation of our telephone company and a well known Canadian steel fabricating organization, The Canadian National Institute for the Blind has been enabled to place the first trained switchboard operator to be employed by a Canadian company according to a recent report.

A special Braille switchboard, having 7 trunk lines and 27 locals, designed and installed by the telephone company is used and the young lady, Miss Françoise Sansoucy, who has been blind since childhood, was trained by Miss Betty Walker who operates the Braille switchboard at the offices of The Canadian National Institute for the Blind.

Development of a Fish Processing Plant at Louisburg, N.S.

by

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A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 20, 1953.

History of Fish Processing

The history of fishing in the waters of the eastern shores of Canada is older than our recorded history. Before the French explorations of the coast and the English exploration of Newfoundland, fishermen from Europe had sailed to the Grand Banks to take cod. No history of any moment of this industry has come down to us.

The early development of the industry centred around the salting and smoking of the better known varieties of fish for long distance shipment. Drying was done outdoors on platforms by natural means, sun and wind. Later, refrigerator cars made possible the extension of fresh fish shipments to markets further from the sea, but still relatively close, since fish begins to lose its prime flavour immediately on leaving the sea. The growth of the industry was consequently slow and the extension of markets into the interior of Canada and of the United States small.

With the development of the fast freezing of meats, vegetables and fruits came the application of the principle to fish. This was not unattended by difficulties and failures, but with experimentation and experience the fast freezing of fish fillets—and equally important to the consumer, attractive packaging—opened up markets for fish which had hitherto been unaware of the true flavour of fish. At present fast frozen fillets are sold at all seasons of the year with a uniformity of product and annual increase in sales are amazing.

Most developments took place gradually, with new processes imposed on existing facilities or on extensions to them. The original fish plant was a landing shed on the wharf where fish were gutted, salted and put out to dry, the first marketable by-product being cod livers. The fishermen at times used fish waste for fertilizer, but mostly it served no useful purpose. As the smoking of fish developed smoke houses were added; later canning facilities were erected on or adjacent to the landing wharf. The fresh fish market required some cold storage space and this was imposed on the existing layout. Finally, space had to be found for fast freezing equipment and processing lines, all within limited space and in addition to processes which continued in operation. It may be said that the plants of the industry, like Topsy, "just growed".

An interesting point about the Louisburg Plant is that it is one of the first of any size to be designed around the processing and fast freezing of fish fillets and the processing of the fish waste into a marketable product.

History of the Louisburg Development

Louisburg, N.S., is located on Louisburg Harbour some twenty-two miles from Sydney. It was originally the location of the well known French fortress which guarded New France and the entrance to the Gulf of St. Lawrence. The harbour is ice free in winter and in area rivals the harbour of Halifax. It is closer to the main fishing grounds than ports further south, but development of the harbour and of the town has been very slow for a long time. A report on Louisburg's possibilities was prepared for the Government of Nova Scotia about 1944. The Department of Trade and Industry of the Province also at-

It is appropriate that this paper should have been presented at the annual meeting in Halifax, important as that city is in Canada's fishing industry. The Louisburg plant is a monument not only to the engineers who designed it and the contractors who built it, but also to those who persuaded its owners to invest and to the Province of Nova Scotia, which supplied some of the necessary funds.

mpted to interest the fishing in-
ıstry in the development of the
ort as a centre. Crown land was set
ide for a plant site and the Federal
overnment built a reinforced con-
ete wharf there. Development
ong the lines proposed by the
rovincial Government, however,
quired heavy financing; such in-
ıstrialists as were interested in the
ısiness preferred to extend existing
lants rather than start on a com-
letely new venture. Eventually the
epartment and the Deputy Min-
ter at the time managed to interest
vo firms in the industry in the joint
evelopment of the site. The mys-
erious migration of fish northward
om their earlier haunts was per-
aps also in some degree respon-
ble for this interest.

Organization of Louisburg Fisheries

The firms are National Sea Pro-
ucts, Ltd., of Halifax, N.S., and
Gorton-Pew Fisheries, Ltd., of
Gloucester, Mass., one of the larger
nembers of the industry in the
Jnited States. The former firm
perates fish plants along the coast
f Nova Scotia and is one of the
argest of its kind in Canada. The
Gorton-Pew organization had been
perating a processing plant in
Caraquet, N.B., for some years past
vith the entire output going to the
Jnited States.

The relatively large amount of
capital required to construct and
equip a plant of the size necessary to
make the project worthwhile pre-
sented some difficulties in financing.
These were eventually surmounted
by arrangements whereby the two
owners erected and equipped their
own processing buildings and the
Provincial Government advanced
the funds for the erection and
equipping of the jointly owned
buildings under a 25-year mortgage.
The Government also arranged for
the transfer of the property set aside
for the plant and for the provision of
a railway siding, a fresh water
supply for plant use and of one for
salt water for cooling purposes. It
should be emphasized that apart
from the latter three items, no
subsidy is involved; the Provincial
Government holds a mortgage on
the jointly owned buildings and
plant equipment at interest. The
salt water system is operated by the
owners.

The two owners organized a third
concern, Louisburg Fisheries, Ltd.,
to hold and operate the joint facili-
ties, each having a half interest in it.

Plant Design

With the site for the enterprise
settled by the location of the
wharf, the factors entering into the
design of the buildings for the plant
were reduced by one. The rest—
quantity and types of fish to be pro-
cessed, freezing capacity and storage
facilities, processing requirements,
by-products production, power and
steam, climatic conditions and their
effect on standard building materials
—were given careful consideration.
The owners desired fire-resistive
structures of a good class.

The buildings comprising the
plant are seven in number; the
landing shed on the wharf, two
processing buildings, a cold storage
and fast freezing building, a shed for
fish meal production, a boiler plant
and an ice house. It was decided
that the plant would handle initially
30,000,000 lb. of fish per year,
landed weight.

The selection of the exterior walls
for the buildings was given careful
thought. The site, 25 feet from the
water, is subject to sudden drops in
temperature from mild fog to severe
freezing. Common walls of the
cheaper varieties have given trouble
in the past because frozen moisture
was trapped within them. The final
selection of corrugated asbestos
board was dictated by its dense im-
pervious nature and its thinness.
The boiler plant and fish meal
buildings have steel frames. the
wharf shed has a wood frame, and
the two processing buildings have
steel frames and insulated stud
walls, with asbestos siding on the
exterior and plaster on the interior.
All buildings have concrete found-
ations and concrete basement and
ground floors.

Aerial view of plant site with buildings outlined.

The cold storage building has a reinforced concrete frame and floors of flat slab type. Outside of the concrete frame, a light steel frame was erected on the same foundation walls. This steel frame was used to support the reinforcing required for gunite concrete, which was shot against plywood forms to a thickness of about two inches. In the process of shooting the gunite the steel frame was also encased in gunite concrete as weather proofing. The consideration which led to the selection of this outside wall was again the climate, which dictated a wall of great impermeability and of utmost density. Only time will tell if the selection is justified. Cork insulation was applied to the inside surface of the gunite with little or no preliminary treatment, the plywood forms having left a good surface for the application of the cork. This is of a uniform thickness of 8 in. and is laid on the ground floor, up the gunite walls for two stories and on the underside of the roof, forming a complete insulating blanket around the cold storage portion of the building. The only breaks in this blanket are the doors into the building, which open into air locks forming part of the corridors. The main cold storage rooms are six in number designed to be held at 10° F., two of which are 35 by 52 ft. on the ground floor, and four are 35 x 35 ft. on the second floor. On the ground floor there are also two rooms each 17 by 35 ft. designed to be held at 30° F. for fast freezing purposes if desired. The fast freezing portion of this building is of similar construction to the processing buildings, having a steel frame, corrugated asbestos walls, insulated, and plastered inside. The basement of this building houses the refrigeration equipment, a fast freezing tunnel and a storage space, and the upper floor contains the plate freezers for package freezing. This portion of the building also contains a refrigerated-bait sales room and a trawl-tub storage room for fishermen to keep their trawls properly. These two rooms are maintained at 25° F.

The processing buildings were designed around the production lines for fish fillets. The basements, which open up at grade on the water side, contain the filleting tables, which are completely mechanized. Fish travel to these tables from scaling machines on conveyer belts to the filleters. After processing the fillets are elevated to the upper floor of the building where they are inspected, packed and wrapped ready for freezing. The trays of packed fillets are loaded into buggies and pushed by hand across bridges to the fast freezers in the cold storage building, the ground floor of which is at the same level as that of the processing buildings. At the rear of the buildings this floor is served by a railway siding, permitting trucking from all three buildings into refrigerator cars and refrigerator trucks.

The location of the wharf placed one owner in a preferred position relative to the landing shed. The eventual layout therefore put the buildings in a row along the waterfront, with the cold storage building between the two processing plants and the fish meal building beyond. This resulted in a short haul from the wharf for one owner and a sluicing arrangement for waste for the other. From the building closest to the wharf, the waste is carried to the fish meal building by truck filled from an elevated hopper.

The sash used throughout the plant is of aluminum with aluminum fly screens provided in the processing buildings. Experience indicates that steel sash has had a short life in the area and that wood sash required frequent painting. It is hoped that the choice will prove a wise one.

The main buildings are equipped with dry pipe automatic sprinklers served from the public water main at the front of the building. Sprinklers, combined with fire resistive construction, resulted in a surprisingly low insurance rate, an unusual circumstance in this type of industry.

Equipment

The selection of service equipment for the plant was the subject of careful investigation, both from first cost and operation standpoints. Competition for the supply of the refrigeration machinery was such that it was eventually decided to lay down certain fundamental principles and the duty to be performed and invite tenders on that basis. Tenders were received from both Canadian and English suppliers and covered ammonia compressor, steam jet and ammonia absorption, and absorption types of refrigeration. The final selection was made on price and delivery and consisted of three 10-by-10-in. ammonia compressors with a 12-by-9-in. booster unit for the very low temperature work, and a 7-by-7-in. standby unit with motor and diesel engine drive to hold storage temperatures in emergency. The system operates as a fully flooded system, with the usual liquid pumps, knockout drums, condensers, receivers, etc. The cooling system uses sea water from the harbour through a heat exchanger, with fresh water in the engine cooling system. Provision is made for using a limited quantity of fresh water for cooling the holding unit in the event that power failure shuts down the salt water supply. The cooling coils in the cold rooms are of special aluminum alloy tubing with 6-by-6-in. aluminum fins welded on at 1½-in. centres. The coils were designed for a temperature difference of 10° F., but they have actually balanced out at better than 5° F. temperature difference, with improved product quality in long term storage as the result. The coils are hung from the concrete

Front view of building C, National Sea Products Ltd.

ilings. In the case of the upper or, which has insulation on the derside of its roof slab, insulated nger rods are used. The system provided with hot gas defrosting d it is reported that the frost lls freely from the fin plates when frosting. Eight plate-type fast eezers were supplied for package eezing, and also a fast freezing nnel, located in the basement of e cold storage building. This unit used primarily to freeze bait fish, it is adaptable to use as a package eezer in the event of a glut of fish r processing. Fish have to be ken when they come and not ecessarily when they are wanted.

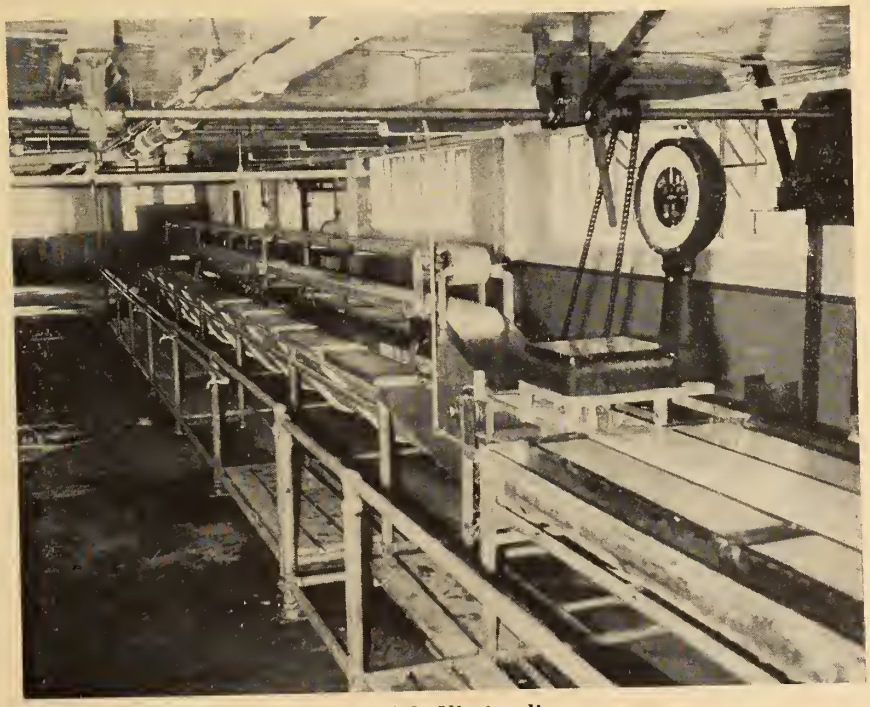
An interesting feature of the eezing tunnel is its foundation, hich is kept from being frozen by radiant heating coil embedded in ne floor of the concrete pit. This, turn is insulated from the tunnel self by a layer of cork. The heating ystem is filled with antifreeze and started up before the freezer is laced in operation. No reports of rouble with the foundation have een received to date. Estimates ndicated that this solution to an ld problem is much cheaper than he forced air ventilation originally roposed and normally used in uch situations.

The processing of waste or offal s an important part of the industry vhen it is realized that the recovery n fillets, the primary product, is less han 30 per cent of the landed fish veight. Competition in high grade by-products dictates careful selection of equipment, which will produce the utmost in high vitamin-content meal to be mixed with animal and poultry feed. Here again, after considerable investigation, a specification was worked up which was eventually met by an English firm. The resulting installation consists of three continuous process fish meal producing units, completely mechanized from the offal pits to the meal bag, and which has already produced a premium grade meal after a short term of breaking in. One of these units operates on oily fish waste, one on non-oily waste and the third is a standby for either of the others. The wisdom of this provision is indicated by the fact that all machines have already been in operation simultaneously.

The design of the boiler plant was started only after an investigation of the economics involved indicated that a plant for the production of heat would be the most profitable installation from the capital and operating points of view. The variation in steam demand from the by-product plant was such that the production of electricity for plant use would be uneconomical. Steam was required for the meal plant at 125 lb. per sq. in. for part of the operation, with a large demand at the start and a rapid falling off in demand during the process. Two bent tube water-tube boilers of 15,000 lb. per hr. capacity each were selected, one of which is capable of carrying the demand of two fish meal machines plus the plant heating load. The second boiler acts as a standby generally, and also comes into operation when the third meal unit is in operation. The boilers are fired by single spreader stokers with hoppers charged from a hand-filled bottom-dump bucket on a monorail. Mechanical coal and ash handling was not provided for economic reasons. The steam plant is completely automatically controlled because of the large and sometimes violent fluctuation in steam demand. Following proper adjustment of the controls, little trouble has been experienced in meeting somewhat onerous requirements.

Steam is distributed from the boiler header to the various buildings by an overhead line running through the meal plant and outside of the other buildings. All steam to the processing buildings is metered, as is the total steam generated, to facilitate cost accounting. Since steam is used principally for heating either the buildings or in the fish meal process, it follows that make-up should be practically nil. The returns are elevated to high level by the usual condensation return pumps in each building, whence they flow by gravity to an elevated hot well and to a steam boiler feed pump, with an electrically driven standby centrifugal pump. Boiler feed from the hot well is automatically controlled by a water level controller and a governor on the steam pump.

The heating systems of the various buildings vary from steam fed unit heaters to forced hot water radiant heating. It is hoped that an economic study may be made of the relative costs of the various systems, since there are two buildings alike in construction, one of which is heated by unit heaters in the factory portion and forced hot water convectors in the office section, while the other is heated throughout by embedded radiant coils. One is controlled in the usual manner by thermostat on the unit heaters and hand valve on the convectors, while the radiant system is controlled by an outdoor thermostat. It was not possible to start the investigation with this heating season, because of late adjustment of the steam meters. Hot water is provided to the washrooms and other outlets in the processing plants from storage heaters. The use of hot water in fish plants is extensive as the process involves iced fish and sea water is used for sluicing.



View of fish filleting line.

Sea water used for cooling condensers, for sluicing and for washing down comes from a pumping plant on the wharf. This provides enough salt water for all purposes at a head suitable for supplying the refrigeration and fish meal condensers. The pressure is boosted in the processing building by 500 g.p.m. pumps which raise the pressure to 50 lb. per sq. in., suitable for sluicing and washing down. This water is chlorinated. The water is supplied to the plant through a 16-in. main running under the wharf and then underground at the front of the plant. The fresh water supply is obtained from a 12-in. town main which feeds an 8-in. main in front of the plant. Separate connections are taken off this main to supply building needs and sprinklers.

The variable nature of the plant waste presented some problems in sewage disposal. The Department of Health insisted that sanitary wastes be not discharged into the harbour without treatment. No such limitation was placed on fish waste or sluicing water. A two compart septic tank was provided, with continuous chlorination of discharge, in place of the more usual disposal bed; the close proximity to the shore left no room for such a facility. The salt water used for cooling and sluicing purposes is discharged to the harbour directly from each building.

With economics denying the use of plant-generated power, electricity is obtained from the Seaboard Power Corp. at Glace Bay over a single 22,000 v. line of the Nova Scotia Power Commission to a 22,000/575 v. step-down substation of 600 kva. capacity. The installed electric load is over 1,000 kw. Power is distributed by an overhead pole line feeding each building. It is used generally at 575 v. for the larger motors, with the exception of those in the Gorton-Pew building. This owner had already purchased his processing motors, which were 220 v., 3 p., the common American voltage, before design of the plant started, and this required the installation of a 575/220 v. substation in his building. The other buildings use poser, as stated, at 575 v., with dry-type step-down transformers supplying service at 120/208 v. for lighting and for small motors. Power failures have not been numerous, but they have occurred occasionally at critical times, justifying the expense of providing an engine driven compressor to hold the cold storage building during such periods. The single supply line runs through territory exposed to violent storms and, although rebuilt and strengthened considerably, is still subject to outages. Fortunately, the storm season normally coincides with the low production period in the fish processing industry.

Construction

Tenders for the refrigeration equipment were invited in April, 1950, and the contract for this part of the work was awarded in May, with delivery scheduled for February, 1951. Final details of building construction were settled during the summer of 1950 and tenders were received in August. A contract was awarded early in September, 1950, and work commenced immediately. So did the incident in Korea. Delays began to follow one another with monotonous regularity. Shortage of steel, cement, labour, pipe, fittings, valves, lumber and, in fact, everything that suffered from shortages during late 1950 and through 1951 found its reflection in this project. The one bright spot in the whole construction period was the insula tion contract, let separately. Thi contractor had purchased the cor immediately on receipt of his orde for much later delivery and foun it delivered almost at once fror Europe, much to his surprise an that of every one else. Constructio did proceed, however, so that in stallation of refrigeration machiner and of the owners' processing equip ment got under way in June, 1951 Delays still harrassed the project however, but cold was made in th cold storage building in February 1952, and the first fish were pro cessed in March, with one cold roon available for storage. The plan was officially opened on June 18 1952, by which time most of the equipment had operated. Since the opening, it is understood that one owner alone has actually handlec 600,000 lb. of fish in one week which is at the annual designec capacity rate. The other owner was also operating at the same time.

NEXT ISSUE

will contain these important papers

A 100% CANADIAN ACCOMPLISHMENT—
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G. M. Demarque, M.E.I.C.

SOME MARINE ASPECTS OF CATHODIC PROTECTION

K. N. Barnard

MODERN INSTRUMENTS OF PHYSICAL OCEANOGRAPHY AND THEIR USE IN WATERS OF INTEREST TO CANADA

J. R. Longard

TESTS ON A FURNACE FOR A COAL BURNING TURBINE

D. L. Mordell, M.E.I.C.

OIL IN WESTERN CANADA

Earl S. Neal

INDUSTRIAL RADIOGRAPHY

by

R. E. MacDonald

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Naval Research Dockyard Laboratory,
Halifax.

A paper presented before the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May 22, 1953.

This paper outlines some of the factors involved in industrial radiography, and supplements this with a more detailed description of the radiographic procedure adapted by the Naval Research-Dockyard Laboratory, Halifax, particularly the inspection, for the R.C.N., of the new all-welded destroyer escort vessels.

I. Introduction

The importance of industrial adiography, particularly in the eld of welding, the production ontrol of castings, and the inspecon of food, ceramics and textiles,— o mention only some of its usages, as been reflected by the many apers (1) published in scientific terature all over the world.

The subject is an ever-growing ne, and applications of industrial adiography are steadily increasing. t is felt, therefore, that no apology s needed for adding a paper on an spect which is relatively new in Canada, even if the remarks are in omewhat general terms.

The main purpose of radiography n non-destructive testing is the letection of flaws or inhomogeneiies. It is therefore essential that good radiographic sensitivity (2) be obtained. Further, this avoids adding to the difficulties associated vith the interpretation of the radiographs.

By radiographic sensitivity is neant the ability of the radiographic procedure to reveal on a film the liscontinuities or changes in density, present in the material under examination. It is a function of the radiographic contrast and the definition and these, in turn, involve the kilovoltage, specimen, distance, from source to film, type of film, screens and cassettes.

Radiographic contrast is measured by the difference in density between two areas of a radiograph. When radiation strikes an object part is transmitted, part is absorbed, and part is scattered. The quantity of radiation transmitted depends on the kilovoltage, thickness and type of the material being inspected.

As the kilovoltage is increased the wavelengths of the x-rays emitted from the x-ray tube decrease. Short wavelengths penetrate greater thicknesses than long wavelengths, and a given thickness of a material will therefore absorb less radiation as the kilovoltage increases. For a given kilovoltage, the quantity of radiation absorbed depends on the thickness of the material being radiographed, its density, and the atomic numbers of its constituents.

As the thickness and density increase the quantity of radiation absorbed increases, but it is not strictly proportional to the density. For example (2), at 200 kilovolts 0.1 in. of lead absorbs as much as 1.2 inches of steel,—that is, a factor of 12, while the density of lead is only 1.5 times that of steel. If the variation in intensity of radiation absorbed by a particular specimen is large due to changes in thickness, density, or atomic number, it is said to have a high subject contrast.

The x-ray film itself exhibits the property of further increasing this inherent subject contrast, and this results in an additional increase in the density differences in the processed film. The ability of a film to cover a range of intensity differences in a single exposure is called its latitude.

Films are of two principal types, slow-speed, fine-grain, and fast-speed, coarse-grain. In general the fine-grain films have the higher contrast, but they do not exhibit the latitude of the fast films. The choice of a particular film depends on the specimen to be radiographed, the permissible time factor and the available equipment.

The definition refers to the sharpness of the outline of the radiographic image. This is principally dependent on geometrical factors but the specimen, film type, and radiation quality (hardness) must also be considered. The source of radiation should be physically small initially so that it is essentially a point source, as this limits the penumbra effect associated with large sources.

The penumbra may be further decreased by moving the source far enough away from the film. Since, however, the intensity is inversely proportional to the square of the distance from the source, this distance should not be so great as to entail excessive exposure times.

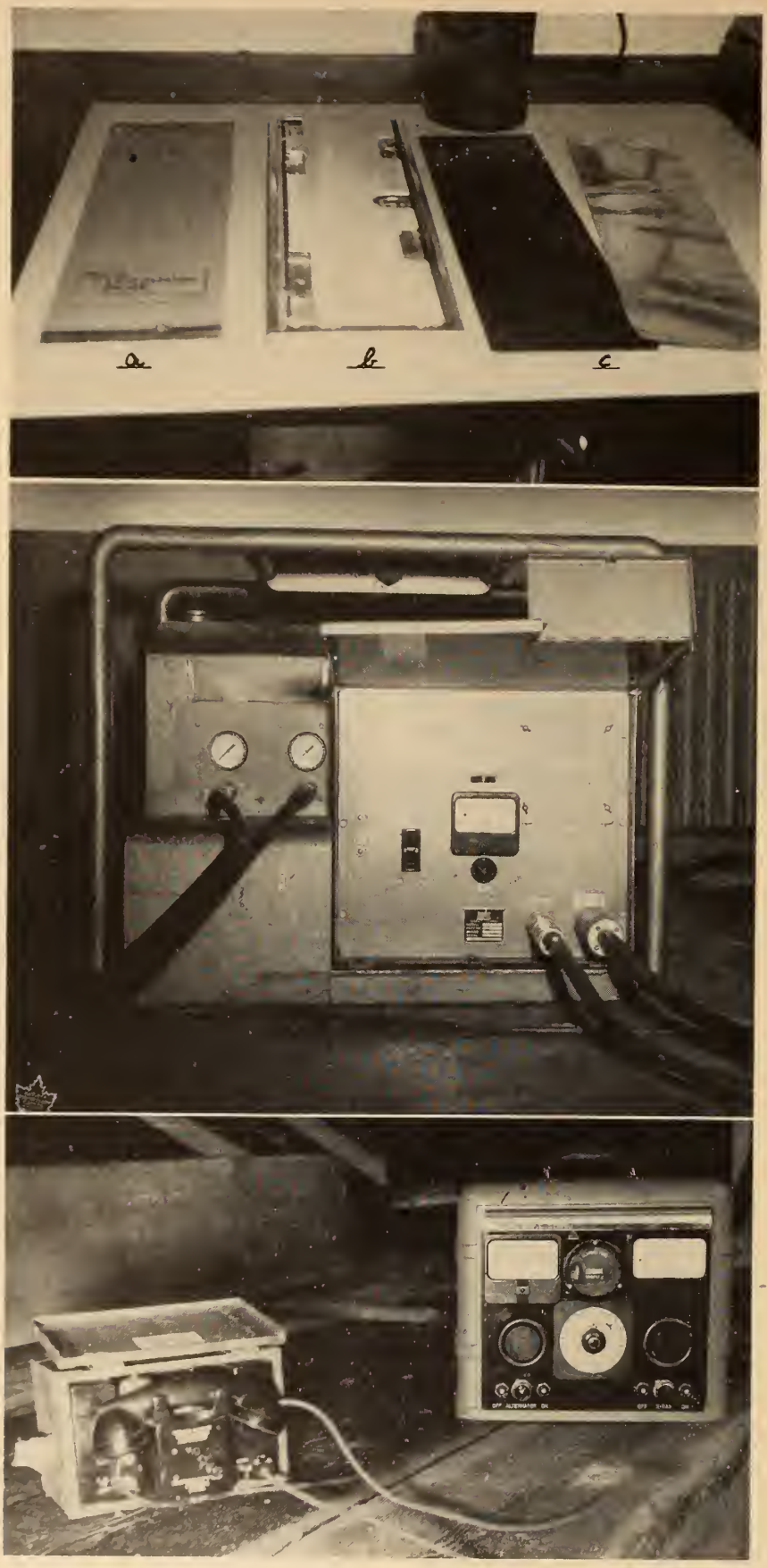

Fig. 1 (top). (a) Cardboard exposure holder; (b) rigid industrial cassette; (c) flexible plastic and lead screen.

Fig. 2 (centre). Power and cooling assembly of the Triplett Barton Unit.

Fig. 3 (bottom). Control panel of the Triplett and Barton Unit and portable telephone.

Scattered radiation also contributes to the lack of sharpness in a radiograph, but as the kilovoltage is increased the quantity of scattered radiation decreases.

Irregular-shaped objects require "blocking" to diminish this effect, if sufficient kilovoltage is not available. However, the choice of film is primarily dependent on the specimen and the highest contrast film will not necessarily be the better in particular instances.

Care of the Film

Since the major portion of the radiation striking a film is transmitted, rather than absorbed, by the film emulsion, it is necessary to use intensifying screens. For industrial purposes screens ([3]), ([4]) are generally of lead or lead alloy. Salt screens which fluoresce under x- or gamma radiation are not generally used, unless one is working near the limit of penetration of the machine.

The lead screens are placed one on either side of the film, and serve a two-fold purpose. The front screen (0.003 in.—0.015 in.) reduces the soft scattered radiation from the primary beam, and the back screen (0.010 in.—0.020 in.) reduces the radiation scattered from objects behind the cassette. There is also an intensifying effect from both screens, caused by the ejection of photo-electrons from the lead.

Care must be taken to guard the surfaces of the screens from scratches, since these can cause spurious defects on the film; it is also necessary to ensure that there is good contact between the screens and the film; otherwise a blurred effect will be obtained on the radiograph, with consequent loss in definition and contrast.

Cassettes (film holders) are of three types (Fig. 1), (a) rigid metal industrial cassettes, similar to the medical cassettes, (b) cardboard exposure holders, (c) flexible plastic film holders. The choice of cassette depends on two factors—the type of specimen to be radiographed and the equipment available.

Metal cassettes give good results with fluorescent or lead screens, but there is a loss of sensitivity ([5]) near the edges of the specimens, particularly noticeable with light alloys, when these cassettes have bakelite fronts. Furthermore, they are expensive and tend to wear rapidly under rough usage. In industrial radiography, cardboard film holders are more often used, being much less expensive and more flexible.

Plastic cassettes are most useful where flexibility is required, their

gree of curvature being limited the film and the screens. If the eight of the cassette is a factor ich must be considered, the non-etal cassettes also have an advant-e. The non-metal cassettes are, owever, more susceptible to pres-re marking of the film, which is used by careless handling and by e weight of specimens resting on cm.

The processing of the film is a raightforward task, and it is one the many variables in radi-graphy which can be fixed. Pre-autions should therefore always be aken to maintain the processing olutions at their proper strength nd temperature, and all of the rocessing should follow a standard rocedure to ensure reproducible esults.

In H.M.C. Dockyard, Halifax, adiography is being used to check ne soundness of rough castings rior to machining, suspected de-ective components, and as a check n welding technique. With the dvent of all-welded construction in aval vessels, complete radio-raphical inspection of all such new onstruction is required. In the Maritimes, this work is done for R.C.N. by the Naval Research-Dockyard Laboratory, using two -ray units, one 250-KVP Triplett-nd Barton set, and one 175-KVP Ferranti (Fedrex) set, and the adioisotope Cobalt 60.

II. Description of X-Ray Units

The application of radiography to welded ship construction has been imited in the past by the lack of uitable easily portable and mobile ndustrial units. Isolated exposures ave been possible with some "port-ble" x-ray units, but due to their veight, physical dimensions and ragility, they proved unsuitable or day-in-day-out shipyard oper-ation.

The Triplett and Barton Unit:

The first set to meet the neces-sary specifications for shipyard work was designed and built by the Trip-lett & Barton Company of Califor-nia. This is a portable, 250-KVP unit, of light weight, specifically designed to be mobile and for ship-yard usage. The prototype unit was sent to Sorel, Quebec, where, under the late Capt. (E) R. R. Teasdale, initial field trials enabled a number of improvements to be incorporated in the later models.

One of these later models is now in operation in Halifax, and consists of three main components:

(i) Power and Cooling Supply.
(ii) Master Control Panel.

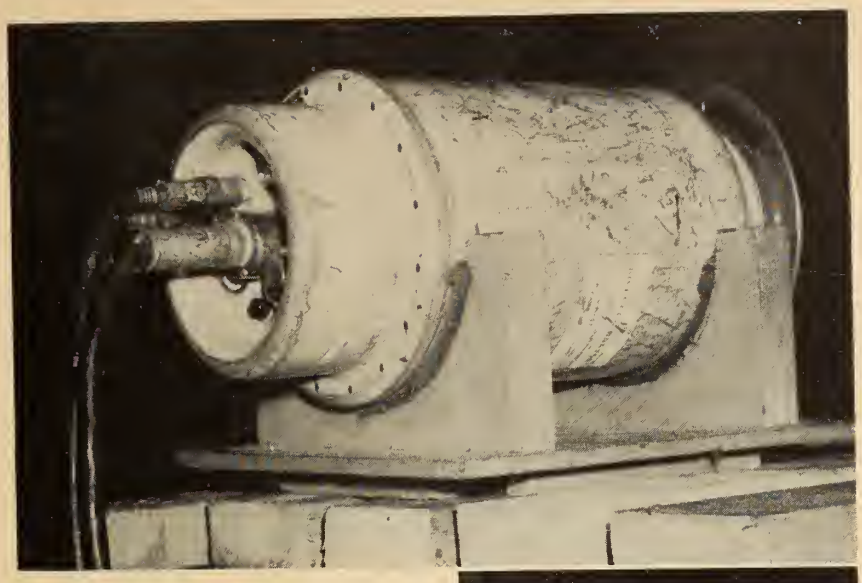

Fig. 4a (above). Three quarter side view of X-ray "head" Triplett and Barton Unit.

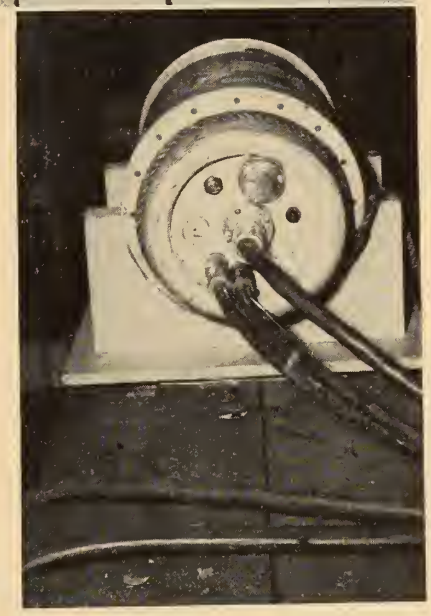

Fig. 4b (right). End view of X-ray "head" Triplett and Barton Unit.

(iii) Self-Contained High-Voltage Transformer and Tube Head.

These are connected in series with three 50-foot lengths of light-weight cable. For transportation these components can easily be packed into a one-ton panel truck, which also contains a light-tight compartment enabling films to be changed or extra cassettes to be loaded in the field.

The Power and Cooling Assembly (Fig. 2) weighs 600 lbs., and is the heaviest part of the unit. It contains a 1200-cycle alternator which is driven by a 7½-h.p., 3-phase motor. It is designed for operation on 60-cycle, 220- or 440-volts supply, and an electronic voltage regulator compensates for line fluctuations.

This component also contains the radiator, from which water is pumped to cool the "head" and anode, and two water pressure gauges, one on the outgoing and one on the return line to indicate the circulation of the coolant. If there is no circulation an interlock flow switch prevents the 1200-cycle output voltage from building up.

The Master Control Panel (Fig. 3) weighs about 50 lbs. It contains the alternator and x-ray switches and their indicator lights, the kilo-voltage and milliampere meters and their controls, all mounted on an illuminated panel. An automatic reset timer enables duplication of any exposure from 0—20 minutes in one-second intervals.

There is also an elapsed-time meter registering in intervals of tenths of a minute, and a totalizing timer registering in hours. Visible through the back of the panel is an

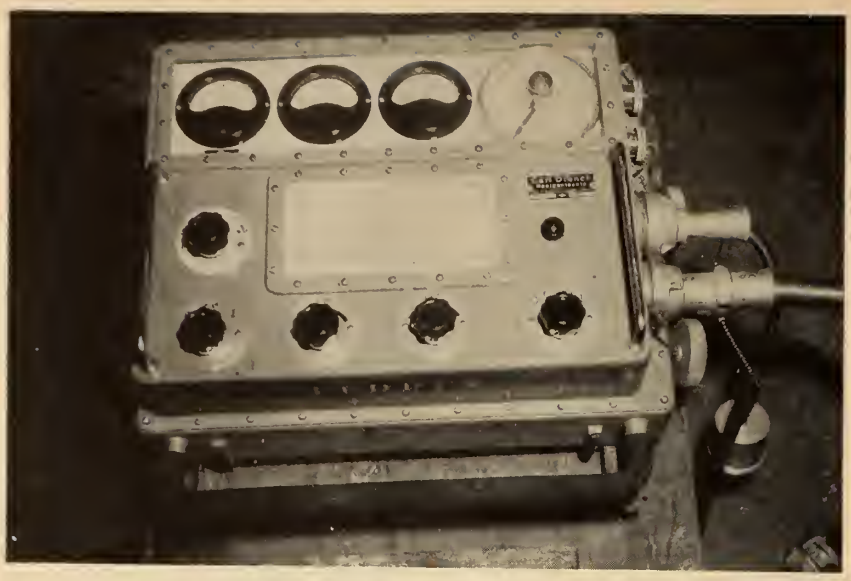

Fig. 5. Control panel Fedrex Unit.

ammeter inserted in the primary circuit of the transformer, which is most useful if a circuit breakdown occurs.

The Self-Contained High-Voltage Transformer and Tube Head (Fig. 4) is an aluminum cylinder about 15 in. in diameter with an overall length of 38¼ in. It contains the 1200-cycle air core resonant transformer and the 250-KVP x-ray tube. A gas, (^{6}) sulphur hexafluoride, which is neither toxic nor flammable, is used for insulation and cooling. Freon 12 may also be used, but the former is preferred because of its greater stability and improved temperature characteristics. The use of a gas as the dielectric, and the absence of the iron core in the transformer, help reduce the overall weight of the "head" to approximately 112 pounds.

The x-ray tube itself is a single section tube of the radial or side emission type, with the anode located at the end of the tube and projecting beyond the main aluminum container. The anode is grounded and enclosed in a "bell-like" aluminum water jacket. The whole x-ray set was designed specifically for outdoor applications, and may be operated under adverse weather conditions and over a temperature range from 0 to 120° F.

The Fedrex Unit:

This is a 175-KVP x-ray unit of Danish design, sold in Canada by Ferranti Electric Limited, Toronto. It consists of only two main components (i) The Control Panel, and (ii) The High-Voltage Transformer and Tube Head. Only two electrical cables are required for operation. One runs from the 110-, 220- or 440-volts, 60-cycle, single-phase power mains to the control panel, and the other from the control panel to the "head."

The Control Panel (Fig. 5) weighs about 60 pounds, and contains the usual kilovoltage and milliampere controls and their meters, an exposure timer calibrated in six-second intervals, and a voltmeter for reading the line voltage, all mounted on an illuminated panel. One novel feature on the panel is an electrical outlet for connecting a trouble lamp.

There is no electronic voltage regulator, but gross fluctuations may be compensated for manually by adjusting the power supply connector on the panel. This can be connected in any one of four fixed positions, and is satisfactory for constant voltages which are not too far above or below the required value. The panel is completely waterproof, and when not in use is enclosed by a cover, locked in position with a key.

The High-Voltage Transformer and Tube Head (Fig. 6) contains an iron-core transformer. The weight of the whole component when filled with oil and the x-ray tube is approximately 170 pounds. Two oval-shaped rubber-covered carrying rings, 15 in. x 17½ in., are fixed one at either end of the "head", which has an overall length of 39 in. If necessary, these may be removed, thus reducing the dimensions to 8½ in. x 14 in. x 37 in.

The single-cable connection fo easy access, is at one end of th head. Oil is used as the dielectri and a fan circulates it around th anode to act as the coolant. If th unit becomes overheated a safet relay trips, and the unit cannot b operated until the temperature ha reached a safe level.

The tube itself is a conventiona single-stage type with the windo in the centre. A removable lea cover on the "head" fits over th window section of the tube, t reduce the radiation when the set i being warmed up. When actuall taking a radiograph the lead cover i removed and two lead diaphragm may be used to collimate the beam To facilitate positioning the head, light and mirror arrangement in dicates the location of the centre o the beam.

The Fedrex unit is a recent pur chase, and has, as yet, not been use in ship radiography. It has bee used successfully, however, in th shops in H.M.C. Dockyard, and i our small radiography laboratory t radiograph thin-walled valves, tes welds and light alloy castings.

The complete x-ray unit includin cables easily fits in the trunk of a standard car for transportation. N auxiliary apparatus such as th power and cooling assembly of th Triplett and Barton unit is required In operation, using the 110-volts 60-cycle single-phase supply, th unit draws less than 15 amperes and therefore may be connected t any standard wall outlet.

III. Ship Radiography

Before commencing radiographic inspection, the welds are first cleaned and then visually inspected. This eliminates rejecting welds for surface slag, and time is saved by not radiographing anything obviously defective. A drawing of the ship section is obtained from the Naval Overseer showing the positions where radiography is required. These positions are then marked on the ship, both inside and out, with chalk.

Work is begun at the keel and progresses upwards. If necessary, the generator* is removed from the truck with a travelling crane and placed under the keel near the section to be radiographed. From here, all the welds on both the port and starboard shell of the section can be reached. To complete the section,

*All reference to x-ray equiment in this section applies to the Triplett & Barton Unit.

e unit is moved by crane to the
o deck.

For ship radiography, it has been
ınd convenient to mount the
ray "head", horizontally, on a
ecial wooden cradle, with two
-shaped supports for the cylin-
ical casing. The upper and lower
rtions of the stand are detach-
le, enabling the height of the
rget to be varied from 36 in. to
in. Further, as the window of the
ray tube projects beyond the
adle, this type of stand allows the
ead" to rotate through 360° about
s longitudinal axis.

As all the supply lines, two water-
se lines and one power-supply
ble are at one end of the "head",
is facilitates handling and position-
g as these operations may be car-
ed out before connecting the cables.
they should become caught in the
aging or cribbing, it is a simple
atter to disconnect and untangle
em.

When it is realized that much of
ıe radiography is carried out on
anking about 12 in. wide and often
ty feet up in the air, the necessity
r a light-weight, easily-man-
euverable head can be appreciated.
he radiography is usually carried
ut by two operators, one inside the
ip, positioning the films, and one
utside, operating the x-ray unit.

Communication between the in-
de and outside of the ship is main-
ained by means of a portable
elephone (Fig. 3). During ex-
osure times, predetermined areas,
oth inside and outside the ship,
re restricted by ropes and warn-
ıg signs, and personnel are cleared
rom these areas.

Before the actual exposures are
egun confirmation is made by
elephone between the operators
hat all are clear. The working area,
f course, is not a fixed location, and
t is necessary to adjust the signs
ınd ropes as work progresses; this is
ısually undertaken by handlers
upplied by the Shipyard.

Flexible cassettes are used with
ead screens, chosen because of
heir light weight (enabling them to
e held in position by a magnet),
heir resistance to wear and their
ability to be bent to follow the cur-
vature of the ship. Identification
ıumbers and penetrameters are
ttached with adhesive tape, and
the cassettes are held in position,
with a U-shaped magnet having
specially attached springs.

For flat overhead exposures,
which commonly occur on the
decks, a special cassette holder has
been constructed, and consists of a
flat piece of plywood, 14 in. x 17 in.
mounted on a metal rod, 6 feet in length. This rod slides inside a hollow tube of about the same length. The height is fixed by an adjustable screw clamp, and any further adjustment in height is made by placing wooden blocks under the stand.

In the shell plating encountered in ship construction there are no large variations in section thickness. The thicknesses themselves are not great, the maximum being about ½ in. To take advantage of this small latitude a fine-grain film with high contrast, sandwiched between lead screens, has been used for the majority of the radiographs.

The penetrameter, used in ship construction, is a step-like strip of metal about 2½ in. long and ½ in. wide. Its steps are .005, .010, .020, .030, .040 thousandths of an inch thick, with a 3/16 in. hole through the centre of each step. The purpose of the penetrameter is to show that the proper radiographic technique has been employed. Two are used on each film, and they are placed one at either end. In general, 2 per cent sensitivity is required, i.e., the thinnest penetrameter section visible on a radiograph must be 2 per cent of the thickness of the base metal.

Effects of Weather

Weather conditions for open x-ray work pose many difficulties. For winter operation, the "head" is left in a warm building until ready for use. It is then wrapped in a blanket and positioned on the cradle. Anti-freeze must be used in the radiator, and to avoid lowering the temperature more than is necessary, circulation of the coolant is stopped after each exposure.

Occasionally, cables become frozen in the ice or snow, which may result in broken or shorted connections. It is most necessary to ensure that the men doing the work are physically comfortable. Canvas is erected as a wind-break near the control panel, and warm winter clothing, such as parkas, battle dress, and wool-lined flight boots, are worn.

The x-ray truck is wired for connection to 110-volt 60-cycle supply, and if a shoreline is available, an electric heater may be connected to an outlet inside the truck. This is useful in very cold weather to dry or thaw wet or frozen clothing. It also provides a convenient place to do field maintenance of a minor nature, such as resoldering cable leads. One further difficulty is the presence of snow or ice on the staging, and this sometimes makes handling the unit above the ground a hazardous task.

While in the Maritimes, the summer temperatures are not extreme, they do cause trouble, mostly with the film, e.g., if films are placed flat

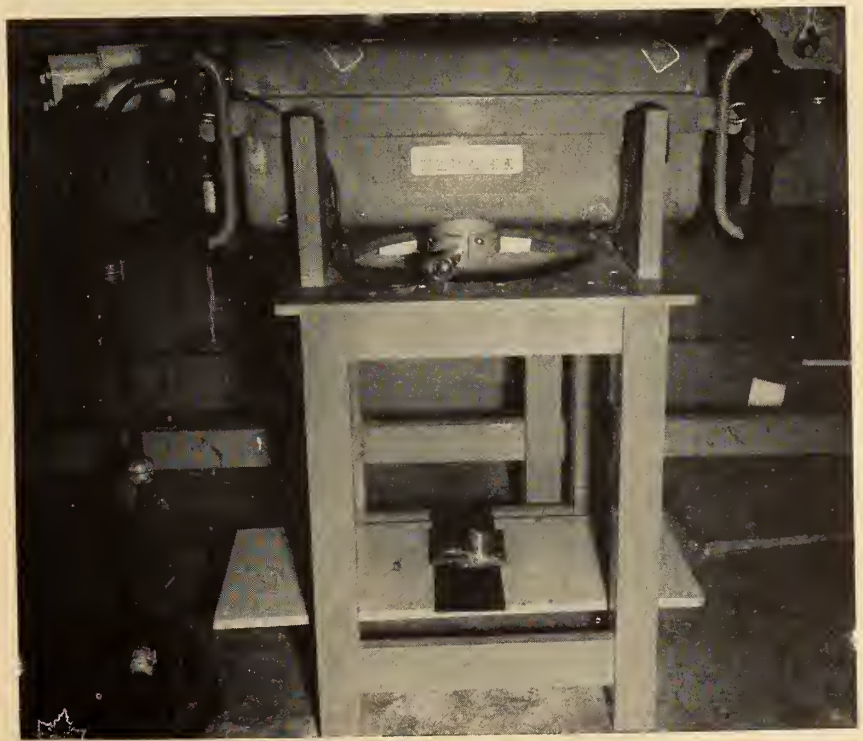

Fig. 6. X-ray "head" Fedrex Unit.

on a steel deck, the heat of the deck sometimes melts the emulsion on the film. In contrast with the cold weather, it is often necessary to keep the coolant circulating and even to run it for a short time after the end of the day's work. The x-ray unit is waterproof, and may be operated in rain, but care must be taken to prevent water from getting inside the cassettes.

For standard exposures, a 30 in. S.F.D.* is used. Because of the manoeuverability of the x-ray "head", the erection of staging is no problem, and this standard distance is maintained most of the time. The average exposure time per radiograph is one minute. After each exposure, the area taken is cancelled with chalk on the ship and also marked as completed on the drawing of the ship's section.

At the conclusion of the day, the films are brought back to the Dockyard Laboratory, and the stage builders at the Shipyards are told where to construct the staging for the next day's work. This is done the following morning, while the previous day's films are being processed.

After the radiographs are processed they are examined on a variable high-intensity illuminator. This is necessary since most industrial "non-screen" films ([2]) exhibit increasing contrast with increasing density and densities up to 4.0 are not uncommon.

For proper interpretation, a radiograph should have adequate density, be properly numbered and the required penetrameters should be visible. Artefacts, such as streaks, abnormal graininess, pressure marks, etc., caused by improper processing or handling of the film, should be kept to a minimum.

These sometimes result in misinterpretation, and always reduce the value of a radiograph by obscuring areas which may contain real defects.

*Source to Film Distance.

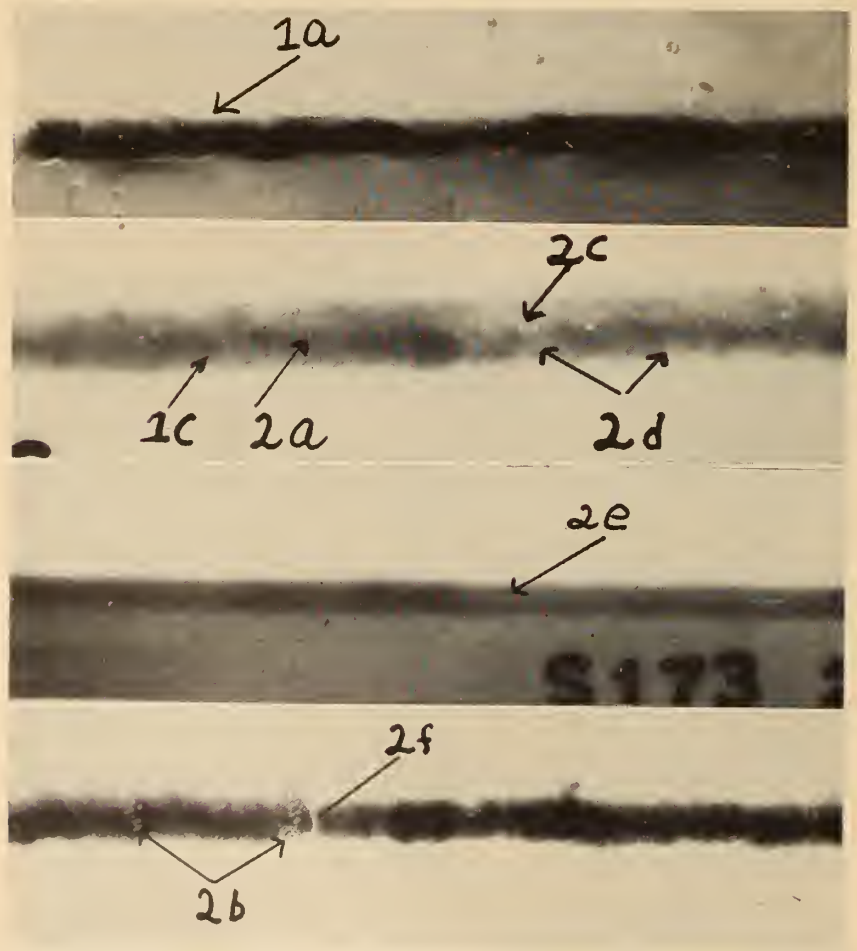

Fig. 7. Typical weld defects. The numbers correspond to the classification in the text. The pictures are positives hence the appearance of the defects is just opposite to that described in section IV.

When the radiograph is considered satisfactory as a radiograph, the search for defects begins.

IV. Radiographic Appearance of Common Weld Defects

Since a radiograph is a two-dimensional picture, all defects appear in the same plane. This does not cause too much difficulty in interpretation ([7]) as experience enables most defects (Fig. 7) to be classified ([8]) as surface or subsurface.

1) Surface Defects

(a) *Undercut*—A groove or channel along the toe of the weld, not always visible on the surface. It appears as a broad, diffuse line on the radiograph, and if extensive and heavy, is a cause for rejection.

(b) *Tool Marks*—The backpass along the seams and butts of the ship are ground or chipped smooth. These chipping marks sometimes have the appearance on a radiograph of slag lines, but such marks are easily correlated with their visual appearance on the weld. Unless severe, these are not a cause for rejection.

(c) *Spatter*—Round blobs of weld metal on, and adjacent to the weld appear as light areas on the radiograph. These are easily removed and are not a cause for rejection.

2) Subsurface Defects

(a) *Porosity*—Small internal cavities caused by entrapped gases. These appear as small, dark, generally round areas on the radiograph.

(b) *Pipe*—Elongated cylindrical-like cavity caused by entrapped gases. It appears on the radiograph as a streak with rounded ends with the density increasing from one end to the other.

(c) *Inclusions*—Slag or foreign matter trapped in the weld appear as dark shadows on the radiograph. They are more irregular in outline than porosity, and since they are solid particles have less contrast than porosity. Multiple inclusions may be orientated in clusters or lines.

(d) *Lack of fusion*—Lack of union in the weld. Generally appears as a straight line which may be diffuse or sharp, depending on the location of the defect. It occurs most frequently along the face of the weld.

(e) *Lack of penetration*—Failure of the weld metal to fill the root of the weld. This generally appears as a dark, straight line, which may be intermittent or continuous.

Fig. 8. Cobalt 60 and lead container.

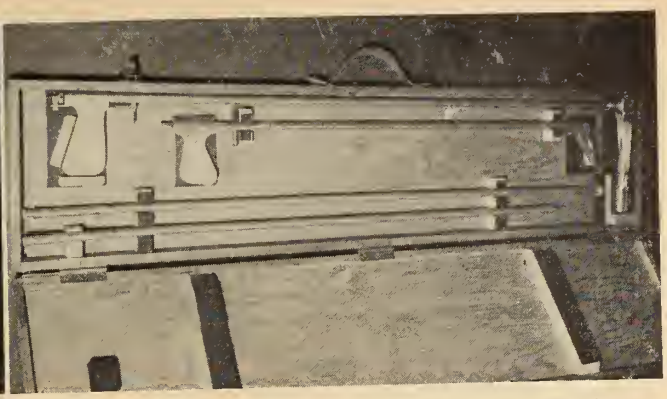

Fig. 9. Aluminum tools for handling Cobalt 60.

') *Cracks*—Sharp discontinuities hich generally occur in the weld ietal, but occasionally are observed ı the parent metal. They may be ıtermittent and wandering. Radio-raphically, they are generally dark nd jagged in outline.

The foremost difficulty in apply-ng radiography to weld examination s the problem of acceptance tandards. A good weld is readily ecognized as such, with the excep-ion of brittleness, which cannot be detected by x-ray techniques. Simi-arly, when a weld which contains nany serious defects is viewed, here is seldom any argument over ejecting it. Unfortunately, the majority of welds radiographed are between these two extremes.

In practice, it is generally agreed that all cracks are rejectable, also lack of fusion and lack of penetration, but with slag, porosity, and undercutting, it is not so easy to obtain agreement. One recent investigator ([9]) has concluded that only cracks and lack of penetration can be correlated.

This is of little help, as these are always serious defects and are usually cause for rejection. Lines of slag seem to show some agreement between their radiographic appearance and mechanical properties, but isolated slag patches, even those which appear similar on a radiograph, may behave quite differently in practice.

The rule adopted by Naval Research-Dockyard Laboratory is to reject all cracks and lack of fusion and lack of penetration. Porosity, slag and undercut are compared with standards for acceptance or rejection, but are always considered with reference to the location of the weld. All welds considered defective must be repaired and re-radiographed.

V. Gamma Radiography

With the advent of nuclear reactors, a multitude of concentrated artificial radioisotopes have become available for radiography whereas previously, only naturally occurring radium which was both expensive and limited in quantity, was used. Advantage is being taken of this availability of radioisotopes, and in Canada more than 63 distinct groups ([10]) of which one-quarter are industrial organizations, are engaged in work with radioisotopes.

For radiography ([11]) three isotopes, Cobalt 60, Iridium 192, and Tantalum 182, are considered to be most practical. Cobalt 60 is the one most commonly used but recently Iridium 192 has been applied to the radiography of thin sections of steel, ½ to 2 inches thick. Tantalum 182 is primarily of laboratory interest, and as yet has not been used industrially.

The purpose of a radioactive isotope in industrial radiography is principally to supplement a moderate kilovoltage x-ray unit. Both methods have their applications, but the major advantages of a gamma ray source are:

1) Penetration

Radioisotopes for radiographic purposes generally emit radiation of much shorter wavelength than that from a regular x-ray unit. They therefore penetrate much greater thickness of material, e.g., the 250-KVP unit may be used on sections of mild steel up to 3 in. and the Co^{60} on sections up to 6 in. in thickness.

2) Portability

The radioisotopes themselves seldom weigh more than a few milligrams, and when removed from their protective carrying case they are easily manipulated with lightweight aluminum tools. Because of their small physical dimensions and light weight, radiographs may be taken in awkward locations, inaccessible to x-ray units.

3) Scattered Radiation

Blocking of irregularly-shaped objects is not necessary, because of the little side scattering associated with high-energy gamma rays; Co^{60}, for example, has gamma ray energies ([12]) of 1.17 and 1.33 MeV.

4) Panoramic Exposures

Because the radiation from a radioisotope is omnidirectional, multiple exposures are possible, and even a variety of objects may be radiographed at one time. Different thicknesses may be compensated for by different S.F.D.'s or exposure times or both.

While the quality or hardness of radiation from a radioisotope is greater than that from a conventional x-ray unit, the quantity is much less and a longer time is required to obtain a given film density. The elimination of tedious and time-consuming blocking, however, and the possibility of multiple exposures help balance what are, in general, the much longer exposure times required with gamma ray sources.

5) Expense

The initial cost of a gamma ray source varies with the particular isotope, and depends upon its ease of activation and its availability. In comparison with an x-ray unit, the initial cost is most reasonable, e.g., the 250-KVP unit cost is about $16,000 while the Co^{60} and carrying container costs $600 and furthermore, no power supply is required.

When choosing a gamma ray

Fig. 10 (above). Charging unit for dosimeter, film lodge and dosimeter.

Fig. 11 (right). Radiation meter.

source for radiography, the following factors should be considered:

1) Material and Thickness to be Radiographed

Light alloys and very thin sections are not very suitable for gamma radiography. Most radioisotopes are used for thick sections equivalent to 2–6 inches of steel, particularly if they are of an irregular nature.

2) Physical Dimensions

For good definition, it is necessary to have a physically small source. It is desirable that it appear as essentially a point source, since this increases sensitivity, and the larger the physical dimensions the greater must be the S.F.D.

3) Specific Activity

To keep the exposures to reasonable times, the source should have a high specific activity. The quality of the radiation from a radioactive source is characteristic of the source. The quantity, however, depends on how many atoms are radioactive in a certain volume and this is the specific activity.

4) Half-life

Radioactive sources are characterized, also, by their half-life. The quantity of radiation from a radioisotope continually decreases with time and the interval required for it to fall to one-half of its original value is called the half-life. Therefore, to ensure that the exposures will not be excessively long, the source selected should have a reasonable half-life.

5) Sensitivity

This depends on the physical dimensions and the energy spectrum of the source. In general, the greater the energy, the less the sensitivity for thin sections. Also, sources with some hard and some soft components in their energy spectrum give better radiographs of specimens of varying thickness.

6) Protection Required

In industrial applications, it is necessary to ensure that not only the personnel handling the radiation are able to do so without too great a hazard, but also that those in the neighbourhood not directly connected with the work may be easily protected. Since it is often desirable to do gamma radiography during the regular working periods, it is not wise to have a source of too high a specific activity.

Advantages of Cobalt 60

For radiographic purposes, Co^{60} is readily seen to be well suited for gamma radiography. It has a half-life of 5.3 years, and physical dimensions comparable to that of an x-ray target and furthermore, Canada is in the happy position of being able to produce sources of high specific activity. It has been found from experience that considering the factors of exposure times and radiation hazard, that a Co^{60} source of about 500 milligrams radium equivalent is most useful.

The actual source operated by Naval Research-Dockyard Laboratory (Fig. 8), consists of 50.3 mgms. of Co^{60} in the form of a right cylindrical pellet, 1.94 mm. in diameter. This is enclosed in an aluminum container, and this in turn is enclosed in a dural hexagonal container. It has a radiation output ([14]) of 447 mrhm. (milliroentgens/hr. at a meter) which is equivalent to that produced by 621 mgms. radium filtered with ¼ in. lead and ¼ in. aluminum.

In comparison with radium, Co^{60} has certain advantages. It is much less expensive. The comparable radium source would cost ([13]) about $10,300. This would be contained in a right cylinder 6.0 mm. in diameter, while Cobalt priced at approximately $600 is in a similar cylinder 1.94 mm. in diameter. It is, therefore, possible to use a much closer source to film distance while maintaining sensitivity and reducing the exposure time.

Special light-weight aluminum tools ([15]) (Fig. 9), have been designed and made which enable the source to be easily and rapidly manipulated and this is important as the present permissible tolerance dose ([16]) for whole body x-ray or gamma-ray radiation is set at 50 milliroentgens per 8-hour day.

This means that if a person remains one meter from the exposed source, assuming an output of 447 mrhm., then he has about 7.5 minutes (447/60), before the daily tolerance dosage is reached. It is, therefore, imperative that the exposure arrangements be carefully considered, and that all is ready before the source is removed from its carrying container. When it is removed, it must be quickly, though carefully, positioned.

While most of the radiography work done has been x-ray, Co^{60} has proved its usefulness on many occasions. In particular, mention should be made of the examination of "A" brackets. These are large castings shaped (as the name implies) like an inverted "A". The sections of interest had a thickness of about 5 in. Using Co^{60} and a fast industrial x-ray film, it was possible to make exposures in a remote area

the Shipyard while x-ray examination of the vessel itself was continued.

Gamma radiography of tail shafts is also much more practical than by x-ray radiography. Here the thickness range is from 2½ in. to 3 in. Because interest is centred in locating cracks, a slow, fine-grain film is required. At 250 KVP and about 30 in. S.F.D., x-ray exposures require approximately 45 minutes. Using Co^{60}, the time required is 1½ hours per exposure, but the setting-up time is much less. Also no warming-up time is required for the Co^{60} source, as is necessary in the case of x-rays.

Co^{60} is most useful in the range from 2—6 inches of mild steel, and while the 250-KVP x-ray machine can be used to radiograph sections up to 3 inches, the radioisotope is often used for sections under 3 inches, particularly if they are of irregular shape.

VI. Health Precautions

Since work with x- and gamma rays involves a health hazard to personnel, it is necessary that adequate safety precautions be taken. At Naval Research-Dockyard Laboratory, each person working continually with radiation has an annual medical examination and regular monthly blood counts. These are obtained at R.C.N.H., H.M.C.S. *STADACONA*, through the co-operation of Naval Medical Authorities, and ensure that, if any regularly small over-exposures occur, they will be noted before any serious effects result.

Use is also made of pocket dosimeters and film badges (Fig. 10). The former are simply charged electroscopes which, when placed in a radiation field (x-ray or gamma ray), are discharged. They are calibrated in milliroentgens, and enable a total dosage record for a certain interval of time to be obtained.

The film badges are for recording gamma radiation from the Co^{60} source. They are worn for a week, then returned to the Health Physics Section of the Department of National Health and Welfare, Ottawa. There they are processed, and if any over-exposure has occurred, the Laboratory is notified.

As stated above, the present permitted tolerance dose of radiation is 50 milliroentgens per 8-hr. day. This has been set as the maximum safe dose for whole body radiation on the basis of experience, and results from experiments on animals. It should be emphasized that this is considered the maximum safe tolerance dose at the present time. As more information is obtained (17), it is possible that this maximum tolerance dose may be lowered, as has occurred in the past.

It is, therefore, advisable to work to as low a radiation dosage level as possible. In a laboratory or hospital, this is easily done with a little caution. Most radiographs may be taken with the operator located in a predetermined shielded area. In general, apparatus will not function unless certain safety doors are closed.

In the case of "open" radiography, however, much more care must be exercised. It is not practical to carry lead shields and, therefore, distance and natural barriers must be employed. During the course of a day's work, the control panel may be moved three or four times. It is, therefore, imperative that a close check be kept on the radiation level at all times.

In addition to the personnel actually working with the source of radiation, one must consider the other employees. In the particular case of shipyard radiography, it is necessary to assume the possibility that the same workmen may be present each day; therefore, strict precautions must be taken to ensure that their work position is well below any harmful radiation level. For this purpose, the area is surveyed with radiation meters (Fig. 11), from which the level of radiation may be determined.

Using this information, it is possible to restrict certain areas. Liberal use is made of brightly painted warning signs, areas are roped off and personnel maintain a close watch for trespassers. Occasionally, employees try to place the responsibility for real or mythical ills on the presence of a source of radiation. It is, therefore, necessary to be able to show conclusively that there has been no possibility of exposure to hazardous radiation. To date, we have been most fortunate in that no over-exposures have occurred.

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INDUSTRIAL STATESMANSHIP

by

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An address delivered at the convocation of Nova Scotia Technical College, May 7, 1953.

I am honoured at the opportunity which has been given me today, to speak at your convocation exercises. I am grateful also, realizing that the natural thing for your president and senate to have done would have been to choose a speaker who had at some time earned what to you must be the highest accolade, a degree in engineering. I confess sadly that I not only have no such degree, but that I am sure I could never have earned one, no matter how hard I had tried. If I have any aptitudes, they do not lie in that direction. And yet I have two brothers, both of whom are engineers. They look upon my completely non-technical, non-scientific approach to a problem with pity, if not derision, and I suspect that they rather smugly console themselves with the thought that sixty-six and two-thirds percent efficiency is fair enough for one family. I am not quite sure what their branch of engineering is, but from their manners, I should say that they are not civil engineers. In this I am sure they differ from the great majority of the profession. But I am a guest, and must not be accused of over-flattering you. I assure you, however, that I really have a great deal of respect for the engineering profession, in spite of my brothers.

By now you may be beginning to wonder as to my choice of subject. I have often been in that position both before and after listening to a speech. I hope that will not be the case with you today. I cannot speak of engineering, since I am afflicted with that simple honesty of intellect which is characteristic of the legal profession, and have already admitted that I am not competent to do so. I could speak of the law, but being seized with that modesty which is also characteristic of lawyers, will refrain. I could talk of world affairs, but since that is a subject upon which too many men embark glibly without cause and mostly without effect, I pass it by. I often feel, with Wordsworth, that, with all the modern marvels of communication and electronics, the world is indeed too much with us. We have as ever our wars and rumours of wars. We even have our new Tower of Babel. But, more than ever before, through the ingenuity of man, these jarring sounds invade our privacy, shatter our silences and solitudes and what ought to be our moments of reflection, with the urgent, inescapable tempo of a trip hammer. So today I shall not attempt to discuss the sad phenomenon of the survival of primitive man that is called world politics, and of which Tennyson says:

"Having politics, never at rest.
As this poor earth's pale history runs,
What is it all but a trouble of ants,
In the gleam of a million millions of suns?"

I still remember my own graduation, also on this campus, in a city and at a college for which I have great affection. I even remember some of the things that the late Canon Cody, who was the special speaker, said. I could crave no better fortune than to say something to you today, as you graduate into a splendid and useful profession, a fragment of which some of you might conceivably carry with you into the exercise of that profession.

You are engineers. I believe that the engineering profession, like that of law, trains men to orderly processes, which can be applied in many endeavours. I do not include Engineering because I wish to flatter you, nor Law merely because it is my own profession. It was the great Bacon who said that Law is the last result of human wisdom. You will be dealing with the forces and resources of Nature and the inventive skill and genius of man. You will find that you have to deal in a special kind of way with men. In the enterprises which will fall to your lot you will have to work with management, some of you as management; you will have to be in tune with colleagues, co-workers, deal with employees or subordinates, and, perhaps most intricate of all, with labour, organized and otherwise. Although engaged in your profession, I am sure that experience will cause many of you to agree with Pope that "the proper study of mankind is Man."

Here is a sphere in which the material with which you work cannot be subjected, as it is in the laboratory, to exact processes yielding the same reaction under the same conditions. The human reaction to the same stimulus can be as varied as the number of individuals. Is there then a rule that can be applied or a pattern that can be followed in these human relationships? I think there is.

During the past sixteen or seventeen years much of my experience has been at the conference table, over a fair section of the earth's surface and covering a variety of problems. I once was asked to make a rough calculation of the number of meetings which I had attended over a period of ten years, and the total impressed and startled even me. Meetings have been described as a place at which you waste hours and keep minutes, but be that as it may, I can assure you that the wear and tear is very real. It is unlikely that from an experience of this kind one could escape unscathed or would gain nothing. And whether the experience be varied, as mine has been, or some-

hat repetitive, I think the same neral principles will emerge.

Some few years ago, when preding over particularly difficult gotiations between management id labour unions representing perips 16,000 members, at a certain age a phrase came almost inoluntarily to my lips. The phrase as "This is a time for Industrial tatesmanship." It was probably ie result of the churning process of me years, and I do not claim it be original, although I could not ive it a source. Fortunately the egotiations ended well, and I was ter asked to enlarge upon the hrase in the monthly publication f one of the unions, and through is, my thinking became more eveloped and precise.

"Industrial Statesmanship." It is resounding phrase, and one that well worth analysis, applying as it oes to human relations in industry. do not want to leave you with nerely a high-flown phrase, but hould like to develop it, in one hase of industry at least, since could not claim the time on this ccasion to do so in more than one. That phase is labour-management elations, in which, as I have said, nany of you will inevitably be ngaged.

During the war years as was to be xpected, by material standards usiness generally thrived and prospered. It was not, however, expected hat this prosperity would continue as it has, almost unbroken for so many years after the war. The reasons are too well known to call for statement here. They cannot continue to apply indefinitely, nor the line in the business graph to move unendingly upward. During the post-war years, with the spirals of price, costs of living and wages rising, the relations between labour and what many refer to as "capital," but which I prefer to call "management," have been difficult enough. The upward trend has, however, eased them, but if and when that trend turns and continues downwards the strain will inevitably become more acute. Organized labour has had an enormous growth in numbers and influence over the past decade. That growth has been concomitant with uniformly increasing returns to labour; and it will not be easy for labour leaders to face and sell to their members the prospect of lower, or even static wage rates, should consumer demand and prices begin to fall.

But whether prices and wages can continue to go up, or must go down, there will be clashes of views between labour and management, whenever wage and working agreements are under discussion. There will be skirmishing or negotiating, which may or may not end peaceably in all cases. The odds are that the solution will be more difficult than it has been during more than a decade. How will it be met? In international law it is said that there are two legal ways of settling an international dispute — by treaty or negotiating, or by war, for war is a legal instrument. Similarly in industry there will be two possibilities — negotiation or open breach. None of us would query as to which will be wiser or preferable but in the conflict between the human intellect and the human emotions, the intellect has not always won.

The meaning of statesmanship you all know, no matter how much you may disagree as to the individuals who in this or any country may merit recognition as statesmen. It has been said rather cynically that one of the prerequisites for such recognition is that the recipient be dead. But what is industrial statesmanship? It lies first, I think, in acceptance without reservation or variation of the premise that industry is one and indivisible; that it is not composed of two separable, mutually exclusive or antagonistic parts — labour and management. They are rather mutually dependent and mutually reliant parts of one endeavour — of one enterprise. One cannot function without the other: one cannot prosper or fail without the other. As the soul and the body go to compound and integrate the man, so do labour and management go to integrate industrial enterprise. The recognition of this integration is the alpha and omega of industrial statesmanship.

The right attitude is the sine qua non of all good relations. One must accept the truth that there cannot be rights without obligations, for the one cannot exist without the other. In exercising rights in civilized society one must do so in conformity with the rights of others. To insist on fulfilment of obligations by others one must scrupulously fulfil his own. No clear thinker can be chronically against management on the one hand or against labour on the other. As long as the resources of nature are extracted from the land, sea, or air, and shaped into products that serve mankind, both will play their part. And with the growth of industry, and the fairly frequent temptations to disregard the Golden Rule, unions and associations of one kind or another will be necessary, as police are necessary in communities and armies in the world, for the same reason, to provide the conditions under which rights may be enjoyed. Unionism is here to stay, and intelligent management must recognize, and indeed can be thankful for that fact, for as industry expands so do the difficulties of dealing with increasing numbers of individuals or small segments of workmen. Collective bargaining can be a convenience to the employer, as well as a protection to the worker. I believe that voluntary collective bargaining, conducted in the proper atmosphere and having its genesis in the right attitude on both sides, can help to protect the western world from sinister influences, which thrive in an atmosphere of misunderstanding, mistrust, suspicion, and hatred.

There are some other features of Industrial Statesmanship upon which I should like to touch, without labouring them unduly. I regard the two that I have mentioned — the full recognition of the partnership in effort of industry, and the cultivation of the right attitude within industry, as the fundamentals. The maintenance of perspective is important, although in the clash and clamour of negotiation it is not always easy to accomplish. When perspective is lost, the view becomes distorted, just as if one were examining a subject through a defective or badly focused microscope. It then follows that one will be thinking in and fighting for extremes. All debate, of course, begins to some extent with extremes, but the truth usually lies between. It is important to remember that, lest one become a prisoner of his own incautious words. Then too, one ought to study and understand the attitude and point of view of the other side, for otherwise his equipment is incomplete. To do so, he must be a good listener, which in my opinion is one of the Golden Rules of negotiation. Many causes have been ruined by talking — few by listening. It is a special talent, often painfully acquired, but it is worth any discipline one must undergo to achieve it. I wish I had the time to give you some illustrations within my own observation of the unfailing efficacy of interested and courteous attention to what the other has to say. It may sometime have to be pursued almost to the point of exasperation, for not all

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THE MODERN ENGINEER SHOULD BE EDUCATED *as a* SCIENTIST. I. In Industry

by

Harry K. Ihrig

Vice President in Charge of Research
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Introduction

In the last forty years industry has changed more perhaps than in the previous hundred years, yet it it has been reported [1] that in most engineering colleges the curricula in at least civil, mechanical, mining and electrical power engineering have not changed materially in that time. Since engineers are trained primarily for industry, it would seem that with the revolutionary changes going on which make industrial processes more scientific and more highly technical, the engineering courses should have been changed to adapt them to industry's needs.

The census figures show that in 1900 one graduate engineer was hired for each 250 workmen in industry. In 1950 one graduate engineer was employed for each 52 workmen and industry was asking for many more.

Taggart in a recent article [2] has said "Engineering education today is like a crazy quilt of somber wools and gaudy shoddy, chain-stitched on an academic assembly line, and sold at ever mounting prices to inexperienced youths for life-time use. Each engineering school offers a half-dozen or so patterns with essentially the same skimpy wool content. Sales appeal is in the colour of the shoddy, denoted by the hopeful adjectives chemical, civil and the like. This article is argument for an all-wool product made by slow, careful handwork. Bluntly, it proposes a thorough four-year undergraduate drill in fundamental science and general engineering empirics, leavened by continuing study of the third of the engineer's troubles: Man."

This discussion is limited to the technical portions of the engineer's training.

Preindustrial Training

Since industry has become so complex and because it is continually changing, it is imperative that the engineer be trained in the fundamentals of science rather than the specific "practical" courses of any one industry. In fact, industry today with its indoctrination courses will train engineers with the most modern equipment and pay them well while so doing. Isn't this preferable to the student to taking up time in the engineering school trying to learn such subjects on equipment that is often obsolete.

None of the thousands of engineers on atomic energy projects could possibly have had specific courses in this particular field. Yet many physicists, chemists and engineers were able to adapt their fundamental training to this entirely new field. The only way an engineer can adapt himself to the new things developed after he has finished his formal training is to have his training embrace enough fundamental science so that he is able to make new applications of that science whenever necessary.

Augustine B. Kelley in a recent article [3] shows that the engineer is essential in the highly mechanized coal industry in the United States. Because of its mechanization our coal industry produces about four times as much coal per man as the next best producer. Also in the utilization of coal in such applications as the coal burning gas turbine highly scientific engineers are necessary.

In the oil industry science is used from geophysical prospecting to the synthesis and rearrangement of hydrocarbons to obtain the maximum antiknock properties in gasolines. The recent development of petrochemicals has opened up a whole new field for the application of physics and chemistry in the engineering of these products.

Allis-Chalmers Manufacturing Company makes about 1600 different items from tractors to hydraulic turbines. No possible engineering course could cover the specific manufacture of half of these. Yet all of them are based fundamentally on physics and chemistry with mathematics as the shorthand for expressing chemical and physical facts.

Engineering Training in Industry

Industry has not assumed that the universities have trained engineers in its specialized procedures. But it would like to be able to assume that the engineer has had a broad fundamental training so that he can adapt himself to industry's special needs. To this end industry has set up various training methods. The larger companies have formal courses, and the smaller ones depend more on personal instruction by older engineers.

A well known example of training supported by industry is the Institute of Paper Chemistry at Appleton, Wisconsin. In addition to paper technology, science courses are given and graduate degrees are conferred. The graduates of this course have made very good records in the paper industry.

The Humble Oil and Refining Company has courses of graduate level given by outstanding engineers and scientists from universities, who are invited to participate in this program by giving lectures and seminars in their various specialties.

Courses in reactor technology are

[1] Thorndike Savilk, "Engineering Education in Changing World," *Journal of the American Society of Engineering Education*, Vol. 41, p. 4, 1950-51.

[2] Arthur F. Taggert, "Education for Engineering," *Mining Engineering*, Vol. 4, No. 8, p. 770-774, August 1952.

[3] Augustine B. Kelley "The Engineer—Key to Coal Progress," *American Engineer*, p. 7-10, Auggust 1952.

en engineers from industry at k Ridge. This training gives them e proper background for the sign of equipment to be built by lustry for the Atomic Energy mmission, and for the eventual e of atomic energy by private lustry.

In many cities, universities give ening courses for engineers in in- strial plants. For example in ilwaukee, the University of Wis- nsin gives graduate courses in echanical, chemical metallurgical, d electrical engineering. Research ork for the master's thesis is done the plants where the engineers e employed. During the last ademic year 170 graduate stu- nts were enrolled. The enrollment r graduate work leading to the aster's degree has steadily in- eased.

The courses are taught by regular culty men from the College of ngineering at Madison. The stu- nt registers in and receives his egree from the Graduate School of ie University of Wisconsin exactly ie same as if he were in residence iere. This enables an engineer to ork full time and obtain a master's egree in two or three years by king his graduate courses in the vening and doing his research ork in the company's laboratories r plants.

A University Cooperating Com- ittee of the Wisconsin Society of rofessional Engineers composed of ngineers from industry has studied iany of the engineer's problems. he writer has been a member of this ommittee for a number of years.

The technical institute was tudied to determine its place in the ducational and industrial engineer- ng fields. It was recommended that he technical institutes be encour- ged to train men for specific jobs o aid engineers in industry. This raining should be given in technical nstitutes not directly connected vith the university. The courses should be specialized and terminal n nature and should not be ac- cepted for credit in the engineering college of the university. The func- tion of the technical institute grad- uate is to do what might be termed sub-engineering jobs so that en- gineers may be used only for profes- sional work. One of the best ways to alleviate the shortage of engineers is to use them for only truly engineer- ing functions in industry. The tech- nical institute graduate can thus release engineers for the real work for which they have been trained.

The medical profession for many years has used nurses, X-ray tech- nicians, therapists, and other sub- professional help to aid the phy- sician and hence free him to direct the medical program.

The University Cooperating Com- mittee next studied a course in fun- damentals for non-specialized en- gineering training and it was decided that such a course was very desir- able from the industrial standpoint. A course was recommended which would consist approximately of:

Mathematics	28 credits
Chemistry	26 credits
Physics	33 credits
Engineering Fundamentals	33 credits
Humanities	24 credits
Total	144 credits

This would be a four year course with a preponderance of science and would lead to a degree of Bachelor of Science in Engineering. Specialization would be left for graduate studies.

Thus a committee of represent- ative engineers of long experience in industry has indicated that there is a need for engineers trained in fun- damental science, and that these engineers can be released for such fundamental work by providing technical institute graduates to do sub-professional work.

It is often said that fundamental courses are all right for large com- panies that have training programs, but that small companies require engineers trained in specialties so that they can start work at once. One of the members of this com- mittee is a mechanical engineer who owns a small company manufactur- ing mechanical equipment. He be- lieves that a broad fundamental training is very important in a small company where the engineers have to be versatile because the company cannot afford an engineer for each specialty.

Allis-Chalmers has had a training program for many years for graduate engineers. This training costs the company about $10,000 per year per man. It consists of lectures and on the job training in various depart- ments. The same training is given to all engineers regardless of specialty. In the recruiting of engineering graduates no specialized training is required of these graduates. A sound background of good scholarship in fundamental subjects is one of the principal standards for picking the man.

In addition to the practical train- ing given in the Allis-Chalmer's plants, courses also are given in graduate engineering subjects by members of the faculty of the Illi- nois Institute of Technology. These courses may be used for a master's degree. The instructors come to the plant to give the courses in the evening. The Company pays a third of the engineers' tuition upon regis- tration for a course and another third upon satisfactory completion of the course. A number of men obtain advanced degrees in engineer- ing each year in this way or through the University of Wisconsin's grad- uate courses given in Milwaukee. Research work for the thesis may be some problem that is being worked on for the Company on company time or it may be a problem of no direct interest to the Company. In the latter case the work is usually done on the student's time, but with company equipment in the plant.

Value of Fundamental Scientific Training in Industry

Engineers usually enter one of four major fields in industry:

1. Design.
2. Production.
3. Sales.
4. Research and Development.

Scientific training is valuable for design because it provides the basis for the creative work necessary. It gives the design engineer the back- ground that enables him to design machines and processes that will work commercially, and that will not violate some fundamental laws. Design is similar to research in that it requires imagination and an ability to visualize new equipment and processes and also new uses for old equipment. A sound background of science is necessary to enable the design engineer to read its literature and hence utilize all new discoveries to produce modern equipment.

Engineers employed in production in today's intricate manufacturing must be well schooled in science because production is no longer an application of brute strength to the fabrication or processing of materi- als; it is no longer a "cut and try" procedure; nor is it a sterile follow- ing of conventional patterns which have proved successful in the past. But rather it is an application of scientific principles to operations to give maximum efficiencies. Often production engineers are able to make improvements in processing that eliminate much expensive labour. Since modern production equipment is highly scientific, an engineer who operates and main- tains this equipment also must know his science. Quality control by

(Continued on page 1024)

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

H.R.H. The Duke of Edinburgh, Hon.M.E.I.C.

It will be good news to members everywhere to learn that His Royal Highness The Duke of Edinburgh has consented to be an Honorary Member of the Institute. The final word was received at Headquarters on July 8, 1953.

It is fitting that one who is so much interested in science and engineering as is His Highness, should be associated with an engineering institution. The Engineering Institute is proud and happy to be the one so honoured.

Members will recall reading in the *Engineering Journal* for August 1951 the outstanding address which His Highness delivered in Edinburgh on the occasion of his induction into the presidency of The British Association for the Advancement of Science. That address showed clearly His Highness' interest in science and his insight into it.

In its sixty-seven years the Institute has received many honours, but within recent weeks great things have been happening. First there was the command from Her Majesty The Queen for the Institute to be represented at the Coronation (with seats in the Abbey); then the award of a Coronation Medal; then the invitation to have a representative on the platform with the Governor General at the Coronation Ceremony on Parliament Hill at Ottawa, and now the acceptance of an Honorary Membership by His Highness. The year 1953 will stand out in Institute history.

The other Honorary Members are (in alphabetical order): Prof. J. A. Allan, Edmonton; Prof. R. W. Angus, Toronto; Dr. W. L. Batt of Philadelphia; The Right Honorable the Earl of Bessborough; E. V. Caton, Winnipeg; Dr. J. B. Challies, Montreal; Prof. A. L. Clark, Kingston; F. W. W. Doane, Halifax; Dr. Percy Dunsheath, London, England; Sir Alexander Gibb, London, England; Dr. Lillian M. Gilbreth of Montclair, N.J.; Dr. Alex J. Grant, Montreal; The Rt. Hon. C. D. Howe, Ottawa; S. J. Hungerford, Montreal; J. G. G. Kerry, Port Hope; A. L. Killaly, Peterborough; W. A. Mather, Montreal; Dr. Malcolm Pirnie, New York; Dr. F. H. Sexton, Halifax; F. P. Shearwood, Montreal; Dr. A. Surveyer, Montreal; Dr. W. R. Turnbull, Rothesay, N.B.; Dr. R. C. Wallace, Kingston; Prof. Frederic Webster, London, England; Sir Frank Whittle, London, England; The Most Honorable The Marquess of Willingdon; H.R.H. The Duke of Windsor; Dr. C. R. Young, Toronto; Stewart Young, Regina.

New Membership Directory

Once again Headquarters is working on a new membership directory. By now members will have received forms asking for the necessary up-to-date details about themselves. If the new directory is to be useful, the information in it must be correct. It is essential that members complete the form and return it promptly.

The preparation of a directory of this size is a huge task. Each directory gets larger than its predecessors. The previous directory was published in late 1950, so there will be many changes to be made. The 1950 edition had 160 pages of alphabetical listings, 20 pages of geographical listings, and 38 pages of advertising, a total of 218. The new one will have 200 of alphabetical listings and 24 pages of geographical listings. It is too early to say how much advertising and catalogue information there will be,

Cover Picture

Our cover picture this month shows the Peace Tower, on Parliament Hill in Ottawa, as it appeared during the fall and early winter of 1952. In order to carry out the repair and re-pointing of the masonry, the 265-ft. tower was encased for the first time in aluminum scaffolding.

In all, 37,000 linear feet of tubing and 9,250 fittings were required for this work. Since there was considerable pedestrian traffic in the vicinity of the Tower, great care had to be exercised in doing the work, and it is stated that not a single fitting or wrench was dropped during the operation.—*Photo courtesy Dominion Bridge Company, Limited.*

H.R.H. The Duke of Edinburgh, Hon.M.E.I.C.

but the hope is that there will be enough to meet a substantial portion of the cost of the whole undertaking. It is expected the total number will approach 400.

A feature of the new publication will be a catalogue section wherein will be listed and described the products and services of many firms —of interest and importance to engineers. It is believed that the combination of a membership directory and a digest of engineering products and services will produce a publication of unusual interest to engineers. It will be a veritable handbook of things you need to know.

Even though you have made no changes since 1950, you are requested to return the form because it asks for certain useful information that we have not had before.

The President and the Coronation

The fact that the Institute was invited to be represented in the Abbey on the occasion of the Coronation has been reported previously in the *Journal*. The president of the Institute, Ross L. Dobbin, was able to be there, and is now back in Canada, so now further details are available.

Reviewing the whole program, it is evident that the days spent abroad were full of activity of significance to the Institute. Mr. Dobbin was received "royally" by officers of the British engineering institutions and Canadian officials in London. Besides the Coronation the president had many important events to attend. A few of them are listed herewith in chronological order.

He arrived in London on Tuesday, May 26, being met at the airport by W. K. Brasher, secretary of the Institute of Electrical Engineers. The next day the presidents and secretaries of the "big three" (institutions of civil, electrical and mechanical engineers) entertained him at luncheon. After luncheon the president of the civils Henri Francis Cronin, chief engineer of the Water Board of London showed him over a portion of London's waterworks system.

Thursday saw him at the Queen's garden party at Buckingham Palace. On Friday he attended the reception and ball of the Royal Institute of British Architects and, of course, on June 2, he was all day at the Coronation. On Thursday, June 4, he was guest of two of Britain's well-known electrical clubs, The Dynamacables and the 25 Club. That afternoon he was present at a garden party at the Hurlingham Club.

Colonel By's Grave

On Friday in company with Mr. Brasher he drove to Frant to see the tomb of Colonel By, the engineer founder of Ottawa. Another Canadian interested in Colonel By was present also — Mayor Charlotte Whitton of Ottawa. It was quite an occasion with the church and municipal officials turning out to greet them. That night he was guest of the Institute of Mechanical Engineers at their annual conversazione.

To Scotland and Ireland

On June 9 he went by rail to Edinburgh where he was met by George Baxter, chief engineer of the water board. As one would expect, he visited the great Firth-of-Forth Bridge. Next day he toured the city, called on the Lord Provost and inspected the city's waterworks system.

On Thursday, the 11th, he motored to Glasgow, where he was met again by waterworks officials. He visited the new power stations north of the city—the Portobello station and the Loch Sloy station and as well took a quick look at Loch Lomond. The same day he embarked for Northern Ireland, arriving at Belfast the next morning.

On Friday he was greeted by members of the Institution of Electrical Engineers, was received by the Lord Mayor and visited the Silent Valley plant of the waterworks system. On Saturday he visited Armagh, then flew back to London.

Sunday, June 14, was the date of the annual garden party of the Royal Aeronautical Society, and Mr. Dobbin was a guest of the Society. This is one of the world's greatest aircraft exhibitions, with the newest and the oldest in planes all taking their turn on the stage in the sky.

Naval Review

The longest day was Monday, June 15. This was the day for the Spithead Naval Review. Mr. Dobbin started on this at 7 a.m. and returned to shore at 5 a.m. the next day. He was with the Canadian party on the *Lord Warden*.

Tuesday, June 16, also had its points. This was the date for the Royal Tournament, and a reception by Ontario's High Commissioner. Here Mr. Dobbin met the High Commissioner, the Lieutenant Governor, the Premier and the Lord Mayor of London. On June 17 he attended the reception of the Canadian High Commissioner at Canada House. On June 18 he was a guest of the Institution of Civil Engineers on the occasion of their annual conversazione. This type of event is the principal item in the social program of several British societies.

On June 22 he was a dinner guest of Sir William Rootes, chairman of the Dollar Export Committee. On Wednesday 24, he dined with the Smeatsonian Society of Civil Engineers, probably the world's oldest engineering organization. He was the guest of A. C. Hartley, famous for his war work on "PLUTO" and "FIDO".

On June 25 he visited Greenwich Observatory and attended the prize giving ceremony at South London Technical School in company of the president of the Institution of Electrical Engineers.

Starting on Sunday, the 28th, he motored to Newcastle to attend the summer meeting of the Institution of Electrical Engineers. In this area he visited the C. P. Parsons plant and also Reyrolles. Friday, July 3, saw him embarked by plane for home. He arrived in Montreal on July 4.

In his letter conveying these details, Mr. Dobbin says "The engineers of Britain are a grand lot. Nothing was too much trouble for them. They arranged my various trips and excursions. In most cases they drove me in their own cars."

There were several pleasant events not mentioned in this account. Some of them were visits to the homes of prominent citizens, and others were personal functions arranged by Mr. Dobbin's friends. Altogether, it was a great experience, and according to the president it was an indication of the high regard in which the British hold the Engineering Institute and Canadians in general.

More on the Annual Meeting

There were some serious omissions in the account of the annual meeting in the July *Journal*. Fortunately, they were discovered at Headquarters before the July issue was in the mail so this apology is being written before any complaints or comments have been received.

The grave of Colonel By, at Frant, England, visited by the president, Ross L. Dobbin and the Mayor of Ottawa, Charlotte Whitton.

This is a picture of the Very Reverend F. J. Lynch, president of St. Mary's University, Halifax, at the head table of the annual meeting banquet. Unfortunately, in some unknown way, it had dropped out of sight when the head table photographs were being assembled for the *July Journal*. Our sincere apologies to Father Lynch.

One omission was the photograph of the Very Reverend F. J. Lynch of St. Mary's University which should have appeared with the other banquet head table guests. In some way not yet clear to Headquarters, Father Lynch's picture was not "among those present" when the assembly work was being done. The *Journal* is happy to publish the picture in this issue.

Other omissions relate to presentations of souvenirs and other useful commodities. At the dinner, Wednesday evening, His Worship Mayor Donahoe presented cigarette lighters bearing the crest of the city to J. B. Stirling, R. L. Dobbin and the general secretary, and on the same occasion, O. Nelson Mann of the Department of Trade and Industry presented Mrs. Stirling with an ash tray, a product of Nova Scotia industry. At that moment waiters distributed a similar gift to every lady at the meeting. Each piece of pottery was nicely wrapped in a box, the cover of which carried the crest of the Institute.

At the special dinner held on Tuesday night for the wives of officers of the Institute, a box of delicious chocolates was presented to each lady, with the compliments of Moirs Limited.

All these gifts were greatly appreciated, and added a touch of piquancy to each occasion.

Council Action

At the July meeting of Council three special committees were authorized which indicates some interesting developments within the Institute.

The first of these was established to study the invasion which is now taking place by engineers and contractors from the United States. Council have had this matter before them for several years, but recent acceleration of developments has made the matter more urgent than ever. The committee is asked to study the matter carefully from all points of view and to make recommendations to Council as to action which might be taken.

The personnel of the committee is as follows: I. R. Tait, vice-president of E.I.C. and consulting engineer to C.I.L.; Hugh Crombie, vice-president, Dominion Engineering Company; A. S. Rutherford, E.I.C. councillor and vice-president of J. L. E. Price & Co., R. E. Heartz, president, Shawinigan Engineering Company; and C. E. Jackson, president, Atlas Asbestos Company.

The second committee was set up to study possible changes in the system of management of the Institute. At the annual meeting the suggestion was made that the Institute might work more efficiently if, in lieu of the present large Council, a small executive committee were established. It is this subject the committee will consider. Already the matter is being studied and a great deal of relevant information is being gathered. It is hoped to have a report ready for Council before the end of the year.

The committee is made up of R. S. Eadie, past vice-president, E.I.C. and vice-president, Dominion Bridge Company; J. E. Armstrong past president E.I.C.; J. B. Stirling past president of E.I.C. and president of E. G. M. Cape & Company Henri Gaudefroy, dean of engineering, Ecole Polytechnique; James L McLaren, consulting engineer o Toronto.

The third committee was set up to study annual meeting procedures and financing. The terms of reference include the study of the technical program, the social events, plant visits, etc. As well the committee is to examine the matter of financing and the division of authority between the Council and the local committee.

This committee was set up at the request of the general secretary, and it is planned that the committee's report will be ready for the consideration of Council before the end of this year. Under such circumstances the plan when approved by Council will be available for the use of committees of the Quebec Branch where the 1954 meeting is to be held.

The personnel of the committee is E. B. Jubien, chairman, chief engineer Dominion Textile Company and past chairman of annual meeting committee; Louis Trudel, Shawinigan Water & Power, and past assistant general secretary of E.I.C.; R. L. Dunsmore, vice-chairman Montreal Branch and president of the Champlain Oil Company; Robert Layton, past chairman, junior section Montreal Branch, with T. Pringle & Son.

It is not expected that Council will meet again before September, although the finance committee will continue to function throughout the summer.

Comparison of Engineers' Incomes

From *Civil Engineering*, June 1953

With a median annual income of $7,100, the civil engineer is the lowest paid in the engineering profession, according to a recent report of the Bureau of Labor Statistics, entitled Employment, Education and Income of Engineers, 1949-1950. Based on a survey made by the Engineers Joint Council for the Department of Defense, the report deals largely with members of full professional grade in the then five constituent EJC societies. Questionnaires were sent to 55,000 engineers, 35 or older, who were asked to supply information on their field of specialization, their three highest fields of competence, their education, present work, and income.

Of the group surveyed, 29.1 per cent were in the $5,000-$7,000 salary range; 25.1 per cent in the $7,999-$9,000 range; and 14.4 per cent in the $9,000-$11,000 range. The median salary for the electrical and mining branches of the profession was found to be $8,000; mechanicals, $8,400; and chemicals,

100. In every category the survey owed engineers with doctors' degrees receiving the top salaries. The port also notes that since "income nds to increase with age and to be ghest among engineers in private dustry, it is believed that if there any bias at all, it resulted in a ght understatement of the earngs level of all members of engining societies 35 years of age and er."

More civil engineers—42.8 per nt—are employed by government gencies, that is, by the United States, states, counties, cities and districts, than in any other type of work, and the second highest number, 34.5 per cent, is in private industry. For the profession at large, the figures are reversed, with private industry employing 65.8 per cent of all those reporting, and the government second with 17.1 per cent of the employees.

Copies of the report are available from the Bureau of Labor Statistics, 14th Street and Constitution Avenue, Washington 25, D.C.

Athlone Fellows - 1953

Once again, the Institute salutes a roup of thirty-seven young Canaian engineers who have been singd out for the award of an Athlone ellowship.

This fellowship entitles the recient to two years of study in British universities or experience in British industry or a combination of oth. The basic thought back of he fellowship is that a group of top Canadian students should have an pportunity to learn something bout British industries, British eople and British institutions, so hey may better understand the British people and may transmit to thers, ideas that will promote etter relations between the two ountries.

This year twenty-eight of this ear's graduates have been selected nd ten who have been out of colege for one or more years. It is nteresting from the Institute's point f view to observe that out of this otal of thirty-eight, twenty-six re Students or Juniors of the Institute.

The Institute has written to each of its members in the list not only congratulating and wishing them well, but offering them certain facilities with the British Institutions which can be made available to members of the Engineering Institute. It is hoped that in this way the experiences of these young men may be widened and the advantages increased greatly.

To the entire group the Institute offers its sincere congratulations. To be selected as an Athlone Scholar is indeed a high honour and it promises great things in the future for the lucky young men. The Institute hopes that it may have an opportunity to be of service to them while they are abroad and as well when they return.

Herewith is the complete list of the winners and the educational institutions from which they were graduated:

GROUP "A"

John Douglas Vachal, S.E.I.C., B.E., Nova Scotia Technical College; Ronald Sterling Shepherd, S.E.I.C., B.Sc., University of New Brunswick; Robert Eric Burridge, S.E.I.C., B.Sc., University of New Brunswick; Jean Louis Chollet, S.E.I.C., B.A.Sc., Laval University; J. Paul Arthur Roberge, S.E.I.C., B.A.Sc., Laval University; Maurice Raymond Bedard, S.E.I.C., B.A.Sc., Laval University; Real Andre Arsenault, S.E.I.C., B.A.Sc., Ecole Polytechnique; Theodore Cameron Kenney, S.E.I.C., B.Eng., McGill University; Edmund Hugh McIntyre, S.E.I.C., B.Eng., McGill University; Philip Graham Hill, S.E.I.C., B.Sc., Queen's University; Earl W. Fee, S.E.I.C., B.A.Sc., University of Toronto; Andrew Robert Molozzi, S.E.I.C., B.A.Sc., University of Toronto; Robert Arthur Newey, S.E.I.C., B.Sc., University of Manitoba; Donald Duncan Young, S.E.I.C., B.Sc., University of Manitoba; Cameron Wallace Blachford, S.E.I.C., B.E., University of Saskatchewan; Leonard David Allen, S.E.I.C., B.Sc., University of Alberta; John Dennison Wood, S.E.I.C., B.A.Sc., University of British Columbia; John Richard Arnold, S.E.I.C., B.A.Sc., University of British Columbia.

GROUP "B"

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Publicity

These days a great deal is heard about publicity for the engineer. Publicity can be a good thing but on the other hand it can be a bad thing. It all depends upon the nature of the publicity. It reminds one of the old-time comparison between fame and notoriety.

The Institute endeavours from time to time when there is suitable material available to have the profession mentioned in the press. Fortunately happenings within the Institute make interesting news for many thousands of people. Therefore, the newspapers are willing to pick it up and use it.

This is borne out by the figures covering the publicity given to the annual meeting of the Institute held in Halifax in May. Although these are not necessarily complete, they are impressive even in their present form. For instance sixty-seven different papers in forty-eight different cities and towns carried one or more references to the meeting. In all the meeting was mentioned in these sixty-seven papers one hundred and fifty-two times.

The papers covered all areas of Canada from St. John's, Newfoundland, to Victoria, British Columbia. As one would expect, the Halifax papers far excelled the others in their reports. The *Mail-Star* gave the equivalent of over two and a quarter full pages and the *Chronicle-Herald* published information totalling just under two full pages.

All this material related to engineering developments which of course are reflected in industrial development which in turn affect the public. Such news is good publicity for the profession.

The Association of Professional Engineers of Newfoundland

The results of the elections of officers of the Association of Professional Engineers of Newfoundland for the ensuing year were announced at the annual general meeting held on May 9, 1953.

B. A. Monkman, M.E.I.C., Newfoundland Light & Power Company,

St. John's, was elected as president, having already served in this capacity since the formation of the Association last year. E. Dickinson, M.E.I.C., United Towns Electric Company of St. John's was elected to the office of vice-president. The following councillors, who were on the Council last year, are to remain in office for another year: E. L. Ball, M.E.I.C., Grand Falls; W. H. Maher, Buchans; C. A. Knight, M.E.I.C., St. John's; G. R. Jack, M.E.I.C., St. John's. Councillors elected for a two-year term were: E. Hinton, M.E.I.C., Deer Lake; E. D. Martin, Buchans; J. M. Hopkins, M.E.I.C., St. John's; and C. H. Conroy, M.E.I.C., St. John's. M. A. Foley, M.E.I.C., St. John's, will continue as secretary-treasurer and registrar.

The *Journal* Thirty-Five Years Ago

The August 1918 *Engineering Journal* was given over principally to presentation of papers which were to be delivered at the professional meeting which was to be held in Saskatoon on August 8, 9 and 10.

Papers and their authors were as follows:—

"Methods and Financing for Good Roads", by W. H. Greene; "Financing Road Work in Saskatchewan", by H. S. Carpenter; "Rural Community Water Supply", by E. L. Miles; "Deterioration of Concrete", by B. Stuart McKenzie; "Concrete in Alkali Soil at Saskatoon", by H. McI. Weir; "Fuels of Western Canada", by James White; "The Briquetting of Lignites", by R. A. Ross.

By peeking ahead into the September *Journal* it can be seen that this Saskatoon meeting was an outstanding success — but more about that in the reference to the September issue.

Canadian Engineering Standards Committee

A full-page article on this subject begins "Quietly and unostentatiously there was recently created in Montreal an organization at present known as the Canadian Engineering Standards Committee, under the chairmanship of Sir John Kennedy, the influence of which in years to come is bound to be felt by Canadian industrial life."

The author of that article may have felt that he was using strong terms, but in the history of the Canadian Engineering Standards Association, now Canadian Standards Association, it is seen readily that the case was not overstated.

The article indicates that the Canadian government had endorsed the establishment of the Committee and had appointed its nominee Almost all these people were we known in the profession. In Institu affairs the most noticeable a Lieut. Col. W. P. Anderson, Lieu Col. C. M. Monsarrat, Captai R. J. Durley, K. M. Cameron R. A. Ross, Dr. R. F. Ruttan Arthur Surveyer, Sir John Kenned W. F. Tye, H. H. Vaughan, D J. B. Porter.

The Engineering Institute's repre sentatives on the Committee wer G. H. Duggan and K. A. Herd The Canadian Institute of Minin and Metallurgy was represented b Dr. Alfred Stansfield and F. H Crockard, both of whom wer members of the Engineering Inst tute as well. The report goes on t say that of the twenty-four mem bers appointed by the governmen and by the two institutes, fourtee were members of the Engineerin Institute.

Sir John Kennedy was electe to the chairmanship with H. H Vaughan and R. J. Durley as vice chairmen. Mr. Vaughan at th time was president of the Engineer ing Institute and R. J. Durley be came general secretary in 1925.

The Engineering Institute ha continued to be closely associate with this organization. Today, th Institute's office in Montreal is distribution centre for all C.S.A literature and there is a member o the Institute on practically ever committee of the association.

Council Meeting

From the notes of the Counci meeting there are a couple of item that would seem to be of specia interest today. First there was proposal that the Institute engag Montreal's most outstanding soli citor "to bring a plea before th Recorder's Court regarding exemp tion from taxes." This subject ha been before the Institute for great many years.

Another item announces that arrangements have been completed with the American Society of Mechanical Engineers, the publishers of the *Engineering Index*, whereby the Engineering Institute could have the full use of this valuable material. Subsequently the volume of this became so great that it was practically impossible to reproduce it in a monthly publication. The *Engineering Index* is now purchased each year by the Institute library where it has become one of the principal reference books for all branches of engineering. It is interesting to note this arrangement because it is early proof of the

New Membership Directory

- A new Membership Directory is to be published before the end of the current year. Forms requesting up to date information have been mailed to all members.
  - If you have not received your form, please advise Headquarters without delay, so that a duplicate can be mailed.
- Every member is requested to complete and return the form, because certain information is asked for, which is not now on record.
  - Please return your Directory information form to Headquarters without delay, if you have not already done so.

lendid relationships that exist etween the Institute and the merican Society of Mechanical Engineers. They have been manifest many times during the intervening years.

Chemical Institute of Canada

The 36th annual conference of he Chemical Institute of Canada as held at Windsor, Ontario, on ıne 4, 5 and 6. The Prince Edward lotel was the conference headuarters and most of the social vents were held there. An interestıg feature of the meeting was the olding of all technical sessions in ıe lecture rooms of the new Iemorial Science Building of Asımption College.

A very full and varied program as arranged with special sessions evoted to Agricultural, Organic, hysical, Analytical, Rubber and iochemistry as well as Protective oatings, Chemical Engineering and hemical Education. Papers were resented by members of the staffs f nearly all our Canadian univerities, various research organizaions and government departments s well as many industrial comanies in the chemical and metalurgical fields.

Special speakers included W. T. Nichols, president, American Intitute of Chemical Engineers; Dr. G. G. Brown, dean of engineering, University of Michigan; Dr. S. M. Cadwell, director of development, United States Rubber Company; Dr. E. W. R. Steacie, president, National Research Council of Canada; and Very Rev. E. C. LeBel, president, Assumption College, Windsor.

Dr. R. S. Jane, M.E.I.C., president of the Chemical Institute of Canada presented the Chemical Institute of Canada Medal for 1953 to Dr. E. W. R. Steacie, president of the National Research Council and a former president of the Chemical Institute of Canada in recognition of his outstanding contributions to chemistry in Canada.

Seventeen prominent Canadian chemists and chemical engineers were elected to Fellowship, according to an announcement made to the conference. This honour is granted each year by the Institute to a limited number of its professional members in recognition of their general contributions to the science of chemistry and chemical engineering. The names of the newly elected Fellows are as follows:

Dr. J. C. Arnell, superintendent, Defence Research Chemical Laboratories, Ottawa; Dr. M. Louise Elder, chemist, Canadian Canners Limited, Hamilton; Dr. T. H. Evans, research chemist, Dominion Rubber Research Laboratories, Guelph; C. W. Gates, development manager, Naugatuck Chemicals, Elmira; Dr. J. W. Hodgins, professor of chemical engineering, Royal Military College, Kingston; Dr. R. N. Jones, senior research chemist, National Research Council, Ottawa; Dr. H. Martin, director, Science Laboratory, Department of Agriculture, London; Dr. I. E. Puddington, director, Division of Applied Chemistry, National Research Council, Ottawa; Dr. W. G. Schneider, associate research chemist, National Research Council, Ottawa; Dr. O. C. W. Allenby, group leader, Central Research Laboratory, Canadian Industries Limited, McMasterville; L. C. Wellington, chief, Raw Materials Survey Division, Aluminum Company of Canada Limited, Montreal; Dr. Leo Yaffe, Department of Chemistry, McGill University, Montreal; W. H. Hill, regional director, Food & Drug Divisions, Department of National Health & Welfare, Vancouver; A. W. Moore, Consolidated Mining & Smelting Co. of Canada Limited, Trail; J. B. Thompson, superintendent of development, Chemicals & Fertilizers Division, Consolidated Mining & Smelting Co. of Canada Ltd., Trail; J. M. Limerick, research director, Bathurst Power & Paper Company, Bathurst; P. V. Wessman, manager, Best Yeast Limited, Liverpool, N.S.

At the conclusion of the business meeting, which opened the conference, the Council of the Institute announced the names of the newly elected officers and members of Council. The president for 1953-54 is Dr. J. W. T. Spinks, dean of the College of Graduate Studies and head of the Department of Chemistry at the University of Saskatchewan. The vice-president is E. R. Rowzee, vice-president and manager of Polymer Corporation Limited, Sarnia. Newly elected councillors are as listed below:

Dr. D. B. MacLean, Nova Scotia Technical College, Halifax; M. Lessard, St. Lawrence Sea Products Company, Quebec City; Dr. J. H. Michell, Central Research Laboratory, Canadian Industries Limited, McMasterville; Dr. A. T. Prince, Mineral Dressing & Process Metallurgy Division, Mines Branch, Ottawa; G. F. DeLong, Hinde & Dauch Paper Co. of Canada Ltd., Toronto; E. A. Crockett, Polymer Corporation Limited, Sarnia; Dr. W. O. S. Meredith, Board of Grain Commissioners, Winnipeg; E. A. G. Colls, Consolidated Mining & Smelting Company of Canada Ltd., Trail; Dr. G. A. Ledingham, Prairie Regional Laboratory, National Research Council, Saskatoon; Dr. R. J. Rossiter, Department of Biochemistry, University of Western Ontario, London; Dr. F. W. Matthews, Canadian Industries Limited, Beloeil; C. B. Brown, Dominion Tar & Chemical Co., Montreal.

News of Other Societies

The Pacific general meeting of the **American Institute of Electrical Engineers** will take place at the Hotel Vancouver, Vancouver, B.C., September 1 to 4, 1953.

The only one of its kind held in Canada, the 1953 version of Canada's Power Show will run for four consecutive days commencing October 19, at the Royal York Hotel, Toronto.

The **Institute of Power Engineers,** 410 Bloor St. E., Toronto, sponsors the Exhibition and the concurrent convention.

An announcement of a convention on metallurgy has been received from the president of the Société Française de Métallurgie, as follows:

"Nous avons l'honneur de vous informer que la Société Française de Métallurgie organise comme chaque année, à Paris, des Journées Métallurgiques d'Automne qui se dérouleront du 19 au 23 octobre 1953.

"Nous serions heureux s'il vous était possible de faire part de ces Journées aux différentes personnalités de votre ressort susceptibles de s'intéresser à la recherche et aux techniques métallurgiques.

"Nous nous féliciterions de leur participation, et nous vous serions reconnaissants de leur signaler qu'elles pourront obtenir toutes informations relatives à l'organisation de ces Journées en s'adressant à la: Société Française de Métallurgie, 25 rue de Clichy, Paris (9ème)."

THE MODERN ENGINEER SHOULD BE EDUCATED AS A SCIENTIST. I. In Industry

(*Continued from page 1015*)

statistical analysis is an example of the use of science in manufacturing. Machining also has been improved as the result of scientific studies on metal removal.

Sales engineering is a field with increasing interest to engineers. Although this field is often entered by many without engineering training, nevertheless sales engineering is a real profession and requires scientific knowledge. The products of highly scientific design and manufacture can be sold only if they fit into the customer's plants and processes. A wide variety of conditions and needs are encountered by the sales engineer. He must be able to discuss each customer's technical problems with engineers in that business. It would be impossible to train engineers in such a wide variety of technologies, but a basic training in science allows the sales engineer to quickly understand and adapt himself to any of the special conditions he meets.

In research and development, it is usually conceded that a thorough knowledge of science is essential. Here on the frontiers of knowledge, only the guideposts of the fundamental sciences can be used as the take-off for expeditions into the unknown. There is no dividing line between the scientist and engineer in research and development. The data obtained in this field are necessary for use by the design engineer to enable him to design large scale equipment and processes. The future of all manufacturing and engineering is determined by research. Only by having a thorough knowledge of science can an engineer progress in research, and to get this knowledge graduate training is desirable.

About half the engineering students do not practice engineering as a life work. They may go into patent law, purchasing, construction, or any business function. Can these engineers profit by scientific training? I think they can. Science is simply common sense or logic applied to natural phenomena. The scientist gets the facts and weighs the importance of each before coming to a decision. This is good training for almost any life career. It is much better than specialized engineering training for which these engineers will never have any use.

Industrial Needs for Scientifically Trained Engineers

Industry requires engineers who have had four years of study in the fundamental sciences such as physics, chemistry, mathematics, thermodynamics, electricity and mechanics. Such graduates in non-specialized engineering should then enter industries' training programs or should take graduate work in the universities for advanced degrees.

These engineers should be used for professional duties in industry with technical institute graduates and other technicians' help to assure maximum utilization of limited numbers of basically trained engineers. Such education and utilization of engineers will raise the standards of engineers and assur industry of an ample supply o adequately trained men.

There is not complete agreemen in academic circles on the advisa bility of fundamental training o engineers and their graduation with out designation. Therefore, it i suggested that a course in "Fun damental Engineering" be estab lished in engineering schools as a alternate course with presen specialized courses. It is believe that with competent and enthu siastic faculties for this course it graduates will be so successful tha eventually industry will deman engineers with this fundamenta training.

INDUSTRIAL STATESMANSHIP

(*Continued from page 1013*)

men are good listeners, but you may be sure that you are not committing injury to your own cause in doing so, as the other may be to his by over-statement.

I have said it is important to appreciate the attitude and point of view of the other side. This cannot be accomplished if one's observation is limited to what he sees and hears across a table. He must go more deeply into the personalities and problems of the party of the other part, even where possible into his personal problems. Often the other is "on the spot" if one may use the vernacular, with his own people, and you can help him if you know him and he knows you well enough. If one's courtesy, understanding and friendliness are genuine — if one is frank in admission of the verities, he can often disarm an adversary, for integrity is contagious. It is the set face and the stony heart that breed antagonism. It is well to avoid friction, remembering that it is one of the ways in which heat is generated. The brittle mind and the quick retort may have their places, but not as instruments of persuasion or conviction.

All men have tempers, but not all a sense of humour. In industrial relations, the man who has and can keep both is blessed indeed. A controlled temper can be the reserve of power which is often needed. A timely sense of humour can be the lubricant without which smooth running is impossible. It can avert strain, overcome friction and restore balance. When relations show signs of becoming strained, cooling off periods are invaluable. As a chairman of long standing — or sitting — in negotiations, I have used them deliberately, and rarely found them to be completely ineffectual.

As I said before, I have had the opportunity of observing skilled negotiators on many occasions, and in many places. Some of these were in international circles, conducted on what are referred to in the capitals as the "diplomatic level," the "expert level," the "administrative level," etc. Others have been intimately connected with two great natural resources — fisheries and forestry. The principles I have adumbrated have emerged time and again in these seemingly dissimilar fields of activity.

I think that experience can be, or ought to be, a good teacher although one cynic has said that it costs a lot and is worth nothing. The justification for my choice of subject is that I am sharing experience with a group of graduates into a profession which, more than most, finds itself faced with problems of industrial relations. While I have had to particularize to some extent, these principles apply, mutatis mutandis, as we say in Law vertically as well as horizontally. In dealing with labour it would come under the head of labour management relations. On the executive or administrative level it could be classed as management through participation, executive collaboration, or what you will. In either case, it embodies the practice of a set of principles which I feel constitute an intelligent and lasting guide for the operation of the free enterprise system in the western world. From that conviction, I commend it to you as "Industrial Statesmanship."

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Personals

News of the Personal Activities of Members of the Institute

Dr. Neil B. Hutcheon, M.E.I.C., former rofessor of mechanical engineering at he University of Saskatchewan, was re-ently appointed assistant director of he Division of Building Research of he National Research Council.

N. B. Hutcheon, M.E.I.C.

Dr. Hutcheon graduated from the University of Saskatchewan in mechanical engineering in 1933, taking his M.Sc. degree from the same university in 1935. He continued his studies in England from 1935 until 1937 and in 1939 received his Ph.D. degree from the University of London.

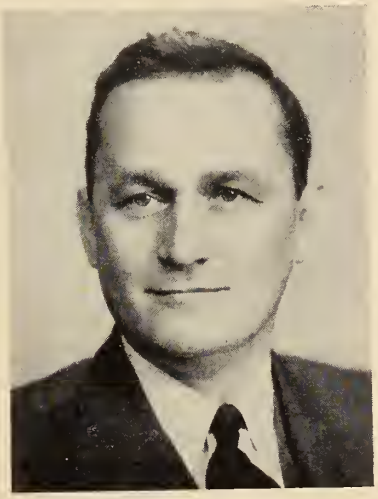
In 1937 he joined the staff of the mechanical engineering department of the University of Saskatchewan and advanced to the rank of full professor in 1944.

He spent his summers from 1939 until 1943 with the Division of Mechanical Engineering of the National Research Council on special wartime research problems. Then, in 1947 he became actively engaged in research on heat and moisture problems at the University of Saskatchewan and has developed this work since that time. Since 1949 this research has been carried out co-operatively by the University of Saskatchewan and the Division of Building Research through its prairie regional station which was established at Saskatoon in 1948. Dr. Hutcheon has served as a consultant to the Division with special responsibilities for this station since its commencement. He is the author of a number of research and scientific research papers, and he presented a paper, "Fundamental Considerations in the Design of Exterior Walls for Buildings," at this year's annual meeting of the Institute at Halifax.

Professionally, Dr. Hutcheon has been active not only in the Engineering Institute but also in the Association of Professional Engineers of Saskatchewan, serving as president of the latter in 1945-46. He is also a member of the American Society of Heating and Ventilating Engineers, and was made a member of this Society's special committee on research in 1951.

Erratum

J. A. Ouimet, M.E.I.C., is general manager of the Canadian Broadcasting Corporation. In the July issue of the *Journal* he was mentioned as presently serving in the capacity of assistant general manager and co-ordinator of television. This, however, was his position previous to his appointment as general manager of the Corporation in January of this year.



J. A. Ouimet, M.E.I.C.

Fraser S. Keith, M.E.I.C., the first full-time secretary of the Engineering Institute, and former manager of the Department of Development of The Shawinigan Water and Power Company in Montreal, was recently granted life membership in the McGill Graduates' Society.

Mr. Keith graduated from McGill University in 1903 with a B.Sc. degree with honours, and served on the engineering staff of the university as senior demonstrator the following year.

He has long been active in the affairs of the Graduates' Society and served as its president for the term 1942-44.

John Morse, M.E.I.C.

John Morse, M.E.I.C., has been recently appointed chairman of the board of Swedish General Electric Limited in Montreal.

Mr. Morse retired in 1951 as vice-president in charge of operation of Shawinigan Water and Power Company in Montreal with which he had been associated for 44 years.

D. M. Stephens, M.E.I.C., former Deputy Minister of Mines and Resources for the Province of Manitoba, is president and general manager of the Winnipeg Electric Company.

After graduation in civil engineering from the University of Manitoba in 1931, and post-graduate work in hydraulics and economics in 1932 and 1933, Mr. Stephens joined the staff of the Department of Mines and Natural Resources as a technical draughtsman and was subsequently promoted to the position of office engineer in charge of design. After five years with the Department he was granted leave of absence to do other special work, but in 1938 was recalled by the Department and appointed Deputy Minister. Mr. Stephens is chairman and general manager of the

D. M. Stephens, M.E.I.C.

L. M. Hovey, M.E.I.C.

C. P. Haltalin, M.E.I.C.

Manitoba Hydro-Electric Board, an appointment received in May, 1951, on the formation of the Board. In January, 1953, he became president of Winnipeg Electric Company.

Mr. Stephens has served as chairman and as councillor of the Winnipeg Branch of the Engineering Institute.

L. M. Hovey, M.E.I.C., has been appointed manager of the System Engineering and Planning Division of the Winnipeg Electric Company.

Since his graduation in electrical engineering from McGill University, Mr. Hovey has been associated with the Winnipeg Electric Company, first as draughtsman, then as assistant engineer, and prior to his recent appointment, as electrical engineer.

C. P. Haltalin, M.E.I.C., has been named manager of the Operating Division of the Winnipeg Electric Company.

Since joining the Company in 1929, he has held the positions of junior engineer, assistant electrical engineer, supervisory engineer, and chief electrical engineer.

Mr. Haltalin graduated in electrical engineering from the University of Manitoba.

T. W. Birt, M.E.I.C., has been appointed manager of the contract department of the Winnipeg Electric Company. He was formerly assistant manager of electric sales.

Before joining the Winnipeg Electric Company he was a member of the sales staff of the Northern Electric Company in Montreal, and during the war he served with the R.C.A.F. in the Aeronautical Engineering Division with the rank of wing commander.

Mr. Birt is a graduate of the University of Manitoba in electrical engineering, class of 1938.

J. R. Rettie, M.E.I.C., has been appointed manager of the Surveys and Construction Division of the Winnipeg Electric Company.

He entered the Manitoba Hydro-Electric Board in 1949 following service with the Canadian Pacific Railway Company in Nelson, B.C.; Anthes Foundry Limited in Winnipeg, Man.; the Manitoba Department of Mines and Natural Resources; and the Fraser-Brace Engineering Company in Montreal, Que.

Mr. Rettie is a graduate of the University of Manitoba in civil engineering, class of 1935.

G. S. G. Henson, M.E.I.C., has been named manager of the Property and Supply Division of the Winnipeg Electric Company.

He joined the Company in 1933 and since that time has held the positions of engineer of equipment, bus and truck department, and manager of company properties, taxes and insurance department.

During the war years he served with the R.C.A.F. Aeronautical Branch as staff officer and senior aeronautical engineer officer of Northwest Air Command with the rank of wing commander.

He is a graduate in electrical engineering from the University of Manitoba, class of 1935.

A. S. Williams, M.E.I.C., has been appointed assistant to the manager of the System Engineering and Planning Division of the Winnipeg Electric Company.

He entered the Company in 1924 after serving previously as superintendent at Seven Sisters Falls power plant, as electrical designer at Northwestern Power Company, and as chief operator at Great Falls plant of the Manitoba Power Company.

He graduated in 1921 in electrical engineering from the University of Manitoba.

A. L. Oddleifsson, M.E.I.C., has been named assistant to the manager of the Operating Division of the Winnipeg Electric Company.

He joined the Company in 1935 after serving as junior engineer at Seven Sisters Falls, electrical engineer with the Manitoba Hydro-Electric Board, and superintendent of the Pine Falls generating plant.

He graduated in 1931 in electrical engineering from the University of Manitoba.

T. W. Birt, M.E.I.C.

J. R. Rettie, M.E.I.C.

G. S. G. Henson, M.E.I.C.

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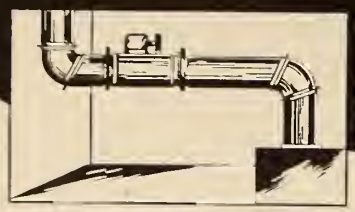
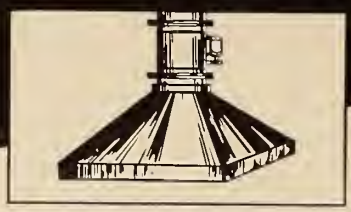
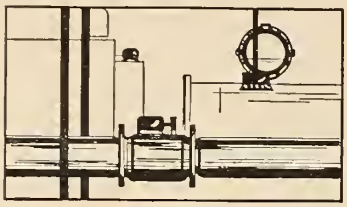


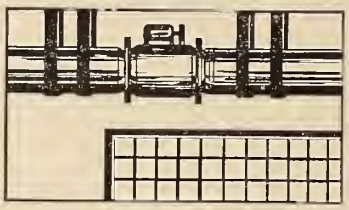
Fits naturally into middle of a straight duct system. Installed with least disturbance and to special advantage when system is overheated.



In a vertical air moving system (exhausting from paint spray booth for example) Axial Flow fans can be set directly over the opening with duct upright.



Where space is limited, in marine installations, for example, these fans take all straight connections, requiring far less room than curved connections for Centrifugal fans.



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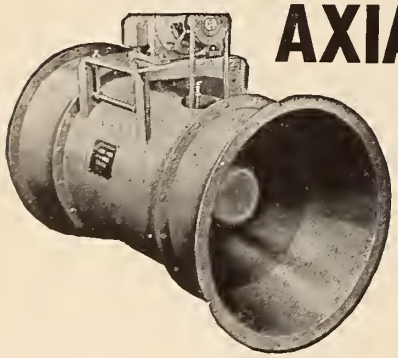

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H. C. G. Ligertwood, M.E.I.C., has been named assistant to the manager of the Surveys and Construction Division of the Winnipeg Electric Company.

A native of Aberdeen, Scotland, Mr Ligertwood has served with the Company from 1926 until 1931, and from 1936 until the present time. He was previously construction engineer with the Winnipeg Electric Company, office engineer with the Northwestern Power Company (Winnipeg Electric Company), and Bridge Site Surveys and Bridge Construction.

He holds a B.Sc. degree in civil engineering from the University of Manitoba.

D. S. G. Ross, M.E.I.C., has been appointed economic studies and cost engineer by the Winnipeg Electric Company. He was previously supervisor of industrial sales and sales engineer.

Before joining the Company in 1945 he was draughtsman and assistant office engineer with the Manitoba Department of Public Works, and supervisory inspector with the Aeronautical Inspection Directorate of the Royal Canadian Air Force during the war.

He is a 1937 graduate in electrical engineering from the University of Manitoba.

R. Wilson, M.E.I.C.

Robert Wilson, M.E.I.C., was recently named general manager of the Northern Electric Company's Telephone Contact Division. He was formerly assistant manager of the Division.

Mr. Wilson was born in Clydebank, Scotland, and worked as a naval architect in that country before coming to Canada in 1922. He joined Northern Electric Company Limited in 1923, as an equipment draughtsman, and three years later was made dial equipment engineer. Other positions Mr. Wilson has held are those of dial equipment supervisor, manual and toll equipment engineer, assistant chief equipment engineer, telephone engineer, chief engineer, installation superintendent, manager of engineering and installation, and acting sales manager of the Company's Communications Equipment Division. He was named assistant manager of the Telephone Contract Division on June 1, 1952, which position he held until his recent appointment as general manager of the Division.

Mr. Wilson served with the Imperial Army during the First War. He was wounded after considerable service in

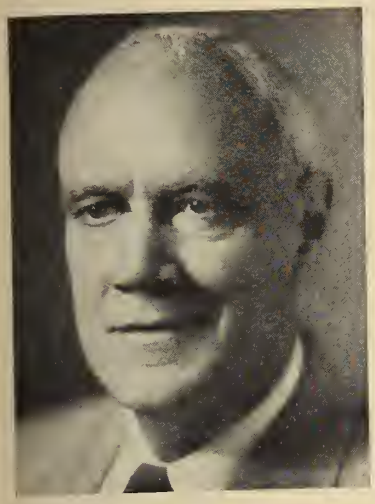
rance and Belgium and was awarded ie Distinguished Conduct Medal.

r. H. Saunderson, M.E.I.C., has been ppointed director of the Ammunition ivision of the Department of Defence roduction.

Dr. Saunderson has been on loan to is Department from the National Re-earch Council since March, 1951.

He received his B.A., B.Sc. and M.Sc. egrees from the University of Mani-oba, and his Ph.D. in chemistry from IcGill University.

He served as assistant professor of iemistry at the University of Mani-oba, and in 1945 was appointed dean f arts and science. In 1947 he joined ie National Research Council as irector of information.



F. Krug, M.E.I.C.

Frederick Krug, M.E.I.C., who has been associated with International Power Company, Limited of Montreal and its subsidiaries for more than thirty years, was recently named president of the Company.

Before joining the Puerto Rico subsidiary in 1922, Mr. Krug served as engineer in the Rosario Mining Company in Honduras. Since 1937 he has devoted his time to the management of the electric utility subsidiaries in Mexico, El Salvador, Venezuela, Bolivia and British Guiana, and in the Montreal Engineering Company of which he was general manager.

Dr. T. A. Monti, M.E.I.C., is now a partner in the firm of Letendre, Monti and Associates in Montreal, Que.

Dr. Monti received his B.A.Sc. degree in civil engineering from Ecole Polytechnique in 1941, and his doctor of science degree from the same university in 1947.

From 1941 until 1943 he was associated with the Dominion Bridge Company in Montreal, and four years later became a consulting engineer in the mechanical field. In 1947 Dr. Monti joined the National Research Council and was for two years its representative in the Montreal area. He was appointed a consulting engineer with Royer, Letendre and Associates in 1952.

Since 1949 he has served as district engineer in Montreal for the Canadian Institute of Steel Construction, and since 1945, as an assistant professor at Ecole Polytechnique.

Dr. Monti was awarded the Ernest Marceau Prize of the Engineering Institute in 1945, and the Keefer Medal of the Engineering Institute last year.

R. H. Clark, M.E.I.C., chief hydraulic engineer with the Water Resources Division of the Department of Resources and Development, has been transferred to Ottawa from Winnipeg, Man., where he was engaged in the Red River Basin Investigation. He was also assistant professor of civil engineering at the University of Manitoba.

Mr. Clark received his B.Sc. degree in civil engineering from McGill University in 1943, and his M.Sc. degree in 1945.

Lt.-Col. G. W. O'Neill, M.E.I.C., who has been Officer Commanding the 7th Technical Regiment R.C.E.M.E. (R.F.) since December, 1950, has been awarded the Canadian Forces Decoration.

Lieutenant-Colonel O'Neill is an engineer on the staff of Manitoba Bridge and Engineering Works Ltd. at Winnipeg, Man. He began his military career with the 10th Siege Battery, C.G.A., during the First War. Subsequently he served with N.P.A.M. units of the Canadian Machine Gun Corps and Royal Canadian Ordnance Corps at Winnipeg and Calgary, respectively. At the beginning of the Second World War, Lieutenant-Colonel O'Neill was commissioned as an ordnance mechanical engineer in No. 6 Army Field Workshop, R.C.O.C., at Drumheller, Alta. In June, 1940, he was called out under G.O. 139 and served with the Active Force until

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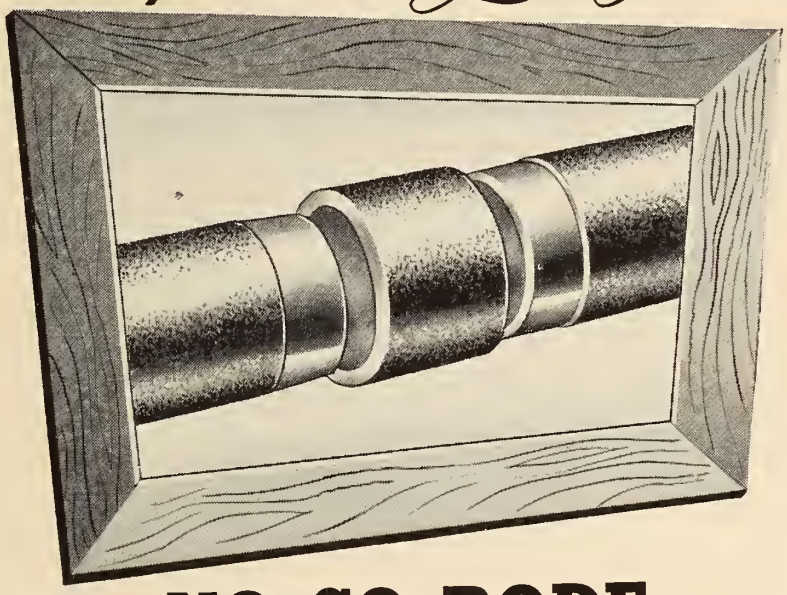

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May, 1946, in a variety of workshop and staff appointments. On his return to civil employment Lieutenant-Colonel O'Neill was posted to the supplementary reserve until March, 1949, when he was appointed major and 2 i/c of his present reserve force unit.

J. K. Partridge, M.E.I.C., assistant district engineer for the Department of Public Works in Central Ontario, has retired after forty years of service.

A native of Yorkshire, England, Mr. Partridge attended the University of Leeds, graduating in civil engineering in 1909. He came to Canada in 1911 and was employed as instrumentman and draughtsman with the Canadian Pacific Railway Company, the Algoma Power Corporation and the Canadian National Railways before entering the Department of Public Works in Toronto in 1913.

In World War I, Mr. Partridge, served as an officer in the Imperial Army from 1915 until 1919, and in World War II he was selected by the Department to assist the Navy in 1941 and 1942 in construction work and wharf design in Halifax. His work in 1943 was connected with wartime housing in that city.

Mr. Partridge's major service in the Department has been in the development of the harbours of Toronto, Whitby, Oshawa, Port Hope and Coburg.

R. T. Sansom, M.E.I.C., regional signal engineer for the Atlantic Region of Canadian National Railways, has been elected chairman of the Moncton Branch of the Engineering Institute.

R. T. Sansom, M.E.I.C.

Mr. Sansom was born in Campbellton, N.B. He received his early education there before entering the University of New Brunswick in 1931. Upon graduation in electrical engineering in 1935, he joined the New Brunswick Department of Public Works as instrumentman.

At the outbreak of war in 1940 he entered the North Shore (New Brunswick) Regiment as signal officer. In 1944 he transferred to the Saskatoon Light Infantry, serving with the rank of captain.

Upon his discharge from the Army in 1946, he joined the Canadian National Railways as assistant engineer in the signal department in Moncton, N.B. Two years later he was appointed signal engineer for the Atlantic Region of the railway system.

C. I. Bacon, M.E.I.C., vice-president and general manager of the Cornwall Street Railway Light and Power Company in Cornwall, Ont., was recently elected president of the Canadian Electrical Association for 1953.

F. F. Walsh, M.E.I.C., is now chief supervisor in the design and construction department of Canadian Industries Limited in Maitland, Ont. He was previously located in the Company's Montreal office.

Mr. Walsh graduated in mechanical engineering from the University of Toronto in 1940.

F. F. Walsh, M.E.I.C.

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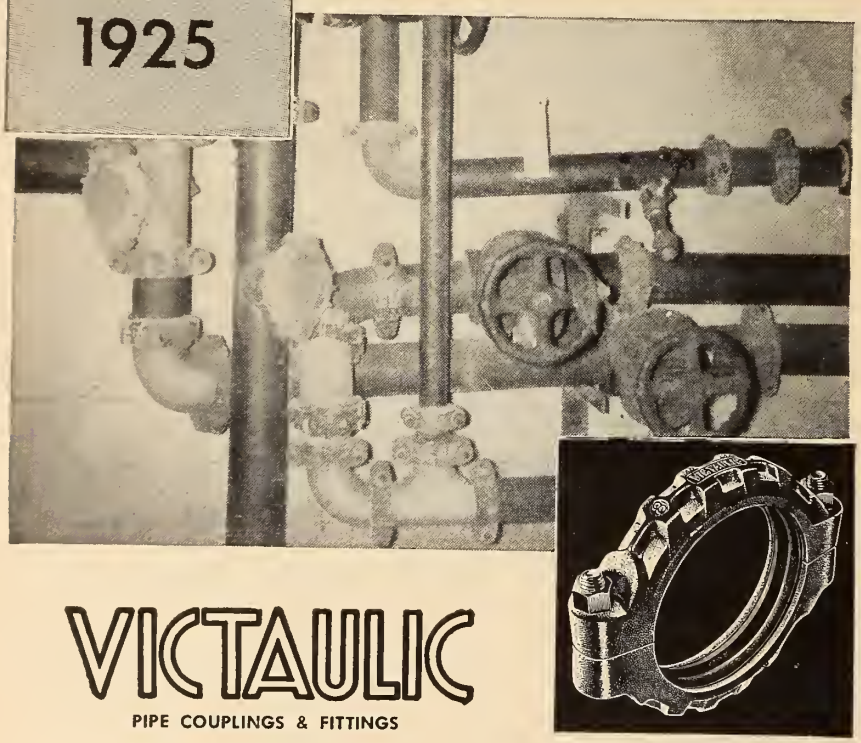

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. **A. Gareau,** M.E.I.C., formerly superintendent of the Rapide Blanc and renche developments for the Shawinan Water and Power Company at apide Blanc, Que., has been transrred as assistant to the divisional igineer in the Company's generation nd transmission department in Shawigan Falls, Que.

He is a graduate in electrical engineering from McGill University, class of 943.

lajor H. Goodfellow, M.B.E., R.C.E.M.E., M.E.I.C., has been posted from the Canaian Army Operational Research Establishment at the Royal Military College Kingston, Ont., to be second in comand, Commander R.C.E.M.E., at Quebec Command Headquarters in Montreal, Que.

Major Goodfellow had previously

Maj. H. Goodfellow, M.E.I.C.

completed his tour of duty as technical staff officer with the 26th Canadian Infantry Brigade in Korea before returning to Kingston in November, 1952.

Thomas B. O'Neill, M.E.I.C., has been transferred from the Montreal office of E. G. M. Cape and Company to Saint John, N.B.

Mr. O'Neill is a graduate in civil engineering from the National University of Ireland, class of 1947.

Edward Halischuk, M.E.I.C., is now project supervisor with Canadian Aviation Electronics Limited.

He was formerly with the Canadian Johns-Manville Company in Asbestos, Que.

Mr. Halischuk received his B.Sc. degree from the University of Toronto in 1946.

R. C. McMordie, M.E.I.C., former building engineer with the Hydro-Electric Power Commission of Ontario, is now program planning and control engineer.

Upon his graduation in civil engineering from the University of Toronto in 1930, Mr. McMordie joined the Hydro-Electric Power Commission as a designing draughtsman, becoming structural design'ng engineer in 1934.

After service with Canadian Bridge Company Limited in Walkerville, Ont., and with Gordon L. Wallace, consulting engineer in Toronto, Mr. McMordie joined H. G. Acres and Company Limited in 1936.

He returned to the Hydro-Electric Commission in 1940.

Mr. McMordie obtained his C.E. degree from the University of Toronto in 1941.

D. D. Whitson, M.E.I.C., is now building engineer with the Hydro-Electric Power Commission of Ontario.

A graduate in civil engineering from the University of Toronto in 1926, Mr. Whitson has served with the City of Toronto's Department of Buildings, and with the Works and Building Branch of the Department of National Defence in Ottawa.

W. M. Hogg, M.E.I.C., is senior resident engineer at the Ontario Hydro-Electric Power Commission's Sir Adam Beck-Niagara No. 2 power development.

He has served with the Commission since receiving his degree in civil engineering from the University of Toronto in 1939.

N. W. Life, M.E.I.C., is assistant city engineer for the City of Port Arthur, Ont.

He was previously town engineer in Wallaceburg, Ont.

Mr. Life graduated in civil engineering from London University in 1949.

C. H. Worembrand, M.E.I.C., has joined Dominion Rubber Co. Ltd. in Montreal, Que., as machine design engineer.

He was previously with Dominion Hoist & Shovel Co. Ltd. in Montreal.

Mr. Worembrand graduated in mechanical engineering in 1944 from McGill University.

Martin O'Day, M.E.I.C., has been transferred by Canadian Rock Salt Co. Ltd. from Neepawa, Man., to Ojibway, Ont.

Mr. O'Day graduated in civil engineering from the University of Manitoba, class of 1926.

H. A. Spencer, M.E.I.C., is now associated with the Research Council of Alberta at the University of Alberta in Edmonton.

He was formerly research engineer with Friden Calculating Machine Company Ltd. in San Leandro, Calif.

Mr. Spencer graduated in mechanical engineering from the University of Saskatchewan in 1945.

Wm. Rutherford, M.E.I.C., is director of technical development with The Rankin Company Limited in Montreal, Que.

He was previously construction engineer with Central Mortgage and Housing Corporation in Montreal.

Mr. Rutherford is a 1936 graduate in civil engineering from the University of Durham.

Garth Griffiths, M.E.I.C., has been appointed distribution superintendent of the British Columbia Power Commission in Victoria, B.C. He was previously the Commission's deputy chief engineer in Victoria, and superintendent of its coastal region at Nanaimo, B.C.

Gilbert Dumont, M.E.I.C., is now with the Mont Laurier Electric Company in Mont Laurier, Que.

Mr. Dumont is a graduate in electrical engineering from Laval University, class of 1944.

Victor G. Bull, M.E.I.C., is now associated with Canadian B.S.A. Limited in Montreal, Que.

He was formerly with Brown Boveri (Canada) Limited in Montreal, Que.

E. R. Welsh, M.E.I.C., formerly Quebec district engineer with Alchem Limited in Montreal, is now associated with Seaman Engineering and Drilling Co. Ltd. in Calgary, Alta.

Mr. Welsh graduated in mechanical engineering from the University of Saskatchewan in 1948.

J. M. Van Winckle, M.E.I.C., has been appointed chief engineer with the Quebec Iron and Titanium Corporation at the Company's Sorel Works.

J. M. Van Winckle, M.E.I.C.

Mr. Van Winckle graduated from the University of Toronto in mechanical engineering in 1940. He had been associated with the Swansea Works of Steel Company of Canada Limited, with Canadian Bridge Company Limited as mechanical engineer, and the Essex Terminal Railway Company as assistant to the chief engineer.

John B. Herbich, M.E.I.C., has been appointed a Research Fellow at the University of Minnesota, Minneapolis,

J. B. Herbich, M.E.I.C.

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ere he is concurrently studying toard a Ph.D. degree in civil engineering. Mr. Herbich served as a commissioned icer with the Polish Army under itish command from 1940 until 1945. He graduated in civil engineering from e University of Edinburgh in 1949. After serving with The Netherlands ydraulic Institute, University of Delft, r a year following graduation, Mr. erbich joined the Aluminum Comny of Canada Limited and was emoyed on three projects, Arvida, Perionka power developments, and the itish Columbia Kitimat project.

W. A. Stewart, M.E.I.C.

W. A. Stewart, M.E.I.C., supervisor of the unicipal section of Margison Babcock nd Associates Limited, has been appointed an associate of the firm.

He is a graduate in civil engineering rom the University of Toronto, class of 950.

D. L. B. Hamlin, M.E.I.C.

D. L. B. Hamlin, M.E.I.C., chief structural engineer of Margison Babcock and Associates Limited, has been appointed to the status of associate in the firm, according to a recent announcement by A. D. Margison, M.E.I.C., vice-president and general manager of the Company.

He is a 1943 graduate in civil engineering from the University of Toronto.

Major D. Veitch, M.E.I.C., has recently been promoted from the rank of captain.

Major Veitch is attached to the office of the chief engineer at Army Headquarters in Ottawa, Ont.

He is a graduate in civil engineering from Queen's University, class of 1948.

Richard Walsh, M.E.I.C., is now associated with the Ontario Department of Highways in Kingston, Ont.

He was previously with Dominion Tar & Chemical Co. Ltd. in Trenton, Ont.

Mr. Walsh is a 1948 civil engineering graduate of the National University of Ireland in Cork.

R. H. Garrett, M.E.I.C., has returned to Vancouver from Prince Rupert, B.C., and is now associated with Gardner Diesel Engines Limited.

He was previously assistant engineer with the Columbia Cellulose Company in Prince Rupert, B.C.

Wm. McRae Rice, M.E.I.C., is superintendent of operations for the Canadian Rock Salt Company in Windsor, Ont.

He was formerly assistant mining engineer with Acadia Coal Co. Ltd. in Stellarton, N.S.

Mr. Rice is a 1945 mining engineering graduate of the Nova Scotia Technical College.

G. A. Havers, M.E.I.C., is in the engineering section of the British Columbia Forest Service.

He was formerly resident engineer with the Saskatchewan Department of Highways in Regina.

Mr. Havers is a graduate in civil engineering from the University of Saskatchewan, class of 1950.

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R. A. Cunningham, M.E.I.C.

R. A. Cunningham, M.E.I.C., supervisor of field inspection for Margison Babcock and Associates Limited, has been appointed an associate of the Company.

He was formerly associated with E. G. M. Cape and Company in St. John's, Nfld., and Price Brothers and Company Limited in Kenogami, Que.

He is a graduate in civil engineering from Queen's University, class of 1941.

W. J. Jessup, M.E.I.C., is now associated with the K.V.P. Company at Espanola, Ont.

He was previously on the staff of the Department of Natural Resources of the Province of Saskatchewan.

Mr. Jessup graduated in chemical engineering from the University of Saskatchewan in 1949.

E. L. Fulcher, Jr.E.I.C., is now associated with Chemical Construction (Inter-American) Limited in Toronto, Ont.

He was previously with H. G. Acres and Company in Niagara Falls, Ont.

Mr. Fulcher is a graduate in mechanical engineering from Queen's University, class of 1946.

C. Belanger, Jr.E.I.C., has been transferred as branch manager by Central Mortgage and Housing Corporation from Val d'Or, Que., to Three Rivers, Que.

Mr. Belanger is a 1946 graduate in metallurgical engineering from Laval University.

J. P. Gelinas, Jr.E.I.C., is now with the Technical Information Services section of the National Research Council.

He was previously employed by Dufresne & McLagan in Montreal, Que., and by the Aluminum Company of Canada Limited in Arvida, Que.

Mr. Gelinas received his B.A.Sc. degree from Ecole Polytechnique in 1946, and his M.A.Sc. degree from the same university in 1947.

W. A. Dow, Jr.E.I.C., is budget supervisor for Ford Motor Company of Canada Limited in Oakville, Ont.

He was formerly with the Industrial Development Bank in Montreal, Que.

Mr. Dow graduated in civil engineering from the University of Manitoba in 1947.

R. D. McEwen, Jr.E.I.C., is now with Canadian Industries Limited in Maitland, Ont.

Mr. McEwen received his B.Sc. degree from Queen's University in 1948.

A. A. Ridler, Jr.E.I.C., is now sales engineer with the Ridco Sales Company in Toronto, Ont.

He was previously with the Toronto and York Roads Commission in Toronto, Ont.

Mr. Ridler graduated in civil engineering from the University of Toronto in 1948.

H. M. Plant, Jr.E.I.C., is now with the production planning department of Canadian Car & Foundry Co. Ltd. in Lachine, Que.

He was previously associated with the Aluminum Company of Canada Ltd. in Arvida, Que.

Mr. Plant is a graduate in mechanical engineering from Queen's University, class of 1948.

W. I. Marshall, Jr.E.I.C., has been transferred by H. G. Acres and Company from Niagara Falls, Ont., to Great Falls, Man., as soils engineer on the McArthur Falls power development.

Mr. Marshall graduated in mechanical engineering from the University of Toronto in 1948.

L. Langlois, Jr.E.I.C., is now associated as chemical engineer with the Quebec Sugar Refinery at St. Hilaire, Que.

He was previously with Montreal Products Co. Ltd., a subsidiary of Canada and Dominion Sugar Co. Ltd. in Montreal.

Mr. Langlois is a 1949 graduate in chemical engineering from Laval University.

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Tallon, JR.E.I.C., is now construction nager with George Hardy Limited in ronto, Ont. He was previously field gineer with this Company.

Mr. Tallon graduated in civil engi-ering from the University of Toronto 1949.

ilip Ross-Ross, JR.E.I.C., is with the perimental design section of the Gas rbine Division of A. V. Roe (Canada) nited in Malton, Ont.

Mr. Ross received his B.Sc. degree in echanical engineering from McGill niversity in 1949, and his M.Sc. degree 1951.

He is the son of Mr. D. Ross-Ross, E.I.C., councillor for the Cornwall anch.

G. Sutherland, JR.E.I.C., is now with uminium Laboratories Limited in ingston, Ont.

Mr. Sutherland graduated in civil gineering from the University of Brit-h Columbia in 1949.

Nixon, JR.E.I.C., has been transferred y Canadian General Electric Company mited from Winnipeg, Man. to Ed-onton, Alta.

Mr. Nixon graduated from the Uni-ersity of Alberta in electrical engineer-g in 1949.

as. H. Hogg, JR.E.I.C., is now with H. V. Brown & Company in Lethbridge, lta.

He was formerly with the P.F.R.A. Lethbridge, Alta.

Mr. Hogg is a graduate in civil engi-eering from the University of Saskat-hewan, class of 1950.

. C. Pike, JR.E.I.C., has joined Mathews Conveyor Company Limited in Port Hope, Ont., as design engineer.

He was previously with Northern Electric Co. Ltd. in Montreal, Que.

Mr. Pike graduated in 1950 from McGill University in mechanical engineering.

J. B. Dicks, JR.E.I.C., is now assistant superintendent of the steam plant of Nova Scotia Light and Power Company Limited in Halifax, N.S.

Mr. Dicks graduated in chemical engineering from the Nova Scotia Technical College in 1950.

J. B. Morrow, JR.E.I.C., has joined Stewart-Warner Corporation of Canada in Belleville, Ont., as a mechanical engineer.

He was previously with Canadian Westinghouse Company Limited.

Mr. Morrow graduated in mechanical engineering from the Nova Scotia Technical College in 1950.

A. P. Alexander, JR.E.I.C., has entered the mechanical department of C. D. Howe Company Limited in Montreal, Que.

He was previously associated with the Industrial Engineering Company in Halifax, N.S.

Mr. Alexander graduated in mechanical engineering from the Nova Scotia Technical College in 1950.

R. H. Shillingford, JR.E.I.C., has joined Montreal Engineering Company Limited in Montreal, Que.

He was previously with the Department of National Defence at H.M.C. Dockyard, Halifax, N.S.

Mr. Shillingford is a 1950 graduate in civil engineering from the Nova Scotia Technical College.

Donald L. King, JR.E.I.C., is now associated with the Frontenac Floor and Wall Tile Company in Kingston, Ont.

He was formerly with the Sangamo Electric Company in Leaside, Ont.

Mr. King is a 1950 graduate in chemical engineering from the University of Toronto.

Louis Carignan, JR.E.I.C., is presently employed by the Continental Can Company in New Toronto, Ont.

He was previously with W. W. Timmins in Montreal, Que.

Mr. Carignan is a B.A.Sc. graduate from the University of Toronto, class of 1950.

R. I. Howard, JR.E.I.C., is now with the headquarters of the North East Air Command at the Peperrel Air Force Base in St. John's, Nfld.

He was previously with the Central Mortgage and Housing Corporation in St. John's, Nfld., and with the Department of Agriculture in Moncton, N.B.

Mr. Howard graduated in civil engineering from the University of New Brunswick in 1950.

H. R. Harris, JR.E.I.C., has joined Edwards of Canada Limited in Owen Sound, Ont.

He was previously with the Bell Telephone Company of Canada, Ltd. in Montreal.

Mr. Harris is a graduate in electrical engineering from the Nova Scotia Technical College, class of 1950.

C. H. Eidt, JR.E.I.C., is now employed

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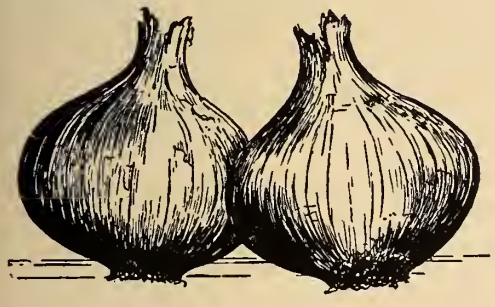

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with the Township of Stamford as junior engineer.

He was previously with the Hydro-Electric Commission of Ontario.

Mr. Eidt is a graduate of the University of Toronto in civil engineering, class of 1950.

H. H. Dubo, JR.E.I.C., is resistance welding engineer in charge of the manufacture of spot welding machines for International Machinery Co. Ltd. in Hamilton, Ont.

Mr. Dubo received his B.Sc. degree in electrical engineering from the University of Manitoba in 1950.

F. W. Brown, JR.E.I.C., has been transferred by The Geophysical Prospecting Company Limited from Bombay, India to London, England.

He was previously with the Geo-Technical Development Company Limited at Bourlamaque, Que.

Mr. Brown is a 1950 graduate in engineering physics from the University of Toronto.

F. F. Newton, JR.E.I.C., is associated with Burns & Dutton, Limited in Calgary, Alta.

He was previously resident engineer for the Alberta Department of Highways.

Mr. Newton graduated in civil engineering from McGill University in 1950.

C. Markopoulos, JR.E.I.C., is now with the Canadian Comstock Company in Montreal, Que.

He was formerly with A. D. Ross & Company in Montreal, Que.

Mr. Markopoulos graduated in electrical and mechanical engineering from the National Technical University in Athens in 1950.

John Niel Fairlie, JR.E.I.C., has entered Atomic Energy of Canada Limited in Chalk River, Ont., as an engineer in training.

Mr. Fairlie graduated in chemical engineering from McGill University in 1951.

A. D. Scothorn, JR.E.I.C., has joined Margison, Babcock & Associates of Toronto, Ont., as assistant engineer in the thermodynamic section.

He was previously with Canadian Arsenals Limited in Montreal, Que.

Mr. Scothorn is a 1951 graduate in mechanical engineering from the Nova Scotia Technical College.

A. S. Lawrence, JR.E.I.C., has been transferred by R. E. Stewart Construction Corporation from Chatham, N.B., to a project at St. Desire de Black Lake, Que.

Mr. Lawrence has been with the Company since his graduation in civil engineering from McGill University in 1951.

J. L. Messier, JR.E.I.C., has been transferred by Canadian General Electric Company Limited from Toronto to Quebec City as apparatus service engineer.

Mr. Messier graduated from Ecole Polytechnique in 1951.

W. A. Patterson, JR.E.I.C., is now associated with Hollinger Consolidated Gold Mines Limited in Timmins, Ont.

He was previously employed with Canadian Westinghouse Company Limited as an engineer in training.

Mr. Patterson is a graduate in electrical engineering from the Nova Scotia Technical College, class of 1951.

David Koch, JR.E.I.C., is now in the Pulp Division of MacMillan & Bloedel Company Limited in Port Alberni, B.C.

Mr. Koch is a 1951 graduate in electrical engineering from the University of British Columbia.

Harry Walter Hopkins, JR.E.I.C., is now assistant engineer with the Canadian Pacific Railway Company in Montreal.

Mr. Hopkins is a 1951 graduate in civil engineering from McGill University.

A. L. Adams, JR.E.I.C., formerly with the James MacLaren Paper Mill at Masson, Que., has joined the C. D. Howe Company at Chalk River, Ont., as field engineer.

Mr. Adams graduated in electrical engineering from McGill University in 1951.

C. V. Flanagan, JR.E.I.C., has accepted employment with the Goodyear Tire & Rubber Company at Bowmanville, Ont.

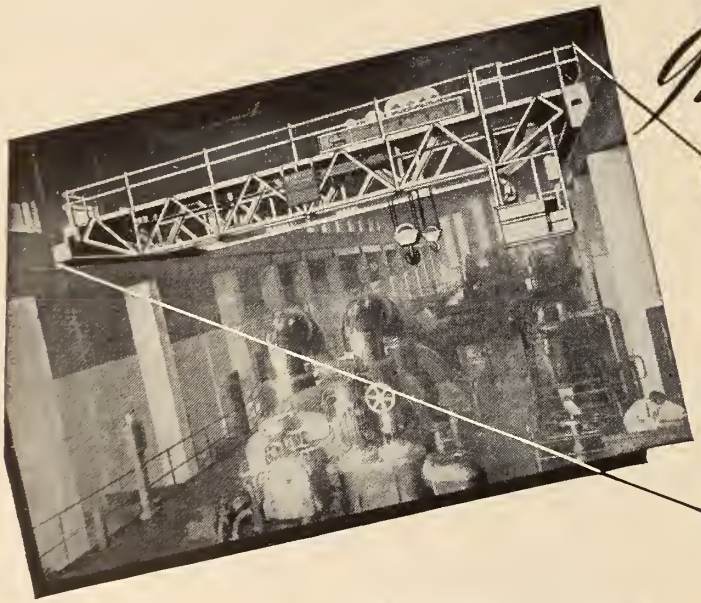
He was previously sales engineer with B. F. Sturtevant Company of Canada Ltd. in Toronto, Ont.

Mr. Flanagan is a graduate in mechanical engineering from the University of Toronto, class of 1951.

Clive D. McCord, JR.E.I.C., is now associated with Link & Nauss Limited in Calgary, Alta.

He was formerly with Crown Silver Mines in New Hazelton, B.C.

Mr. McCord received his B.A.Sc. de-



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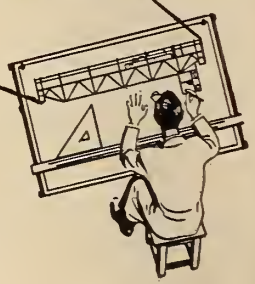

REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL P.Q. (Walter M. Smith—President). Telephone: WEllington 7742. Telegram: "Marquipco". Montreal.

MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. Telephones: 37-187; 37-188; 37-189; 37-180. Telegram: "Manden".

BRITISH COLUMBIA: Vancouver Machinery Depot Ltd., 1155 West Sixth Avenue, VANCOUVER, B.C. Telephone: Bayview 1112. Telegram: "Vanmacdep".

ONTARIO: Dugald Cameron Associates Limited, MALTON, Ont. Telephone: Toronto Cherry 1-4311. Telegram: "Dugald".

THE WHARTON CRANE & HOIST CO. LTD.

REDDISH STOCKPORT ENGLAND

ee in geology from the University British Columbia in 1951.

D. Stabler, JR.E.I.C., is field engineer th Morrison-Knudsen Company of nada, Limited at the Kemano Power use of the Aluminum Company of nada Limited.

Mr. Stabler was formerly with cColl-Frontenac Oil Co. Ltd. in ontreal.

He is a graduate in civil engineering om Queen's University, class of 1951.

O. Marshall, JR.E.I.C., is now assistant sident engineer at the Nylon Interediates Plant of Canadian Industries mited in Maitland, Ont.

Mr. Marshall is a graduate in civil gineering from the Nova Scotia Techcal College, class of 1951.

/O P. J. H. Sheasby, R.C.A.F., S.E.I.C., now telecommunications officer at the .C.A.F. Station in Clinton, Ont.

Flying Officer Sheasby graduated in ectrical engineering from the Uniersity of Manitoba in 1952.

G. Malus, S.E.I.C., is now transitman the Division Engineer's Office of the anadian Pacific Railway Company in ancouver, B.C.

He is a 1952 graduate in civil engieering from the University of Manioba.

ean Fedorowich, S.E.I.C., has joined the eneral Geophysical Company in Edmonton, Alta., as computer.

Mr. Fedorowich graduated in civil ngineering in 1952 from the University f Alberta.

Charles Boisvert, S.E.I.C., is with the Canadian Armament Research and Development Establishment in Quebec City.

He is a graduate in electrical engineering from McGill University, class of 1952.

H. L. J. Maisonneuve, S.E.I.C., is with Canadian General Electric Co. Ltd. at the Industrial Centre No. 5 in Quebec City.

Mr. Maisonneuve received his degree in mechanical and electrical engineering from Ecole Polytechnique in 1952.

Lieut. (L) G. L. Hopkins, R.C.N., S.E.I.C., is now stationed with H.M.C.S. *Stadacona* in Halifax, N.S.

Lieutenant Hopkins graduated in electrical engineering from McGill University in 1952.

R. A. Beattie, S.E.I.C., is now associated with the Kilborn Engineering Company in Toronto, Ont.

Mr. Beattie is a 1952 graduate in civil engineering from the University of Toronto.

W. D. Burton, S.E.I.C., is now distribution designer with B.C. Electric Railway Company Limited in Vancouver, B.C.

Mr. Burton is a graduate of the University of British Columbia in chemical engineering, class of 1952.

C. I. Broadbent, S.E.I.C., has joined Stothert and Pitt (Canada) Limited in Montreal, Que.

Mr. Broadbent received his B.Sc. degree in civil engineering from McGill University in 1952, and his diploma in business adminstration from the University of Western Ontario this year.

A. F. Collings, S.E.I.C., is now employed as assistant engineer with the outside plant group of the Comunications Department of the Canadian Pacific Railway in Montreal, Que.

Mr. Collings is a 1952 graduate in civil engineering from the Nova Scotia Technical College.

C. R. Bouskill, S.E.I.C., has joined the engineering staff of T. Eaton Company Limited in Winnipeg, Man.

He was previously with Spruce Falls Power & Paper Co. Ltd. at Kapuskasing, Ont.

Mr. Bouskill is a mechanical engineering graduate from the University of Manitoba, class of 1952.

J. E. Fletcher, S.E.I.C., has entered Consolidated Mining and Smelting Company of Canada Limited in Trail, B.C.

Mr. Fletcher graduated this year from Queen's University in chemical engineering.

M. R. Gunderson, S.E.I.C., is now associated with the Saskatchewan Department of Highways as resident engineer in Kindersley, Sask.

He received his B.Sc. degree from the University of Saskatchewan in civil engineering this year.

K. E. Ludwig, S.E.I.C., has joined the Ontario Department of Highways in Toronto, Ont.

He is a 1953 graduate of Queen's University in civil engineering.

J. F. Longley, S.E.I.C., has joined the engineering department of the Canadian International Paper Company's Kipawa Mill in Temiskaming, Que.

Mr. Longley graduated this year in civil engineering from Queen's University.

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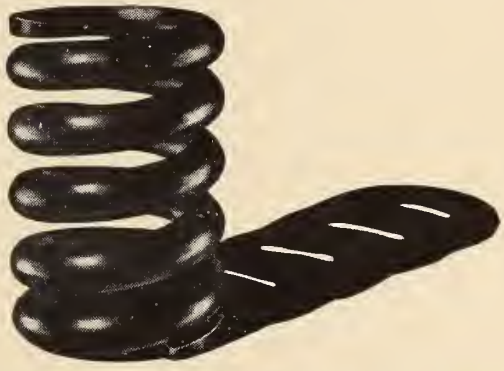

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C. M. Lovsted & Co. (Canada) Limited, Vancouver

D. W. Lawrie, S.E.I.C., is an engineer in training with Alberta Government Telepones in Calgary, Alta.

He is a 1953 graduate in electrical engineering from the University of Alberta.

D. W. Ballantyne, S.E.I.C., has joined Maritime Engineering Limited in Fredericton, N.B.

Mr. Ballantyne graduated this year in civil engineering from the University of New Brunswick.

A. H. Ruel, S.E.I.C., is associated with Angus Robertson Limited in Montreal.

He is a 1953 engineering graduate of Ecole Polytechnique.

W. B. Magyar, S.E.I.C., has entered the Iron Mining Division of the Inland Steel Company in Ishpeming, Mich.

He graduated this year in mining engineering from McGill University.

R. H. Tully, S.E.I.C., has joined the Spruce Falls Power & Paper Company in Kapuskasing, Ont., as design engineer.

He graduated this year in mechanical engineering from McGill University.

W. L. Fraser, S.E.I.C., is now employed in the equipment and waterworks department of Calgary Power Limited.

He is a graduate this year in electrical engineering from the University of British Columbia.

C. W. Kirkpatrick, S.E.I.C., is now with Massey Harris Company Limited in Hamilton, Ont.

Mr. Kirkpatrick is a graduate in engineering and business from the University of Toronto, class of 1953.

A. J. M. English, S.E.I.C., is now with the City Engineer's Office in Kitchener, Ont.

He graduated this year in civil engineering from the University of British Columbia.

D. Hicks, S.E.I.C., is employed with the Marwell Construction Company in Clearwater, B.C.

Mr. Hicks is a 1953 graduate in civil engineering from Queen's University.

Patrick Ross-Ross, S.E.I.C., has joined the Combustion Engineering Corporation in Montreal.

He is a graduate this year in mechanical engineering from McGill University.

Mr. Ross-Ross is the son of Mr. Donald Ross-Ross, M.E.I.C., councillor for the Cornwall Branch.

Armand Couture, S.E.I.C., is now employed by the National Harbours Board in Ottawa, Ont.

Mr. Couture is a graduate in civil engineering from Laval University, class of 1953.

C. W. J. Atkinson, S.E.I.C., is now a student engineer with Canadian Westinghouse Company Limited in Hamilton Ont.

He graduated with a B.Sc. degree this year from the University of Toronto.

Roger Pinault, S.E.I.C., has joined the Quebec Iron and Titanium Corporation at Sorel, Que., as a development engineer.

Mr. Pinault is a 1953 graduate in metallurgical engineering from Laval University.

D. M. Baker, S.E.I.C., is plant engineer with Canadian Keyes Fibre Company Limited in Hantsport, N.S.

He graduated this year in mechanical engineering from the Nova Scotia Technical College.

Robin Pearce, S.E.I.C., has entered the student training course of Canadian Westinghouse Co. Ltd. in Hamilton, Ont.

J. D. Cuccia, S.E.I.C., has joined International Resistance Limited in Toronto, Ont.

Visitors to Headquarters

Professor W. M. Treadgold, M.E.I.C., Toronto, Ontario, June 25, 1953.

J. H. Addison, M.E.I.C., Bogota, Colombia, June 29, 1953.

R. C. T. Stewart, M.E.I.C., Halifax, Nova Scotia, July 3, 1953.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Thomas Stuart Moffat, M.E.I.C., president and general manager of Moffat Supplies, Limited, in Saint John, N.B., died suddenly on June 20, 1953, at Victoria, B.C., while visiting with relatives on the West Coast.

Mr. Moffat was born in Victoria, B.C., on February 14, 1905. He received his general education at the Victoria High School, and after one year of arts study at the University of British Columbia, he entered McGill University in 1923, graduating with a B.Sc. degree in electrical engineering in 1927.

During his summers from 1922 until 1925 Mr. Moffat worked as a machinist's helper with the Canadian Pacific Railway in Victoria, B.C., and in the summer of 1926, as an electrician with the Aluminum Company of Canada Limited in Arvida, Que.

After graduating from McGill University in 1927, Mr. Moffat enrolled in the student training course provided by Canadian Westinghouse Company Limited, and the following year was employed by the Company in electrical substation design. In January, 1930, he joined Northern Electric Company Limited as an engineer in the automatic telephone department, and a year later was transferred to the Company's general manufacturing department. By November, 1933, he entered the Simonds Canada Saw Company as an industrial engineer; and the following year served as industrial engineer with Management Engineers of Canada. In March, 1935, he became superintendent of the Provincial Wood Products Company in Saint John, N.B. After ten years' service with this Company, he joined the New Brunswick Resources Development Board as forest products development engineer in Saint John, N.B. In 1946 Mr. Moffat was appointed manager of Forest Industries Limited in Saint John, N.B., and three years later he established his own company, Moffat Supplies, Limited, in Saint John, serving as its president and general manager.

He was a member of the Association of Professional Engineers of New Brunswick, and a member of the New Brunswick Labour Relations Board. During recent years he has served as consultant to the Newfoundland Government in the development of wood products.

Mr. Moffat joined the Engineering Institute of Canada as a Student in 1925, transferring to Associate Member in 1935, and to Member in 1940.

David Yik Fu Chow, S.E.I.C., a postgraduate student of McGill University, died suddenly in Montreal, Quebec, on April 20, 1953.

Mr. Chow was born in Kwangfung, China, on December 1, 1921. After receiving his early education there, he entered National Sun Yet Sen University in 1941, graduating in engineering in 1945.

From 1947 until 1949 Mr. Chow was associated with the Chinese Ministry of Health as an engineer in the Eighth Sanitary Engineering Corps.

Mr. Chow came to Canada in 1949 and entered McGill University for further engineering study. While in Montreal, he served for some time on the staff of the Dominion Structural Steel Company.

He was granted his M.Sc. degree in civil engineering post-humously at this year's convocation.

Mr. Chow joined the Engineering Institute as a Student Member in November, 1949.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CIVIL

RADUATE CIVIL ENGINEER preferably with graduate work in public engineering and some public health engineering experience, to do field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewage systems, stream pollutions, deficient drainage and other environmental factors. File No. 4617-V.

ONCRETE CONSTRUCTION experience for promotional work with architects and contractors. Special experience and schooling in cement and concrete an asset. Please give full details in letter. Interview will be arranged. File No. 4619-V.

OUNG RECENT CIVIL graduate, thoroughly bilingual for sale of concrete pipe and building units in the Montreal region. Salary open. File No. 4630-V.

CHEMICAL

ALES ENGINEER required by a Canadian manufacturer of vacuum washers and thickeners for the pulp and paper industry. Applicant must have five to ten years experience in a pulp and paper mill preferably a graduate in chemical engineering. Excellent opportunity for engineer with sales aptitude. Salary open depending on qualifications. File No. 4613-V.

ALES ENGINEER required by Canadian manufacturer of continuous vacuum filters for the chemical metallurgical and industrial field. Applicant must have five to ten years experience in chemical metallurgical plants. A graduate chemical engineer with sales ability preferred. Salary open, depending on qualifications. File No. 4613-V.

ELECTRICAL

LECTRICAL SALES ENGINEER wanted in Toronto. Preferably experienced in design of rectifiers, control equipment and communication power systems. File No. 4612-V.

LECTRICAL ENGINEER with considerable experience as electrical draftsman and office work on plans for substations, motor distribution and general lighting and power work. Location Northern Ontario. File No. 4620-V.

LECTRICAL ENGINEER (power option), age 30-45 required by heavy electrical manufacturing company located in vicinity of Montreal with a minimum of 3 years experience for transformer electrical design, quotations and cost estimating on power transformers up to 10,000 KVA. Should be able to take over duties of department head in his absence. Salary commensurate with past experience and ability. Good prospects for advancement. File No. 4623-V.

MECHANICAL

MECHANICAL GRADUATE with at least one year's draughting experience wanted for engineering department of a structural steel company in Southern Ontario. Permanent position with opportunities for advancement in engineering and contracting. File No. 4610-V.

CHIEF ENGINEER home appliances. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design styling, standardization, lab. etc. Canadian engineer with experience in home appliances designs age 35 to 40 preferred. This is an excellent opportunity for creative engineering since this company is Canadian owned and wishes to produce Canadian designs for the Canadian market. Location Ontario. File No. 4616-V.

GRADUATE MECHANICAL ENGINEER who has had four or five years experience preferably in the machine or structural design field. The successful applicant would at first be placed in charge of a defence project and later would act as project engineer on development work pertaining to diesel engines and locomotives. File No. 4621-V.

MECHANICAL ENGINEER with approximately 5 to 15 years experience in shop engineering to design factory material handling, work stations for induction heating, etc. Location Toronto. File No. 4627-V.

MISCELLANEOUS

SALES ENGINEER required by Canadian manufacturer of mine hoist machinery. Some experience with mine hoist equipment desirable. Contact experience with Canadian mines essential. This position will lead directly to the management of the mine hoist division for the right man. File No. 4609-V.

MECHANICAL OR CHEMICAL engineer required for selling and servicing accounts by sound well-established Canadian paper company engaged in the corrugated and solid fibre box field. Splendid openings in both Toronto and Montreal are due to retirement of long-service personnel and also large scale expansion program of manufacturing facilities. Thorough training will be given prior to assignment. Replies are invited from recent graduates as well as those with four years minimum selling experience. File No. 4611-V.

SALES ENGINEER bilingual and married preferred. Proven sales record, capable of handling mining and industrial equipment and supplies. Salary commensurate with experience and ability. Ideal living and education facilities. Bright future. Permanent position. File No. **4614-V.**

AN ENGINEER $6,420-$7,200 for the Board of Transport Commission at Ottawa. Details and application forms at your nearest civil service commission office national employment office and post office. File No. 4618-V.

MECHANICAL OR CHEMICAL engineer required who is willing and financially able to accept small present remuneration in the prospect of ownership of business carrying lines for industry. Sales and administrative ability required. File No. 4622-V.

PULP AND PAPER COMPANY requires for its engineering department a graduate in mechanical or civil engineering to act as engineer on diversified mill projects. Candidates should have a minimum of five years experience in the pulp and paper or related process industry. This opening offers good opportunities and our location presents excellent recreational, educational and housing facilities. Replies treated confidentially. File No. 4624-V.

THE HEBREW INSTITUTE OF TECHNOLOGY, Haifa, Israel, is seeking candidates to fill senior teaching posts in all faculties of the profession. Appointments will be made for three years, professorships may be permanent. Those interested are invited to write, not later than Aug. 31, 1953, to UNESCO 19 Avenue Kleber, Paris 16, for forms of application. File No. 4625-V.

METALLURGIST with approximately five years experience. Graduate of recognized University in metallurgy, capable of taking charge of electric furnace operation, iron cupola, and to supervise metallurgical laboratory. Location in Western Canada. Salary depending on experience and to be negotiated. File No. 4626-V.

A TECHNICAL OFFICER is required in the Naval Technical Services of the department of National Defence at Ottawa to be responsible for the design, specifications and drawings for the construction of steel ships, destroyers, frigates and wooden auxiliary vessels. To prepare estimates and compile specifications for ships and for new materials and to prepare working instructions; to inspect ships in dockyards and other

ship building yards when required; to supervise the drawing office staff and to perform other related duties as required. File No. 4628-V.

AN ELECTRONICS SPECIALIST is required to study the design of electro-mechanical control systems and in particular to develop a reading unit applicable to either fluorescent or ordinary markings for sortation purposes. The work will be done by a team which will study all aspects of high speed mechanical sortation systems and the aerodynamics of interference in the movement of papers at high speed. A knowledge of electronics and in particular pulse circuits is required. Graduation in applied science is a preferred qualification. File No. 4628-V.

IN THE PATENT OFFICE of the Secretary of State Department at Ottawa, six mechanical engineers are required to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the mechanical engineering field with a view to making recommendations for the award or denial of patents. The desired qualifications include graduation at the bachelor's level with specialization in applied science and some experience in the production of research field having to do with mechanical problems. File No. 4623-V.

EXPERIENCED ADMINISTRATOR required for work in industrial training. Duties to investigate, develop and co-ordinate in plant training for engineering graduates and other professional trainees, and advanced technical workers. To locate and select suitable trainee material from all sources. To carry out essential liaison with other inplant training and personnel functions. This is a responsible position in a growing Ontario industry. It requires maturity, versatility and breadth of outlook. There is opportunity for advancement. Applications are encouraged from industrial personnel or from well-qualified teachers and educational administrators who have successful industrial experience. Successful applicant must have broad training and experience which covers both personnel work and engineering or allied fields. A specialist in either personnel or engineering would be acceptable providing he had support through either education or experience in the other field. Special consideration would be given to an applicant who, in addition to the above, had administrative or business experience. Send details of background, education, experience, interests and occupational goals. All replies in confidence. File No. 4629-V.

COST ENGINEER, with 10 years practical experience preferably on hydro-electric projects. To train and supervise a small staff in the field to report and analyse costs. To assist in preparation of estimates, budgets and other similar work. Location in Sao Paulo, Brazil with frequent trips to camps in the vicinity of Sao Paulo and Rio de Janeiro. Age 35 to 45. File No. 4631-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEER recent graduate, required by water treatment company for sales and service. Location Eastern Canada. Applicants must be free to travel. File No. 4550-V.

CHEMICAL ENGINEERING GRADUATES required by power and paper company located in Toronto. Applicants should have up to 5 years experience and be interested in research. File No. 4579-V.

CHEMICAL ENGINEER required by a company in Montreal for the industrial division which embraces the brewing, paper and oil industries. Applicant must have sales ability and be able to meet company officials. When applying please enclose recent photo. File No. 4590-V.

CHEMICAL ENGINEER required age 25 to 35 who has had some experience in formulating lacquer, lacquer thinners and brake fluids. The work will entail laying out evaluating programs in our application labs and contacting accounts all over Canada. Salary will be dependent on experience and qualifications and all replies will be held confidential. File No. 4599-V.

CIVIL

CIVIL ENGINEER, required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

CITY IN NEW BRUNSWICK requires a municipal engineer. Qualifications: university graduation in civil engineering, supplemented by extensive related experience in all municipal services including water works and services. Salary commensurate with ability and responsibilities. File No. 4574-V.

PLANNING ENGINEER required by rapidly growing municipality in Ontario, to act as chief physical planner and manager of industrial commission. Applicant should have town planning experience and be able to co-ordinate all planning and development activities. Salary according to qualifications. File No. 4580-V.

BUILDING COMMISSIONER and zoning administrator required by rapidly growing municipality in Ontario to be in charge of the operation of the building and zoning by-laws. Applicant must be able to check construction and have administrative experience of some kind. File No. 4580-V.

TOWN IN ALBERTA IS seeking applicants for the position of Town Engineer. Duties include supervision of the public works program, direction of the town crews, administration of building inspection and zoning control, and development detail of the general plan for the town as circumstances require. Special consideration will be given to applicants with executive training and to those with some experience or training in town planning. Population now 3,000 every prospect of growing into a small city within the near future. Salary depending upon qualifications. File No. 4581-V.

ASSISTANT CHIEF DRAUGHTSMAN structural steel industry Niagara District. All replies confidential. File No. 4585-V.

CIVIL ENGINEER recent graduate required by suburban municipality, Montreal area for general municipal work. Reply stating age, experience and salary required. File No. 4596-V.

COMMISSIONER OF WORKS required in Halifax, Nova Scotia. This position involves administrative and professional engineering work in directing, under the jurisdiction of the City manager all activities of the Public Works Department. Extensive knowledge of the modern principles and practice of administration as applied to the design, construction and maintenance of streets, sewers and other public works facilities. File No. 4608-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER graduate with 1 or 2 years field experience, good appearance and high sales ability by the leading manufacturing company in their line. Duties consist of calling on architects and engineers and assisting in preparing specifications and technical data in connection with low tension signaling equipment. Experience in dealing with electrical contractors will be helpful. Territory to be served is Montreal, Province of Quebec and the Maritimes after a short specialized training program at our plant. This is a salaried position with an excellent future also participation in full group sick and accident insurance and pension plans. Applicants to give full details including age, marital status and experience first letter. Personal interview will be given selected applicants. File No. 4569-V.

CHIEF ENGINEER required in West Toronto. The man we seek is now a chief engineer or an assistant ready to step into this key position. Through a promotion in our organization we can offer this highly desirable position to a man with an E.E. degree, conversant with television; home and auto, radio circuits. Should have strong experience in successfully administering a small flexible engineering group. Excellent opportunity for right man to take a big part in a fast growing aggressive organization and earn an excellent salary. Free medical services and company profit sharing plan. Please send complete resume to File No. 4576-V.

LIGHTING SALES ENGINEER required by leading manufacturer of lighting and switchgear. Actual sales experience in commercial and industrial lighting in Ontario, contacts with architects consulting engineers and contractors would be an asset. Unusual opportunity with better than average earnings for right man. Good salary and commission. New car supplied plus car allowance and expenses. File No. 4577-V.

RECENT GRADUATE electrical engineering (Power Option) required by industrial organization in Ottawa. Engineer would be employed in the design and control department working on electrical power installation. He would be trained in the company's methods of design, cost accounting, material expedition and personnel relations. Salary would be commensurate with past experience and ability. File No. 4598-V.

MECHANICAL

SALES ENGINEER preferably mechanical interested in the sale of air handling equipment such as fans, heating coils, air conditioning units, etc. Present location Toronto. File No. 4572-V.

MECHANICAL ENGINEER university graduate with two or three years experience in mechanical or metallurgical fields and above average literary ability. Permanent employment in Ottawa with well-known industrial association. Pension plan. File No. 4578-V.

THE SERVICES OF A design engineer mechanical preferred are required by large organization in Montreal, Canada. Must be thoroughly familiar with portable and permanent crushing plants, asphalt plants, ready mix concrete plants and all types of road building equipment with eight to ten years experience in this field and with engineering degree or equivalent. Permanent position if applicant is qualified. Please give age, experience and references and state salary expected. All replies will be treated in strictest confidence. File No. 4586-V.

MECHANICAL ENGINEER with two to three years experience in design of air conditioning and heating required by Montreal contractor and manufacturer. State age, training, experience and salary expected. File No. 4587-V.

MECHANICAL ENGINEER for the mechanical engineer's division of the Chief Architect's Branch of the Department of Public Works at Ottawa, Ontario. Duties: to take charge of the mechanical engineering section of the chief architect's Branch of the department of Public Works and will be responsible for the design of power plants, heating systems, ventilation systems, plumbing installations, air conditioning systems, sprinkler systems, refrigeration and for the installation of such equipment in public buildings, laboratories and hospitals. The desirable qualifications include university graduate from a university of recognized standing member of the Engineering Institute of Canada or in a Provincial Association of Professional Engineers. Applications received until September 1, 1953. Salary up to $7,200.00. File No. 4593-V.

APPLICATIONS ARE invited for sales engineering position in long established machinery company to commence in engineering department. Age 19-30 should have mechanical training or education in engineering. Positions are permanent and would entail designing and also selling mechanical equipment. Give full details and phone number to File No. 4601-V.

MECHANICAL ENGINEER required in new department of organization in Montreal manufacturing industrial heating equipment. Work involves preparation of shop drawings, production schedules with some sales and plant investigations. File No. 4605-V.

MISCELLANEOUS

RESEARCH ENGINEER required by Saskatchewan Department of Mineral Resources $273-$348 per month, a variable cost of living bonus presently $6.40 is paid in addition to above stated basic salary. Recent graduate in ceramic, chemical or geological engineering; to carry out lab. and pilot scale experimental work, field exploration, and economic surveys dealing with the non-metalic or industrial minerals of the province. Good pension plan and conditions of employment. File No. 4564-V.

AN ENGINEER

$6,420 - $7,200

for the

Board of Transport Commissioners at Ottawa

Details and application forms at your nearest Civil Service Commission Office, National Employment Office and Post Office.

METALLURGIST REQUIRED with a background in foundry practice for large organization with headquarters in Montreal. Applicant should be in the age range of 22 to 35 years. File No. 4571-V.

POSITION OPEN AS assistant to the plant superintendent. Duties in connection with the operation and maintenance of a low head hydro plant consisting of 5 Francis type units with a total capacity of 167,000 k.w. Location about 125 miles from Rio de Janeiro in a healthy climate. Preferably single between 30 and 40 with at least 5 years experience in hydro plants. File No. 4583-V.

CHIEF SUPERINTENDING ENGINEER ($7,000.00-$8,500.00) for the post office department at Ottawa. Details and application forms at your nearest Civil Service Commission Office, National Employment Office, or Post Office. File No. 4592-V.

ENGINEERS REQUIRED for work on new types of electro-mechanical instruments for marine and aircraft use. University degree and two to eight years experience required. Preference given to men with manufacturing experience. All replies will be treated in confidence. Please write full details of education and experience. File No. 4594-V.

A WESTERN CANADIAN manufacturer requires an experienced and capable sales manager to direct the sales of its products which includes commercial semi-trailers and sheet metal and plate products for the petroleum and petrochemical industry. The company wishes to enlarge its operations in the sheet metal plate work and mechanical fields and requires an energetic and capable man with vision to assist in this department. File No. 4595-V.

MECHANICAL ELECTRICAL ENGINEER as factory manager for medium sized plant engaged in the manufacture of both light and heavy industrial handling equipment in Southern Ontario. Essential qualifications comprise sound knowledge of plant engineering and factory layout, contract estimating, wage incentives, methods study for volume production and quality control. Must be good disciplinarian. File No. 4597-V.

INSPECTING ENGINEER with wide experience in the erection and maintenance of materials handling equipment to organize a service department covering the Provinces of Ontario and Quebec and thereafter assume full responsibility for technical installation of all new equipment and the servicing of that already in use. File No. 4597-V.

SIX SALES ENGINEERS, graduate mechanical or civil. Sales experience in air conditioning, refrigeration, heating products or technical products. Graduates 1949 to 1953. File No. 4600-V.

PRODUCTION CONTROL SUPERINTENDENT. Engineering graduate or equivalent. Background and experience in methods trade automotive or production machine industry. Knowledge of plant layout, process engineering, industrial engineering, production control and cost control essential. Salary $6,000. Location Ontario. File No. 4600-V.

INDUSTRIAL ENGINEER mechanical or metallurgical graduate or equivalent. Background and experience in production standards, time and motion study, plant layout and process engineering in metals trade industry. Salary $4,500.00. Location Ontario. File No. 4600-V.

SALES ENGINEER, engineering graduate or equivalent. Proven sales record in heating field or allied industry. Contacts with architects, engineers and contractors desirable. Should be capable of developing plans and estimates for radiator and boiler installations in dwellings, apartments, institutions, commercial and industrial buildings. Salary $5,000.00. Location Ontario. File No. 4600-V.

WORKS MANAGER, mechanical or metallurgical graduate. Experience plant engineering and factory management in grey iron foundry and machine shop production. Knowledge of production engineering industrial engineering, plant rehabilitation, time and motion study and cost control. Salary $10,000. Location Ontario. File No. 4600-V.

YOUNG ENGINEER for industrial engineering in textile industry. Experience in textiles preferable but not necessary. Full training will be given in our plants in N.B. and Ontario. Besides technical ability work will require ability to sell ideas and to deal successfully with mill personnel. Replies should outline experience, age and salary expected. File No. 4602-V.

INSPECTION ENGINEER required in Toronto. The job involves making inspection of a wide variety of power equipment, including prime movers, generating equipment and switch gear pumps and compressors, and other types of power equipment. Applicant will work out of Toronto in various plants in P.Q. and Ontario. Age range 25-35 years. Degree in mechanical or electrical engineering. File No. 4603-V.

METALLURGIST REQUIRED with some experience in the heat treating of stainless steel, should be interested in development work and have sales ability. Three months training period. File No. 4606-V.

Situations Wanted

TOOL AND PRODUCTION ENGINEER, age 44, McGill 1931, fully qualified in production planning, supervision and organization requires position of a permanent nature which would utilize past experience. Preferably work on executive level as a Production or works manager. File No. 551-W.

ELECTRICAL ENGINEER 32 years of age, veteran, married, graduated in 1950 from McGill University. For the past 3 years worked on a large diversification of electrical equipment for a power and paper company whose mills are undergoing rehabilitation and speed up programs. Experience in layout and design of lighting power distribution, motor control, industrial electronics, etc.; estimating and preparing of specifications. Prefer position offering advancement and incentive to ambitious engineer. Will accept position anywhere in Canada or U.S.A. Available on short notice. I have also several years of practical experience as electronics technician and electrician. File No. 666-W.

McGILL GRADUATE, Jr.E.I.C., 1950, age 25. Experience consists of 2½ years consulting work in plumbing, heating and ventilation seeks employment in the air conditioning and ventilating field. Other experience in electrical switchgear and illumination. File No. 691-W.

MECHANICAL ENGINEER, graduated 1940, age 37, married with 2 children. Has experience as manufacturing manager, superintendent, plant engineer, maintenance, construction, manufacturing methods, quality control and inspection in metal fabricating and process industries. Desires a job as manufacturing manager or superintendent, or plant engineer, in metal fabricating or process manufacturing preferably in Alberta, British Columbia or Ontario. File No 1586-W.

MECHANICAL ENGINEER, sound technical and administrative background gained through 15 years of practical engineering experience. Seeking position with greater scope than present senior supervisory position offers. B.Sc. in M.E. M.E.I.C., and P.E. of Ont. Canadian age 38, married. If there is a future in your organiaztion for such an engineer please contact File No. 2745-W.

ELECTRONICS ENGINEER, age 40, Queen's University 1944. Miscellaneous industrial experience, ten years teaching experience in radio, television and industrial eelctronics, at technical school and college levels, experience in organizing and directing small staff, bilingual, desires position with small progressive electronies firm with an eventual view towards management. File No. 2635-W.

CIVIL ENGINEER, Jr.E.I.C., married, presently employed, with over 5 years experience in all types of structural design, field work and some sales desires first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., A.M.I.C.E., P.Eng. 42, with 17 years of varied experience (England, U.S.A., Canada) in: structural design (industrial and municipal buildings, power stations, oil refinery plants, hospitals, schools, harbour and river works, bridges, concrete cylindrical shells and domes, prestressed concrete), sewerage, surveying estimating, 3 years experience in supervision of const. Seeks responsible position. Also would be interested in partnership. File No. 3369-W.

CHEMICAL ENGINEER, B.Sc., Alberta, 1949, P.Eng., Alberta, Jr.E.I.C., war veteran, married. Experience operation of municipal lime-soda softening plant and boiler water treatment high pressure turbo-generator plant, desires change to more progressive position where past experience may be applied. File No. 3897-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 25, single. Experience includes 12 months sales and installation of equipment in propane

SENIOR ENGINEER

Pulp and paper company requires for its engineering department a graduate in mechanical or civil engineering to act as engineer on diversified mill projects. Candidates should have a minimum of five years experience in the pulp and paper or related process industry.

This opening offers good opportunities and our location presents excellent recreational, educational and housing facilities.

Replies treated confidentially.

Apply to:

Director of Personnel Relations,
Brown Corporation,
La Tuque, P.Q.

gas and 6 months in building construction. Desire permanent position preferably in sales covering Maritime Provinces. File No. 3903-W.

INDUSTRIAL CHEMICAL ENGINEER, P.Eng., M.E.I.C., married, family, 10 years experience at supervisory level in production, food chemistry, mine and mill metallurgy and design, safety quality and production minded. Seeking responsible and permanent position with established firm, situated in small city or town, requiring capable, energetic supervision for production or technical control work. File No. 3914-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

ELECTRICAL ENGINEER desires position with consulting firm or utility. Jr.E.I.C., B.Sc.E.E., University of Manitoba, 1949, Canadian citizen, age 26, married. Experience record: 1949-50 electrical designer-draughtsman with well known firm of consulting engineers in Los Angeles, Calif., on steam power plant, substation and transmission line projects. 1950-1952 on active duty in U.S Army, assigned to guided missile centre as electrical engineer on related power and lighting projects. At present with former employer as electrical designer on substation, control house; transmission line project, but contemplate returning to Canada if suitable employment is found. References and further details on request. File No. 4030-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A. Sc., age 35, married with children. Seeks position as Regional or District sales manager with progressive company in some branch of electrical industry. Extensive experience in sales and distribution of electrical hardware and associated products to public utilities in Province of Ontario. Experience includes five years sales engineer, two years public utilities, two years own business, three years Army (Captain). Excellent record and have available for examination recent report from well known firm management consultants. Presently located in Southern Ontario. Available on one month's notice. File No. 4039-W.

CIVIL ENGINEER B.A. (Honours in mathematics); B.Sc. (Civil Eng.) Has done post-graduate work at McGill University. Outstanding academic record; about one and a half years experience in irrigation dam design and bridge work; working on soil problems at present. Available from November 1, 1953, anywhere in Canada. Best references. File No. 4108-W.

ELECTRICAL ENGINEER, English, A.M.I. E.E., P.Eng., age 29, married, no children. 7 years' experience in switchgear manufacturing, 4 years' experience in consultants on H.V. substations and steam power plants, 2 years' experience with large Canadian electrical manufacturer. Desires responsible position with consultant, manufacturer or utility. Available on short notice. File No. 4162-W.

SANITARY ENGINEER, P.Eng., M.E.I.C., age 35, married, desires change in employment. Qualifications include a B.A.Sc. in Civil engineering and a M.Sc.E. in Sanitary Engineering. Experience includes two years in hydraulics and hydrometrics and six years in public health and sanitary engineering. Desire job involving the planning, design or administration of water supply systems, sewage disposal systems or industrial waste treatment facilities. File No. 4234-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng. (McGill 1951). Experience: two years training course with Canadian Westinghouse Company including courses toward a Masters Degree. Desires position with consulting firm in Montreal, in power or industrial electronics field. Presently employed in Ontario. Available on approximately one month's notice. Age 25, married. File No. 4235-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. 1949, aged 28, R.C.A.F. veteran, currently engaged in automatic controls and rolling mill electrics with a large firm in England, desires to return to Canada end of September. 1953. Experience since graduation includes substation operation, development engineering, demonstrating at a Canadian university, lecturing at a British technical college, industrial control engineering, rolling mill engineering, commercial experience in estimating and tendering. File No. 4237-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., Queen's 1948, veteran, aged 31, married, with five years experience on design, layouts and surveys related to steel and reinforced concrete structures, desires position as design engineer with construction company or consulting firm. Available on 30 days notice to present employer. Will locate anywhere in Canada if position suitable. File No. 4238-W.

GRADUATE ENGINEER, Jr.E.I.C., B.A.Sc. (Electrical, 1951), U.B.C., P.Eng., Ont., graduate training course with large electrical manufacturer, also design and administrative experience in Canada and overseas, desirous of improving present position with wider scope of responsibility and opportunities of growth, preferably in the administrative field. File No. 4239-W.

APPLICATION ENGINEER returning to Canada from completed foreign assignment. Six years experience in the design, construction and placing in operation of air conditioning and refrigeration plants. Desires responsible position either in Canada or foreign. Willing to travel. B.A.Sc. and M.Sc. degrees. Registered professional engineer in Ontario. Working knowledge of Spanish. References and background resume upon request. File No. 4240-W.

CIVIL ENGINEER, member E.I.C., A.C.I., graduate Univ. of Pennsylvania, U.S.A., bilingual, married, 2 children, 18 years varied experience abroad and in Canada. Last 9 years specialized in design and supervision of reinforced concrete and steel structures of all types. Seeking permanent position where technical skill and experience would be of value. Available on reasonable notice to present employer. File No. 4242-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc., Technological University of Delft, Netherlands with 20 years executive experience as consultant-sales engineer on continent. Design experience in Canada, specialist in steam, air, instrument ration and internal transportation. Perfect English and fluent French seeks position. File No. 4243-W.

1953 GRADUATE IN CIVIL Engineering, University of Berlin, age 34, married, 2 children. Specialist in hydraulics, 7 years experience in design of navigable waterway, dams, locks and hydro power stations, hydraulic research and hydraulic laboratory work, and also river regulations and water supply. File No. 4244-W.

MECHANICAL ENGINEER, M.E.I.C., 31, married, family. Desires position in Ontario. Higher National Certificate (Great Britain) and endorsement in industrial administration, 10 years experience in medium and heavy special purpose machine design. At present employed in Montreal as mechanical engineer on machine design. File No. 4245-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., Ont., B.Sc., Sask., 1945, age 29, single. Last 5 years engaged in project design for two large petro-chemical plants. Plant engineering studies to improve and replace equipment for 3 years. Desire one of the following supervisory positions in a process industry, plant design and construction, production or works engineering in that order. Greater than average responsibility of a small industry or plant desirable. Available after middle of August. Location not a prime consideration. File No. 4248-W.

SENIOR CHEMIST, graduated in chemical engineering. Have held leading positions in Hungary, France and Brazil. Two years in Canada in Pulp and Paper Research Institute. Broad scientific knowledge and experience. Desires position in paper or related industry, mineral oil laboratories or rubber tire manufacturer. Language spoken, English, French and German. Excelle references. Single, will accept wo anywhere. Available immediately. F No. 4249-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., a 30. 5 years varied construction expe ience including small homes, apar ments, hospitals, heating plants, a force and industrial buildings whe work entailed project supervision, est mating contracts, complete liaison wit owners, architects, engineers and sut contractors. Fully experienced in offic routine, accounting, and purchasing, an knowledge of design of timber, cor crete and steel construction. Desir position where exerience and adminis trative ability may be best utilized. Fi No. 4254-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.I (mechanical), Nova Scotia Technic College, 1949. Several years experienc in machine shop practice, some exper ience in the design and installation c mechanical drying systems, three sum mers experience on survey parties, de sires an engineering position, not neces sarily in the mechanical field, in o in the vicinity of St. John's, Newfound land. File No. 4255-W.

ELECTRICAL ENGINEER, P.Eng. (Ont.) B.A.Sc., U.T., 1951, age 28, married Have completed training course wit large electrical manufacturer. Additiona experience on power and lighting lay outs for large buildings. Prefer positio in plant engineering or inspection worl in vicinity of Toronto. File No. 4256-W

ENGINEERING PHYSICIST, Ph.D., British married. With about 20 years exper ience in industry and government ser vice, desires responsible position i Canada. Special experience: vibrations noise, wear, metrology and design of re search apparatus for laboratory, tes bed and field use, particular on steam and gas turbines and gears. File No 4257-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. University of Alberta, 1949, test course graduate and two years field experience on power apparatus. Desires position ir Western Canada. Age 30, married with one child. File No. 4263-W.

CIVIL ENGINEER, B.A., degree in engineering, Cambridge, England, 1945. A.M I.C.E., M.E.I.C., single. Experience ir airfield work in Malaya, Hydro-electric and other works in the United Kingdom Since 1948 and until leaving for Canada in 1952 employed by a well knowr firm of consulting civil engineer ir London. Experience in reinforced concrete design, hydraulic design and investigations, site experience on tunnels dams and associated works. Presently employed as resident engineer on the supervision of defence contracts in the Province of Alberta and comprising hangars, other buildings, water supply project and services. Would like work on engineering supervision or administrative staff or on investigations, and preferably in the Province of British Columbia or Ontario or Eastern Canada. File No. 4264-V.

INDUSTRIAL MECHANICAL ENGINEER, Jr.E.I.C., McGill graduate, single, age 31. R.C.A.F. veteran (4 years as pilot. navigation instructor and pilot, also

Public Health Engineer
REQUIRED BY
Saskatchewan Department of Public Health

Graduate civil engineer, preferably with graduate work in public health engineering and some public health engineering experience: to do field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewerage systems, steam pollutions, deficient drainage and other environmental factors.

For application forms and further information apply to: Public Service Commission, Legislative Bldg., Regina.

liaison and administrative work, etc.). Experience includes management and operating control systems, plant layout, material handling systems, tool design and control, liaison and supervision of building construction and small machinery installation. Has some experience in refrigeration, building and machinery maintenance, and manufacture, acting as administrative and technical assistant to top executives in the brewing and aircraft industries. Has ability in the supervision and handling of people. Interested in position where a willing, intelligent young engineer can enthusiastically use some of the above outlined background, experience and talent. Available on short notice anywhere in Canada. File No. 4267-W.

ARTNER WANTED TO form construction company with McGill, 1944, graduate M.E.I.C., who has had previous experience with own company. Applicant should have available capital and experience. File No. 4268-W.

IVIL ENGINEER, Jr.E.I.C., available. Experience includes one year in Canada. Interested in field work on construction or design with highway department, railway or construction firm. File No. 4270-W.

LECTRICAL ENGINEER, age 31 years. Formerly electrcial superintendent of large mining and milling property, at present distribution superintendent in city of 300,000; experience in hydro, steam, and diesel plant operation and maintenance, electrical construction of lines and substations, electrical shop operation. Desires similar work of equal or greater responsibility in Canada. File No. 4271-W.

HEMICAL ENGINEER, 43, graduated at the Technical University in Dantzig, Europe, in 1935, with practice in analytical and research work in Poland and several years of activity in open-hearth steel plants as production engineer and assistant manager in Poland and in South America, seeks an adequate position preferably in Quebec or Ontario. File No. 4272-W.

IVIL ENGINEER, Jr.E.I.C., McGill, 1951, married, one child. Two years experience in steel, concrete, and timber design, architectural planning on office and industrial buildings. One year on projects involving piping layouts for the petroleum industry. Seeks further opportunity for advancement and diversified work. Available on reasonable notice to present employer. File No. 4273-W.

IETALLURGIST EMIGRATING October, 1953, seek appointment. M.Sc., Ph.D. (Manchester) with 14 years of experience in metallurgical fields. Experience includes five years conducting investigations in one of the largest iron and steel plant laboratories. Nine years in planning administration and conductance of research in a newly built metallurgical laboratory as the official in charge. Desires position in industry or research organization on development work or in administration-cum-technical capacity. Salary of secondary consideration. File No. 4274-W.

AGRICULTURAL ENGINEER, 1942 graduate, M.E.I.C., P.Eng., (Sask.), age 37, married. Ten years experience with oil companies. Process work, drafting, in the production department, drafting, designing, construction and maintenance in the marketing department. Desires position in West. Available on reasonable notice to present employer. File No. 4277-W.

CIVIL ENGINEER B.E., National University of Ireland. Arriving Montreal approximately August 15th. 2 years experience in structural steel design, and draughting of steel-framed buildings and various types of steel roofs. Also some surveying experience. Position in housing, road construction, sewer and water services preferred but willing to remain in same line of suitable employment offered. Location preferably Montreal or Eastern Ontario. Age 23, married. File No. 4283-W.

INSTRUMENT ENGINEER, graduate chemical engineer, Jr.E.I.C., McGill, 1950, with three years experience in instrumentation, desires a position in the chemical or petrochemical industries. File No. 4284-W.

MECHANICAL ENGINEER. University graduate. Age 54, married, 2 children. Over 10 years experience as factory manager, 4 years experience as field engineer. Experience covers production, administration, maintenance, standards, plating, etc., 1½ years working in Canada. Presently employed and available from the 1st of August. Fluent in French, German, Polish and Czech. Depending on nature of position would consider going elsewhere. Willing to start in junior position with the possibility of advancement. At present located in Montreal (Longueuil). File No. 4287-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc., 1950, B.Eng., 1952, McGill, age 25, married. Experience: 2 years during summers, surveying, inspecting, 1 year in design group for a chemical plant. Desire a position with wider scope and responsibility, preferably with a small progressive firm either in engineering or sales engineering. Location preferred but not mandatory. File No. 4288-W.

CIVIL ENGINEER, B.A.Sc. (Honors, Toronto), P.Eng. (Ont.), Jr.E.I.C., seeks a position with an aggressive company in Vancouver or vicinity that needs a man who is well experienced in all phases of bridge design, both reinforced concrete and structural steel, who has also served as resident engineer on a large road construction project, who has an abundance of energy and initiative. File No. 4289-W.

YOUNG ENGINEERING EXECUTIVE experienced sales and general management, M.E.I.C., M.S.A.E., D.L.C. (Eng.), A.M.I.I.A., Grad. R.Ae.S., age 30. Experience covers production, research, sales-domestic and export, advertising, general management over a wide range of engineering products including jet engines, air, oil and fuel filters, abrasives, fans and blowers, machine tools. Widely travelled in Canada, U.S.A., South America and Europe. Experienced in preparing technical articles, delivering lectures. Would like to join a progressive organization where drive, initiative and organizing ability would be utilized to the fullest extent. File No. 4295-W.

CHEMICAL ENGINEER, graduate (1950), M.C.I.C., age 27, single. Three years production experience in large chemical factory including two years in production of caustic chlorine by electrolysis also experience in pulp and paper plant. Interested in production, pulp and paper, chemical, paint and varnish industry. Available on short notice. File No. 4299-W.

GRADUATE MECHANICAL ENGINEER, married with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., M.I. Mech.E., experience includes apprenticeship 7 years draughting office and research, technical executive on foreign railways, 5 years works manager railway workshops. At present mechanical superintendent of sulphite pulp mill. Would prefer change to Ontario or Maritime Provinces. File No. 4302-W.

GRADUATE NOTTINGHAM UNIVERSITY, England, 1st class certificate in mining. Experience includes technical work as planner on major reorganization programme research engineer and chief safety engineer. One year in Canada engaged in design and plant engineering. Wishes to relocate in responsible position in production processes. File No. 4303-W.

Attention, Members

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned.

TELEPHONE PLATEAU 5078

Except in special cases all interviews will be arranged between the hours of 9 and 12.

HORTON STRUCTURES

Top right: *6-ft. diam. by 94-ft. fractionator tower loaded at our Fort Erie plant for shipment to the McColl-Frontenac Oil Company, Ltd., refinery at Edmonton.*

Above: *Rising high above the British American Oil Company's refinery at Moose Jaw, Sask., is the large reactor-regenerator at the right in the view and two catalyst hoppers at the left.*

Below: *Six 144-ft. diam. by 48-ft. high tanks at the Interprovincial Pipe Line Company station near Edmonton, Alberta. The tanks have a capacity of 140,000 bbls. each and are used to accumulate crude oil for movement eastward through their pipe line system.*

for the PETROLEUM INDUSTR

For years Horton processing equipment h helped the petroleum industry keep pace wi the ever-growing demand for its products. O engineering staff, our fabricating plant a our experienced field crews offer the petrole industry complete, dependable service in t design, fabrication and erection of oil stora tanks and special steel plate structures. T accompanying illustrations show a few exa ples of the types of Horton structures now service throughout the petroleum industry. O engineers will be glad to work with you whe ever you need steel plate structures of any typ

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Hortonspheres for efficient pressure stora of highly volatile hydrocarbons.

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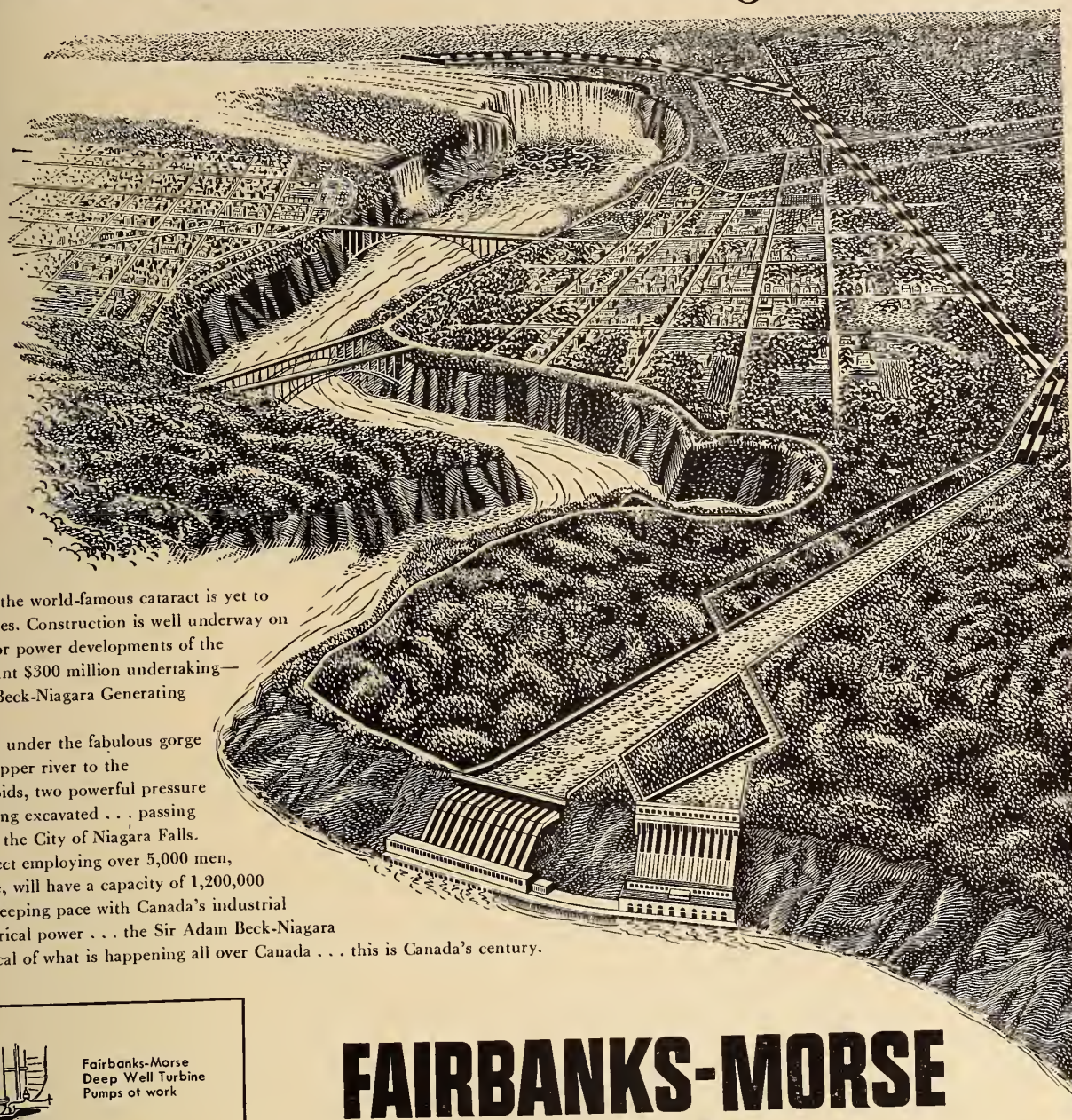

ıra Falls—the world-famous cataract is yet to more riches. Construction is well underway on f the major power developments of the l . . . a giant $300 million undertaking— ir Adam Beck-Niagara Generating on No. 2.

ight miles under the fabulous gorge rom the upper river to the lpool Rapids, two powerful pressure els are being excavated . . . passing feet under the City of Niagara Falls. vast project employing over 5,000 men, n complete, will have a capacity of 1,200,000 epower. Keeping pace with Canada's industrial t for electrical power . . . the Sir Adam Beck-Niagara ect is typical of what is happening all over Canada . . . this is Canada's century.

Fairbanks-Morse Deep Well Turbine Pumps at work

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Metal and waad-warking machinery far every purpose

Marine and Stotionary Diesel engines and lectrical equipment

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In the development of Canada's national resources and industry, FAIRBANKS-MORSE has played an important role. The ability of FAIRBANKS-MORSE to supply the right equipment anywhere in Canada—from any of its fifteen branches—has earned for the Company the confidence of Canadian industry which it has served for more than half a century.

The Departmental Store for Industry supplies all types of machine tools, industrial supplies, and materials handling equipment—FAIRBANKS-MORSE Scales, Diesel Engines, Pumps and Electrical Equipment—steam goods, railway and contractors' and automotive equipment—heating, farm equipment and appliances.

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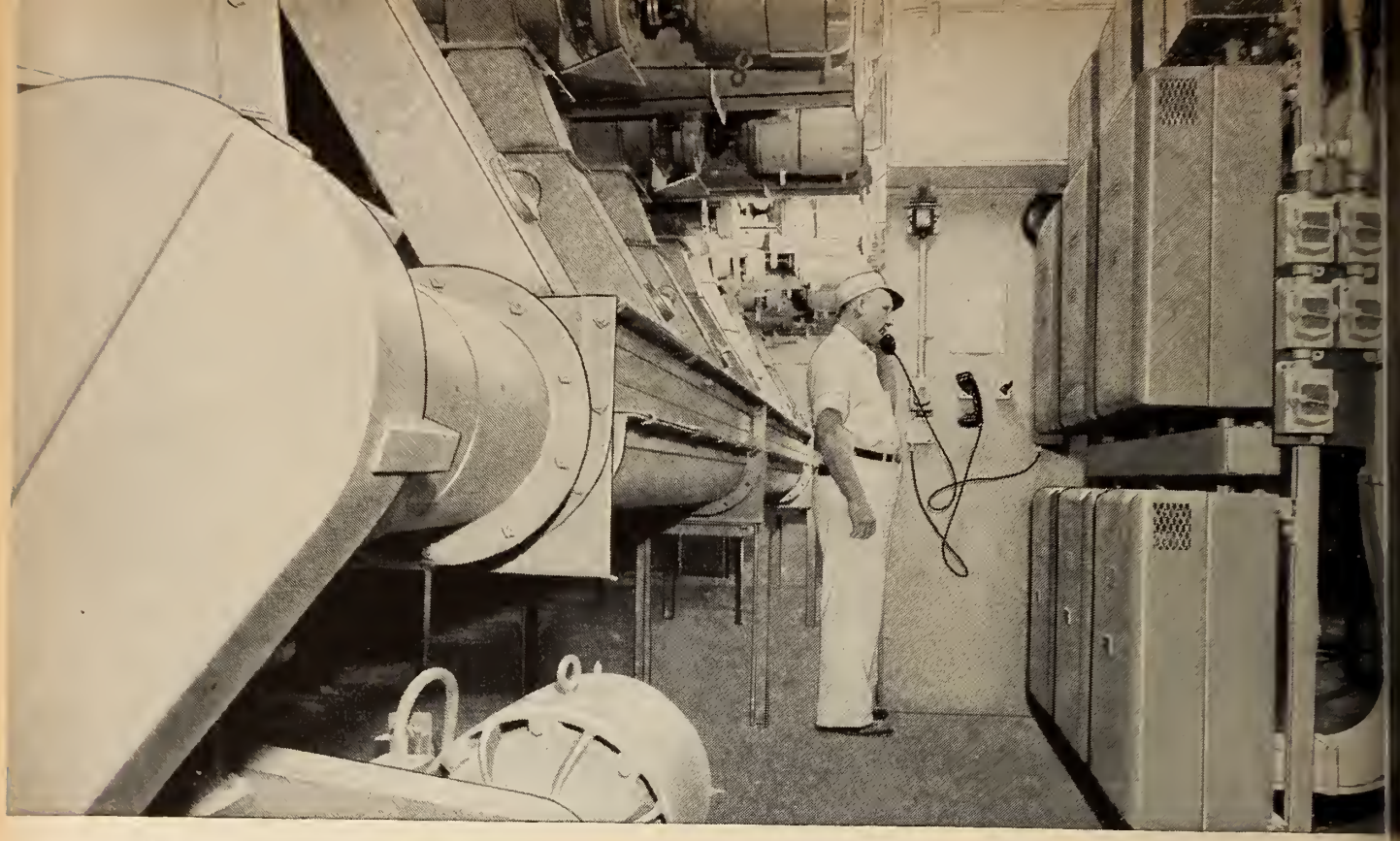
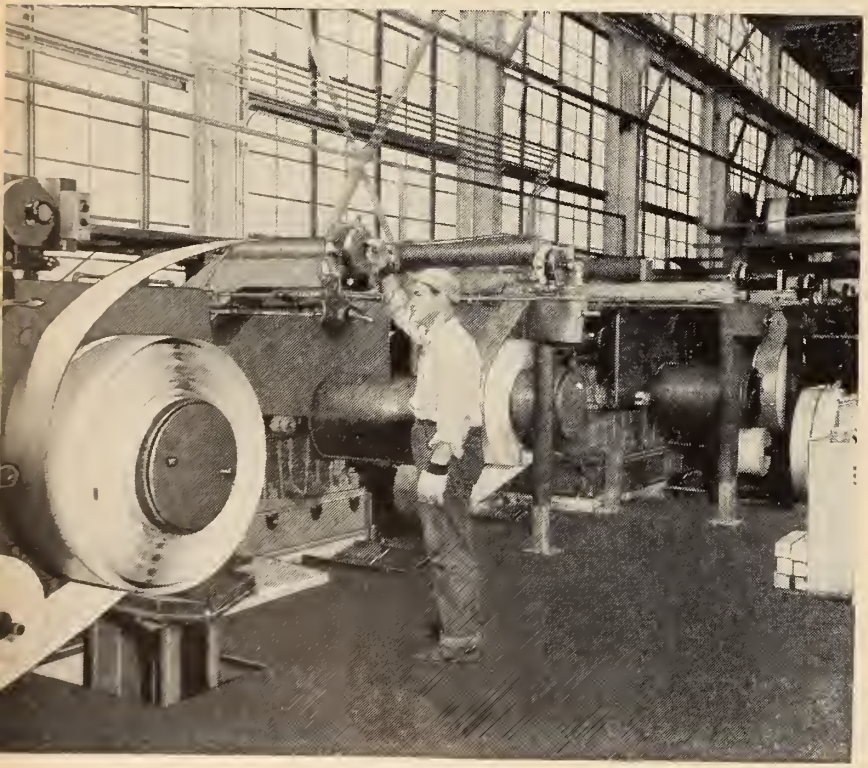
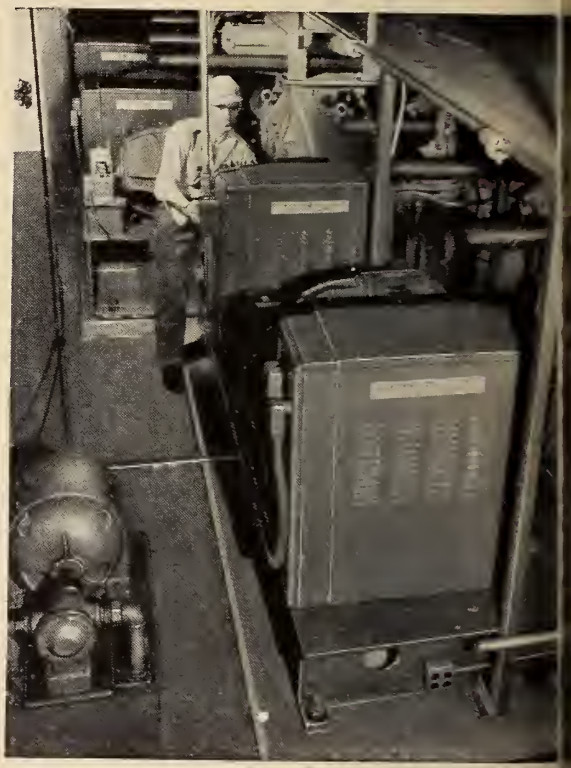


G-E THY-MO-TROL DRIVES shown here regulate the flow of flour to the packer and the proportional blending of many different varieties of flour—to meet customer's specifications exactly—in a large flour-milling plant. These packaged adjustable-speed drives provide the close speed control and wide speed range needed to adjust the flow of mat or to assure precisely the right mix every time in blending. Re substantial savings in processing time and costs.

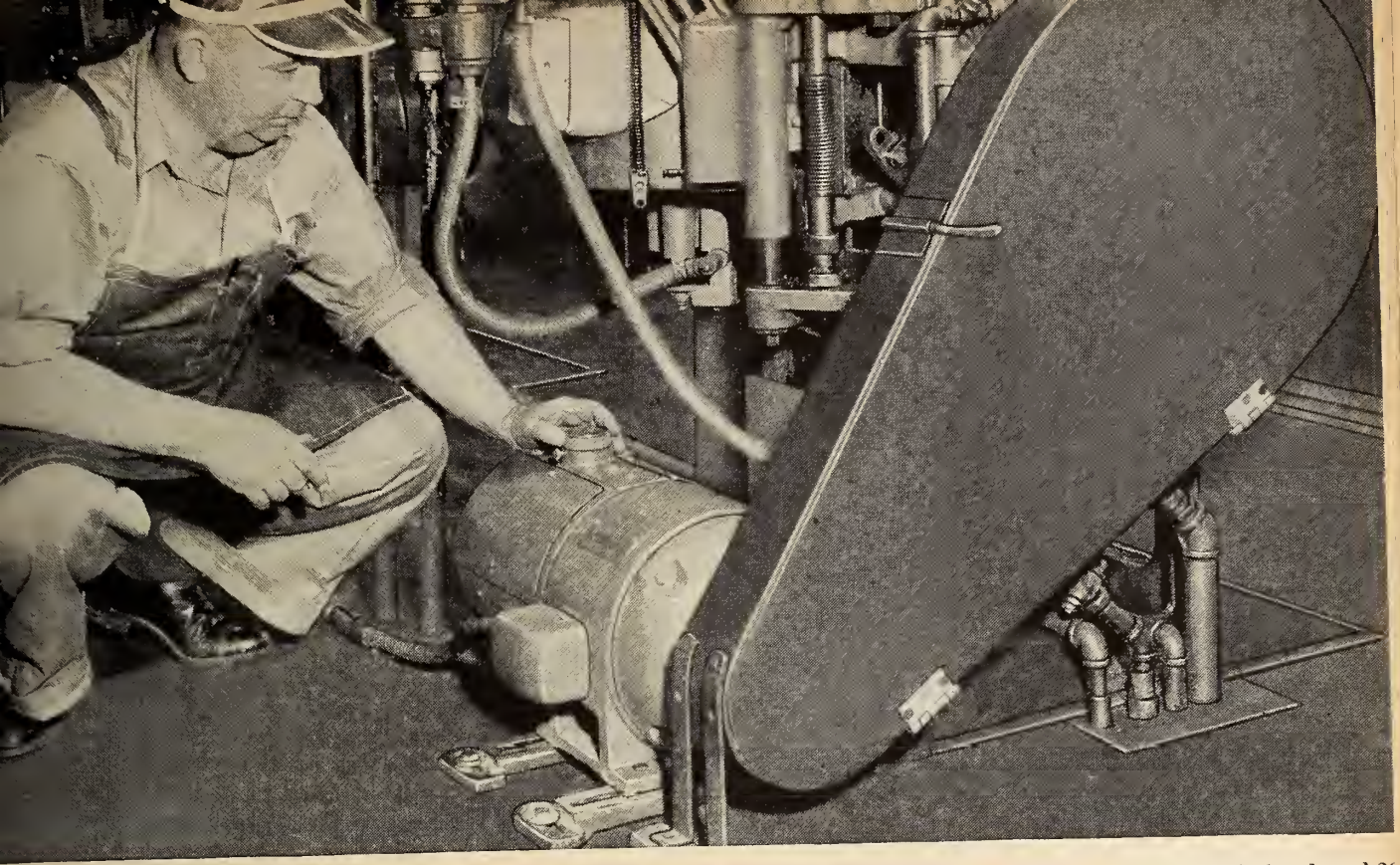
Make your machinery more versatile





G-E SPEED VARIATOR boosts output of winders "spooling" chrome strip steel in a large steel processing plant—handles all speeds from 5 to 80 feet per minute. G-E Speed Variators, with speed ranges up to 40 to 1, are complete "packaged" units—available in ratings from 1 to 2 horsepower. For even greater accuracy and versatility, these driv may include amplidyne or electronic regulators.

CANADIAN GENERAL ELECTRIC COMPANY LIMI



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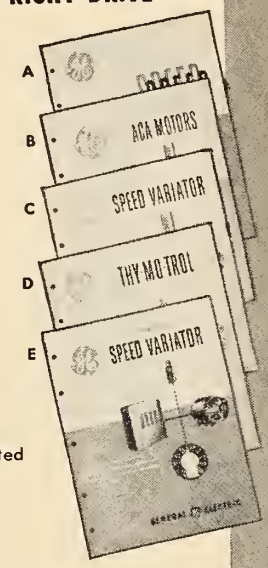

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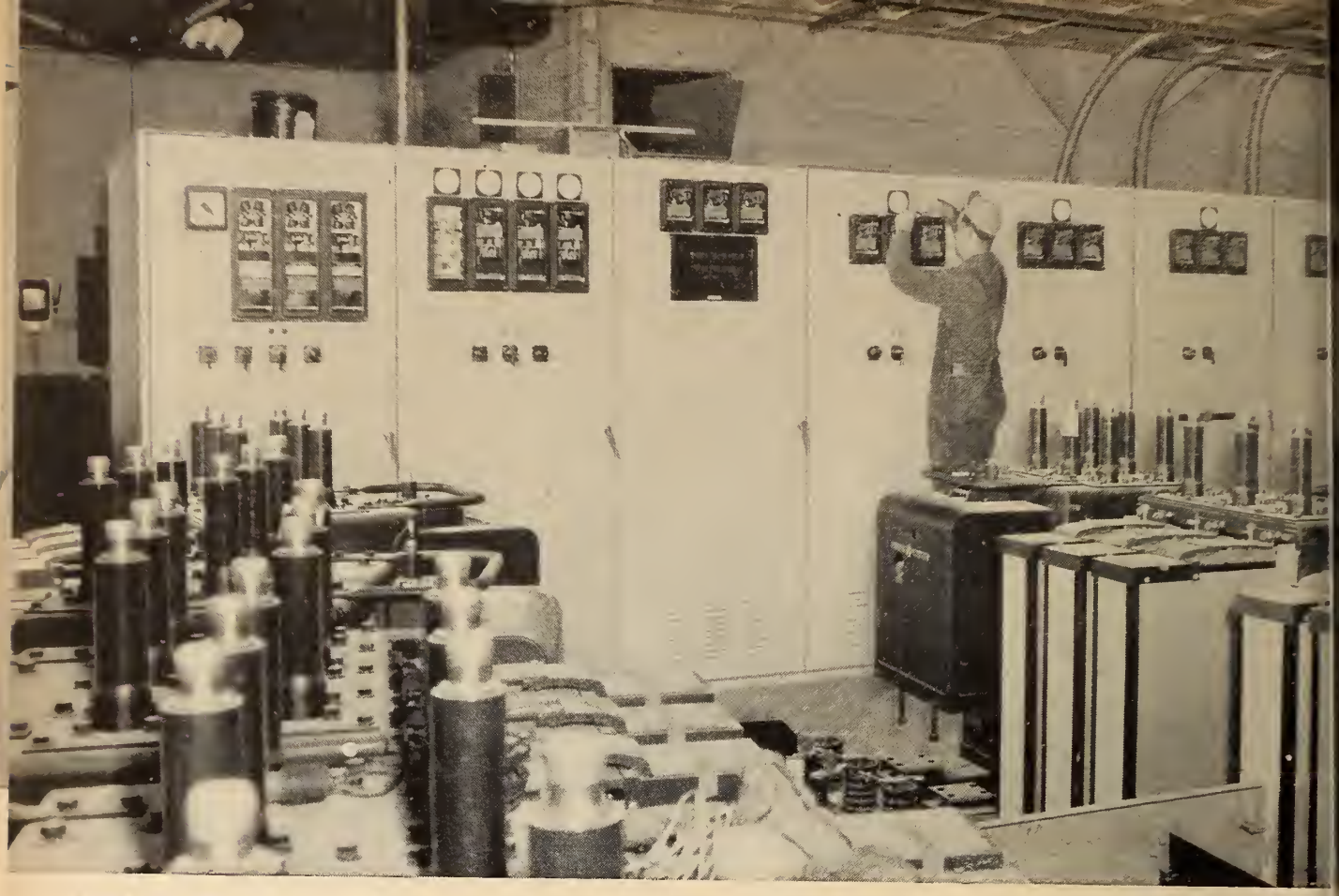
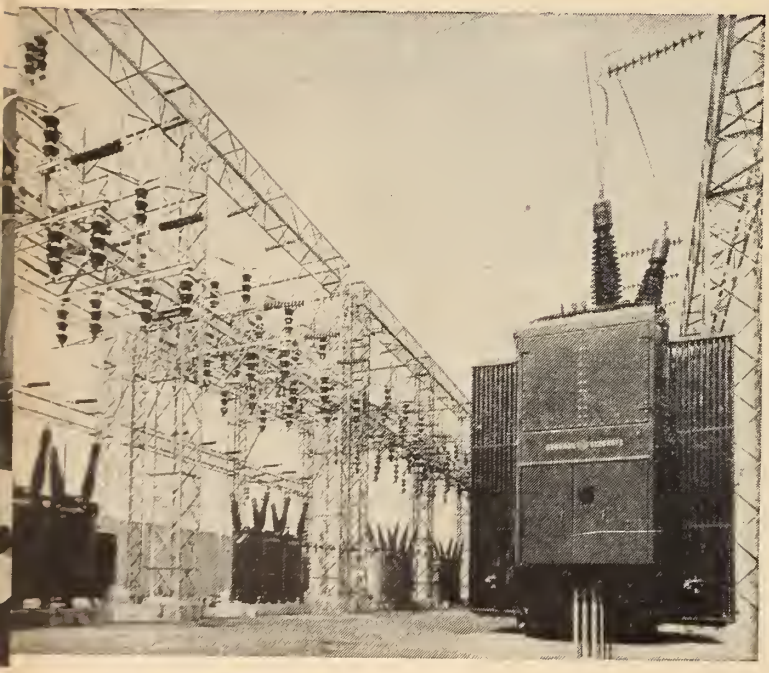
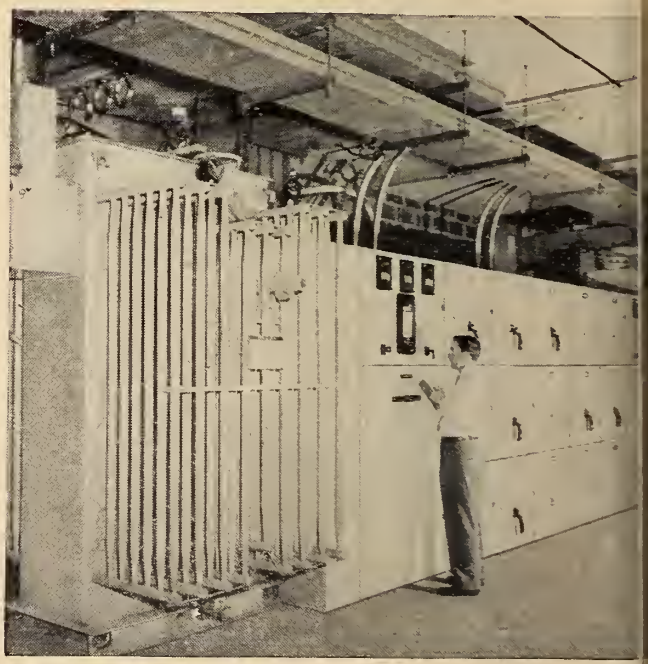


G-E METAL-CLAD SWITCHGEAR shown being installed above, has many features that provide for increased safety and protection against power shut-downs. Units in the foreground are removable 15-kv G-E magne-blast circuit breakers, ready to be moved into a switchgear compartments. Switchgear unit is supplied fully asse ready to connect.

How General Electric Switchgear Helpe



OUTDOOR SUBSTATION, built entirely from standard units, including transformer, oil circuit breakers and complete steel structure. Standard units saved months in planning and installation.



LOAD-CENTER UNIT SUBSTATION, installed in plant, sup low voltage power close to machines—eliminates voltage drop countered with long, low-voltage feeder systems.

App

CANADIAN GENERAL ELECTRIC COMPANY LIMIT

OW-PROOF INSTRUMENTS with easier to read, long scales, pical of many advances featured in G-E Metal-clad Switchgear. uments enable constant check to be kept on many circuits feeding throughout plant.

REMOVABLE MAGNE-BLAST CIRCUIT BREAKER, offers maximum accessibility for testing and inspection—may be easily replaced with a spare if necessary. Adequate interrupting capacity gives full protection against electrical failures.

Speed Major Production Change-over

Standard equipment helps solve difficult conversion problem —gets large plant in production ahead of schedule

When a large manufacturer planned to convert a light duty assembly plant into a heavy industrial plant, electric power requirements posed a major problem. To handle the tremendous demands of such a heavy industrial operation, a completely new power distribution system was needed. It had to be dependable, with maximum protection against power shut-downs. And it had to be installed fast, to meet an almost "impossible" production schedule.

Based on recommendations of General Electric engineers, this plant got one of the finest and most dependable power distribution systems ever installed. What's more, they got it in record time.

All power used throughout the plant flows through *standard* G-E Metal-clad switchgear. Supplied factory-assembled, ready for installation, it saved months of time-consuming on-the-job engineering and assembly. Having the entire power distribution job handled as a co-ordinated project by G-E engineers was an essential part of the excellent planning that resulted in starting production three months ahead of schedule.

For examples of the equipment used, see the pictures at left and above. For information on how similar equipment can help your modernization or expansion plans, *contact your nearest C-G-E office or Apparatus Division, 212 King St., West, Toronto, Ont.*

GENERAL ELECTRIC SWITCHGEAR

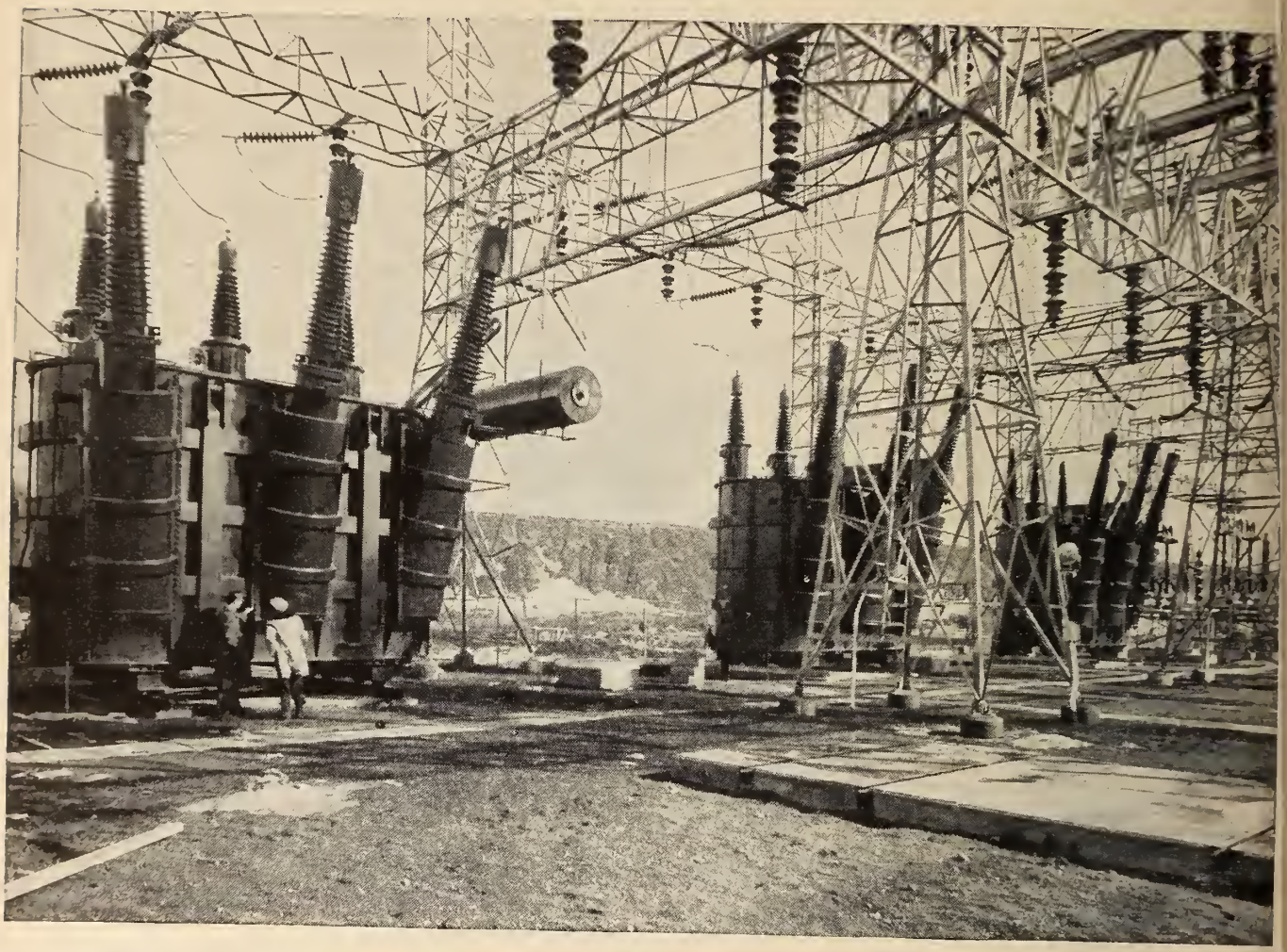
AAD-102

vision

EAD OFFICE: TORONTO — SALES OFFICES COAST TO COAST

NEWS FROM CANADIAN GENERAL ELECTRIC

Compact design of these transformers allows tremendous output in small package



The three 159,000 KVA transformers you see here are unique. They have the largest KVA output—for their size—of any transformers in Canada.

Recently installed at Aluminum Company of Canada's smelter at Isle Maligne, Quebec, they are used for transmission tie-line service with high voltage of 250,000 and low of 160,000. Their compact design is made possible by an improved cooling system which uses forced oil-to-water heat exchangers—hence the tremendous output in small package.

Two further advantages of this modern design are considerably reduced cost and the important fact that these new-style transformers can be shipped upright for easier handling and installation at the site.

For further information, contact Apparatus Division, Head Office, Canadian General Electric, 212 King Street West, Toronto or the district office nearest you.

GENERAL ELECTRIC
POWER
TRANSFORMERS

Apparatus Division

AAD-105

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

News of the Branches

Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings

Montreal

C.P.E.Q.-E.I.C. Golf Tournament

The golfing members of the Montreal Branch and of the Corporation of Professional Engineers of Quebec met again on June 10th last for their annual tournament at the LaSalle Golf and Country Club.

This year the weather did not play them false as it did a year ago and while the number of playing members was slightly under the century figure, the scores were well below it. For Low Gross, Roch Gohier again carried off the honours with a score of 79 while G. E. Cunningham finished next with an 83. The competition for Low Net was unusually close with Nicholson, Palmer and Peacock tied for first place with 73 while Webster and others scoring 74 ran them a tight second.

Refreshments followed after which a most enjoyable dinner was served. At the conclusion the many prizes were presented, accompanied by brief remarks from G. Lorne Wiggs and G. N. Martin on behalf of the respective organizations.

Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

Supper Dance, May 23

The supper-dance, held at the Saguenay Inn, was the final function of the year. Over seventy-five members entertained their wives and friends at this annual party.

The theme of the party was "Your Home Town", and the Inn was tastefully decorated in keeping with this. The cosmopolitan membership showed keen interest in seeing their home towns and countries represented, and the efforts of the Junior Section in carrying out the decorations were sincerely appreciated.

An orchestra supplied music for dancing, and supper in the grill completed an evening of merriment and good fellowship.

Special thanks for their successful efforts in organizing the party are due Messrs. G. K. Clement, F. E. Hogg, S. T. Solinski, and C. Louttit.

St. Maurice Valley

C. Yoshida, Jr.E.I.C.,
Secretary-Treasurer

D. G. Demianiw, Jr.E.I.C.,
Branch News Editor

President's Visit

Dr. J. B. Stirling, president of the Institute, addressed a mixed gathering of the St. Maurice Valley branch at the Cascade Inn, Shawinigan Falls, on Wednesday, April 22.

The president, who was introduced by D. E. Covey, the branch chairman, stressed the importance of public recognition of the engineer in the civic, national and international spheres. At present the number of engineers serving in these spheres ranks seventh among the professions, according to a recent survey published in *Canadian Business Week*. He strongly urged the membership to participate more in these fields of public service. During the president's address, also some mention was made of the large membership of the Institute.

Dr. Stirling and Mrs. Stirling, together with the other members of the visiting party which included Dr. L. Austin Wright and Mrs. Wright, Mr. and Mrs. I. R. Tait and Mr. R. E. Heartz, were entertained at dinner by the members of the branch executive and their wives, prior to the general meeting.

The winner of the Montreal C.P.E.Q.–E.I.C. golf tournament, and others. Left to right, R. Cyr, R. Gohier, winner, J. J. Leroux, G. Perron, two golfers whose names the *Journal* was unable to trace, and W. J. Yorgan.

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More Montreal engineer golfers at the annual tournament. First row, left to right: J. P. Valade, Leo Nadeau, M. Gosselin, J. Brissette, G. N. Martin, H. Esdaile, R. Dansereau, J. Vinet. Second row: E. G. Fraser, J. Provan, G. W. Vogan, E. Palmer, Dr. L. Berlinguet, Leo Scharry, P. Bournival, Sam Webster.

Annual Meeting

The annual meeting of the St. Maurice Valley branch was held on May 27, at the Cascade Inn, Shawinigan Falls.

L. A. Robillard of Shawinigan Chemicals Ltd., Shawinigan Falls, was elected chairman of the branch for the 1953-54 session. E. R. McMullen of the Consolidated Paper Corp. Ltd., Trois Rivieres, was elected vice-chairman. Executive committee members will be J. W. Korcz for Trois Rivieres, T. G. Edgeworth for Shawinigan Falls and J. B. Sweeney for Grand'Mere, with other members of the executive committee, who have one more year to serve, A. M. Hubley of Trois Rivieres, J. O. Kelly of Shawinigan Falls and J. M. Jopp of La Tuque. D. M. McKim of Shawinigan Falls was appointed secretary-treasurer.

D. E. Covey, the retiring chairman, presided. In his annual report, he mentioned that the senior section of the branch had held six general meetings and a golf tournament during the past session. The visit of Dr. Lillian Gilbreth on April 8, 1953, was the chief highlight. The branch secretary-treasurer, C. Yoshida, presented a report on the branch finances and membership.

Guest speaker at the dinner meeting was A. R. Jacobs, Quebec representative of the Lincoln Electric Company of Canada Limited. The subject of his address was the development of arc welding and some of its applications. Slides and a coloured movie complemented the speaker's address.

Mr. Jacobs stated that the history of arc welding started in 1801 in the laboratories of Sir Humphrey Davy. The use of arc welding in industry only reached prominence during the world war of 1914-18 when the U.S. Navy used this welding technique to speed the salvage and restoration of German ships which had been scuttled in New York harbor in 1917. The progress of arc welding was hastened in 1927 when extruded flux coatings for electrodes were introduced.

In the recent war of 1939-45, arc welding played a very important part in the construction of the Liberty ships. Considerable adverse publicity had been given to the poor structural features which had supposedly been caused by the use of arc welding. Mr. Jacobs stated, however, that only twenty-three out of a total of four thousand ships constructed by arc welding had serious failures, while only five ships actually broke in half.

The cost of steel construction can be reduced by fifteen per cent by arc welding but up to the present time only a few cities in Canada permit welded construction in their building codes.

Mr. Jacobs, who was introduced to the meeting by the new branch chairman, Mr. Robillard, was thanked by D. G. Demianiw of Shawinigan Falls.

Shawinigan Falls Junior Section

May Meeting

E. R. Williams, former works manager of Shawinigan Chemicals Limited, addressed the Shawinigan Falls Junior Section of the St. Maurice Valley branch on Wednesday, May 6, 1953, at the Cascade Inn, Shawinigan Falls.

Mr. Williams, who was introduced by Conrad Hebert, spoke on "Job Satisfaction". In his opening remarks, the speaker urged the gathered engineers to exploit all opportunities to convey thoughts to others. He stated, "To transmit thought is the chief function of the spoken and the written word".

Mr. Williams groups "job satisfaction" into three headings: mental satisfaction, which is derived from doing the work one likes; the social satisfaction of working with people one likes; and economic satisfaction, or economic freedom in one's work.

Like the professional sportsman, the young man in the industrial world must abide by "certain rules of the game", said Mr. Williams. There are many opportunities in the industrial world available to those who show vision, knowledge and the readiness to take the advantage of these opportunities. In Mr. Williams' opinion there are more opportunities surrounding us today than at any time in the past.

As a concluding note, Mr. Williams stressed the importance of an occasional honest personal audit of oneself. D. G. Demianiw expressed the thanks of the audience.

Annual Meeting

The annual meeting of the Shawinigan Falls Junior Section was held at the Cascade Inn, Shawinigan Falls on Wednesday, May 26, 1953, at 8.00 p.m. The meeting took the form of a smoker. Two very interesting films were presented, one showing the manufacture of "Cellophane" and the other the 1952 Canadian Open Golf Championship.

The new chairman for the 1953-54 session is M. P. Murphy of the E. D. Lavergne Construction Company, Shawinigan Falls. B. L. McIntyre of the Canadian Resins and Chemicals was elected vice-chairman. T. J. Goddard of Shawinigan Chemicals was elected secretary-treasurer.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

W. V. Morris, M.E.I.C.,
Branch News Editor

Armand Mayer Is Speaker

On May 25 the members of the Winnipeg Branch, at an informal evening meeting, were privileged to meet M. Armand Mayer who is the first French exchange consultant in Canada under the new France-Canada exchange of information program. D. M. Stephens introduced M. Mayer to the members.

M. Mayer had brought with him two films showing the construction of two of the hydroelectric projects on the Rhone River, for which he had been soils consultant. Before the films were shown, M. Mayer gave a thumbnail sketch of the entire Rhone development scheme. This scheme will involve the entire 300-mile length of the Rhone, from Switzerland to the Mediterranean. It is being carried out by the Compagnie Nationale du Rhone (CNR), which is sponsored by the French government but was organized as a private company to develop the Rhone for hydro-power, navigation, and irrigation. When completed, in an estimated 25 years, it will involve twenty-two separate projects, and the total installed hydroelectric capacity will be 2.5 million kilowatts.

In his brief preliminary remarks, M. Mayer described several of the soil and foundation problems which were encountered during the construction of the first two of the Rhone projects—the dam at Genissiat, and the dam and canal at Donzere-Mondragon. Among these problems were those of building cofferdams for the dewatering of the river at Genissiat, and of excavation of the canal at Donzere.

The two films showed details of the construction of the dam at Genissiat and Mondragon. The first of these to be built, Genissiat, is the largest power dam in western Europe and is exceeded in size on the continent only by Russia's Dnieprostroy. It has a maximum head of 345 feet, and is designed to handle a 180,000 c.f.s. flood flow. Completed a

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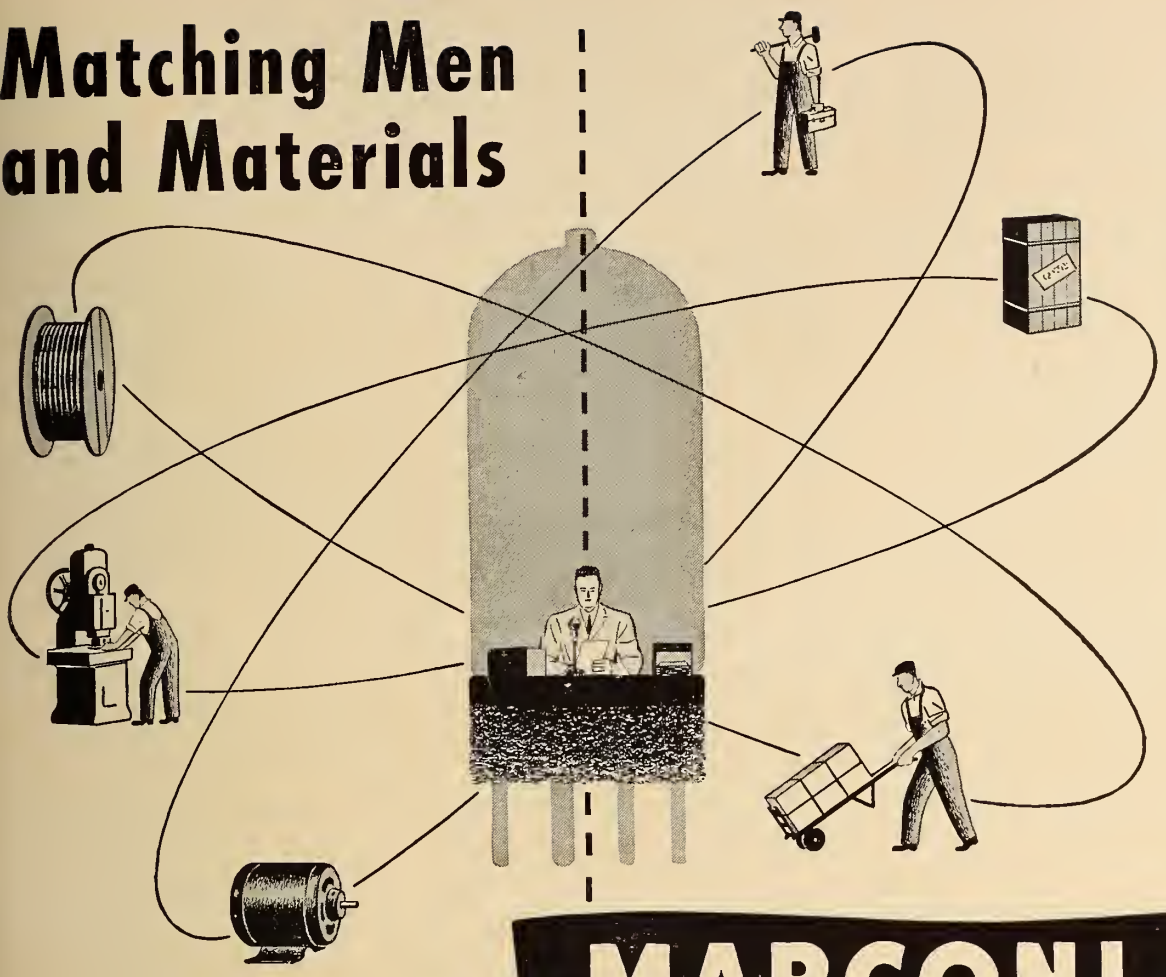

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month before the implementation of U.S. Marshall Plan aid to France, it is a truly French product, as no outside aid, machinery, materials or money were used in its construction. The dam and canal at Donzere-Mondragon is now completed, but the film which M. Mayer showed was of some of the earlier stages of construction.

In the discussion period questions indicated the keen interest which M. Mayer had aroused in his hearers, many of whom had not previously known of the existence of Rhone River developments, even though they compare favourably in size and technique with many better-advertised U.S. projects.

Vancouver

S. S. Lefeaux, M.E.I.C.,
Secretary-Treasurer

K. Y. Lochhead, M.E.I.C.,
Branch News Editor

Annual Meeting

The annual meeting of the Vancouver Branch was held at the Faculty Club of the University of British Columbia.

Elected to the Branch executive for 1953-1954 were: E. L. Hartley, chairman; W. O. Richmond, vice-chairman; C. P. Jones, secretary; I. D. Smith, treasurer; and J. C. Oliver, L. B. Stacey, R. A. McLachlan, P. N. Bland, K. Y. Lochhead and F. M. Cazalet, as committeemen; N. T. Libby is past chairman; S. S. Lefeaux, past secretary, S. Hogg, and J. C. MacDonald, Branch councillors; and George Faulder, student section chairman.

At a dinner at N.W.H.S. Officers' Mess, Whitehorse, April 24, with Col. L. F Grant, E.I.C. field secretary, as host, the formation of the Yukon Branch wa discussed. Those present (left to right) were Maj. E. R. Amhrose, R.C.E.M.E. Gordon Bird, M.E.I.C. (behind Maj. Ambrose); Al Eberts, M.E.I.C.; Bill Emery F/L G. H. Hicks, R.C.A.F., Jr.E.I.C.; Lieut.-Col. M. C. Sutherland Brown R.C.E., M.E.I.C.; Clark Morrison, S.E.I.C.; Lieut. R. G. Armstrong, R.C.E. Jr.E.I.C.; John Phelps, M.E.I.C.; Brig. H. W. Love, M.E.I.C.; Col. Grant; John Scott; and Capt. D. J. Kempster, R.C.E., S.E.I.C. The photographer wa James Quong, of Whitehorse.

Seattle Engineers Visit Vancouver

On Saturday, May 23, members of the Seattle Chapter of the American Society of Civil Engineers, and their wives, were guests of the Vancouver Branch of the Institute.

The new Granville Street Bridge, the Capilano Dam and the Fraser River Model at the University of British Columbia were inspected during the afternoon. The inspection trip was followed by dinner and entertainment at the Pacific Athletic Club during the evening.

W. O. Richmond was chairman of the committee in charge of arrangements.

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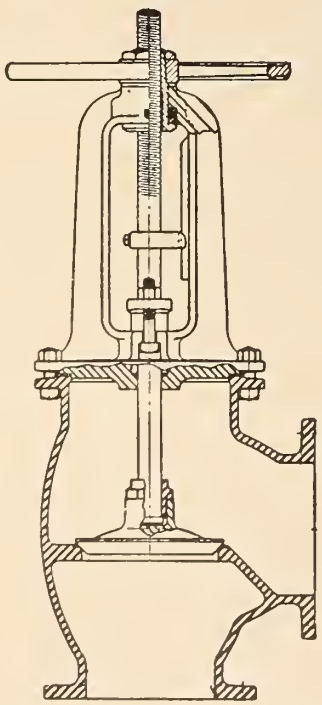

FIG. 5796
Flanged Angle Valve

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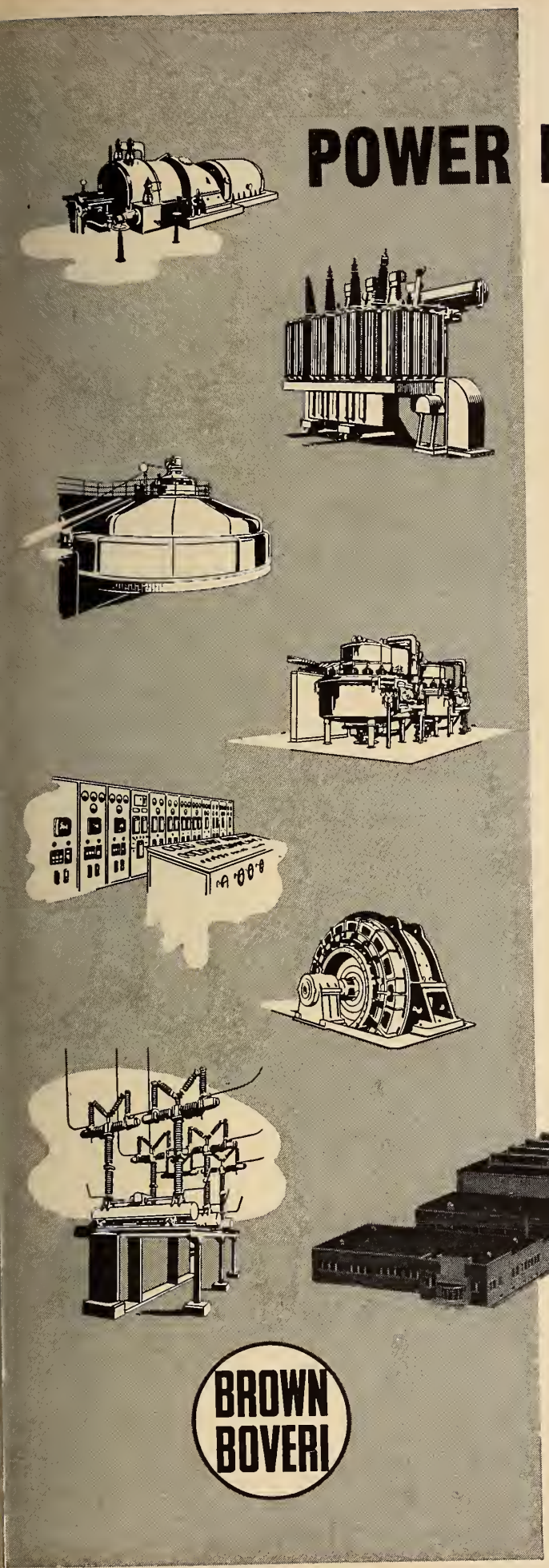

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BOOK REVIEW

Architects', builders', civil and highway engineers' reference book: an encyclopaedia of technical information and sources of supply, ed. E. Molloy. 4th ed. London, Newnes, Toronto, British Book, 1952. 971 pp., illus.

This mighty tome of nine hundred and seventy-one large pages, is now in its fourth revised and enlarged edition, being formerly published under the title ARCHITECTS', BUILDERS' AND CIVIL ENGINEERS' REFERENCE BOOK.

Special articles indicating trends of development is the heading of the first section, and it deals with School buildings, Water resources in Great Britain, and Highway legislation, which latter includes a table of the principle statutes relating to highways and bridges, with the number and name of each statute, and its date of incorporation.

Site investigations, soil, and air surveys are considered in the second section, along with new surveying instruments.

All the articles are up to date on current practice, and those of you familiar with the volume do not need the subjects enumerated.

However, what is new is the information on highway engineering and street lighting, which is a new departure for this publication. All types of road foundation materials are considered, appropriate reinforcements, and tests.

But, our greatest disappointment in reviewing this volume was in finding no information on the rubberized road surface. One thinks of Great Britain as the leader in this new twist in road surfacing, and it is always to English books and magazine articles we turn for this information. Only one firm name is even listed for the production of this type of surface.

Lists of suppliers of the materials under consideration are included with each chapter, and British Standards are included in their appropriate sections.

The publishers give no indication o how the companies and manufacturer represented in the volume are chosen, bu the whole thing appears to be a co-opera tive effort on the part of publisher an producer. It is certainly an "encyclopaedi of technical information and sources o supply", as the subtitle indicates.

The volume closes with an alphabetica directory of manufacturers included in th work, an index to advertisers, and sixteer pages of subject index to content.

This book will be a valuable source o reference for many of our members.

E.K

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Aeronautical drafting manual, 4th ed. New York, Society of automotive engineers, 1953. 13 sections, illus.

Since this manual was first issued in 1941 the scope has been widened to include, besides aircraft engine drafting practices, those that apply to the aircraft propeller and accessory industries. The practices applicable to these industry divisions are also of value in other fields They are divided into sections dealing with the preparation of drawings, dimensioning by the decimal system, abbreviations and symbols, material on threads, gears, splines and serrations, forgings, finish marks and special finishes, springs and welding. The last section contains tables of twist drill, material gage, and material stock data, and figures on wrench clearance. The manual is profusely illustrated with diagrams and is conveniently arranged by sections.

Air conservation engineering, 2nd ed. Henry Sleik and Amos Turk. Danbury, Conn., Connor engineering corporation, c1953. 76 pp., illus., $5.00 (U.S.).

"Air conservation engineering is concerned with recovering used air in the interest of efficiency and economy in air conditioning." This book describes the theory and practice of air purification including the latest developments and application methods. It may be used as a practical reference manual for it provides economic data, tables and charts which are helpful in planning an application and estimating its value in industrial and commercial establishments. Material useful in designing heating and cooling systems is also included. Chapters discussing adsorption, air purification in refrigerated storage as a means of retarding the metabolism of fruits and vegetables, the inhibition of specific tissue diseases, protection of foods against organic decay and the preservation of natural flavors will be of value to food engineers. A section on catalytic com-

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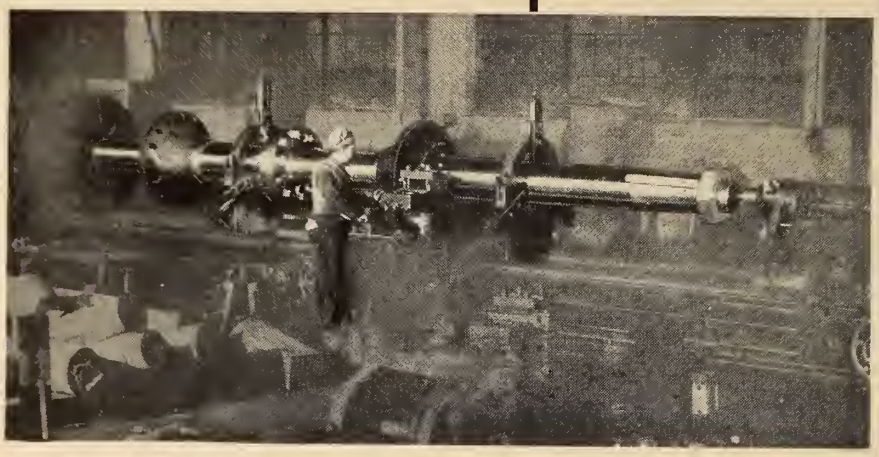

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bustion covers this new method of controlling odors in high concentration and a high temperatures. A large section i devoted to the air recovery equipmen developed by the Connor Engineering Corporation. The book is not indexed.

Drafting by the model method. J. B Musacchia, H. A. Fluchere, and M. J Grainger. New York, Arco publishing co., 1953. 143 pp., illus., (pa.), $3.5((U.S.).

This is a complete course in drafting which claims to employ an entirely new method of instruction featuring cutout 3-dimensional models. The basic instruments and procedures used in drafting are clearly explained with large illustrations. Following notes on the scale and its use there are ten elementary, and ten advanced, drafting lessons. In each lesson the step-by-step procedure is explained and the scale to be used is given.

Earth manual: a manual on the use of earth materials for foundation and construction purposes, tentative edition. U.S., Department of the interior, Bureau of reclamation. Denver, 1952. 332 pp., illus., $2.50 (U.S.).

Augmented by illustrations and graphs this manual presents a wide coverage of the subject of earth materials in construction. It is divided into six chapters covering the use of earth in dam and canal construction, and earth foundations; basic soil components; identification, classification and description of earth materials, with their engineering properties; sources of earth material, and of riprap and rockfill sources; subsurface exploration; inspection, field laboratory facilities and reports. The appendices deal with sampling, classification and testing. Publication of the first edition is planned about one year after the issuance of this tentative edition.

Industrial electronic engineering. W. L. Davis and H. R. Weed. New York, Prentice-Hall, 1953. 514 pp., illus., $11.35 (U.S.).

The reader's knowledge of a-c circuit theory, elementary theory of electronic circuits, and elementary differential equations is assumed by the authors. There is, however, a chapter covering the theory of gas tubes since they are so widely used in industry. The book is mainly concerned with principles and problems, and descriptions of circuits for specific application are only given to illustrate these. The chapters, which are largely independent of each other, cover such subjects as rectifiers and inverters, semiconductor rectifiers, phototubes and associated circuits, industrial timing circuits, servomechanisms, regulation, electronic control of motors, radio frequency heating and X-rays. An attempt has been made to present basic methods of analyzing and solving problems and samples are given at the end of each chapter. The numerous equations, graphs, tables and illustrations increase the value and understanding of the text. The index is detailed with cross-references given between different subjects. Some bibliographical footnotes are found throughout the text. This highly technical publication will be of interest to those engineers concerned with industrial electronics.

International boundary commission. Joint report upon the survey and demarcation of the boundary between Canada and the United States from Tongass passage to Mount St. Elias. Ottawa, Queen's printer, 1952. 365 pp., illus.

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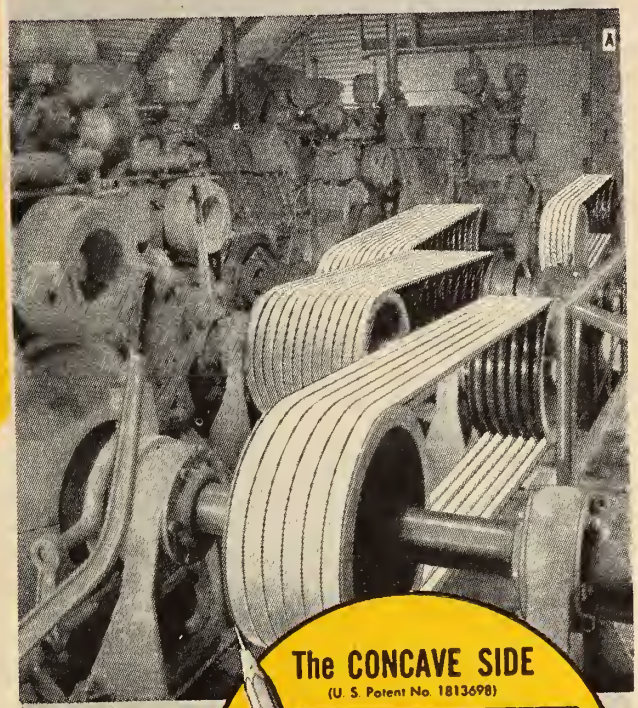

What Happens When a V-Belt Bends

Straight-Sided V-Belt

Fig 1

Fig. 1-A

How a Straight-Sided V-Belt Bulges in the Sheave-Groove. Sides Press Unevenly Against the V-Pulley, Causing Extra Wear at Point Shown by the Arrows.

Gates Vulco Rope With Concave Sides

Fig 2

Fig. 2-A

The Concave Sides Fill Out to Precise Fit in Sheave-Groove. No Side-bulge! Sides Press Evenly Against the V-Pulley —Uniform Wear and Longer Life!

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This is the last of a series of reports prepared to cover the survey and demarcation of the boundary between the two nations. It includes a historical sketch of this section of the boundary as well as the texts of all conventions, tribunal awards, commissioners' reports and other exchanges from 1903 to 1925. The field work of delimiting, marking, and defining this northwest section of the International Boundary line is described. There is also an account of the preparation of the 13 topographic maps which cover the 32,000 square miles contained in this region. Besides these maps, and drawings of boundary monuments, there are numerous photographic illustrations of the terrain and people. The appendices include boundary treaties, explorations prior to the convention of 1903, and elevations and descriptions of bench marks, followed by an index to boundary points, reference monuments, and triangulation stations and a general index.

Lexicon of terms used in connexion with international civil aviation, English - French - Spanish. International civil aviation organizations. Montreal, ICAO, 1952. 197 pp., $1.00.

About 2,500 aviation terms are given in the three languages with the English entry listed first, and in 625 entries, definitions have also been shown. Thus the Lexicon provides a trilingual vocabulary, combined with an index to definitions developed or used by ICAO. This edition is intended as the first of a series of aeronautical vocabularies in the three official languages of the Organization. The compilers have attempted to develop definitions suitable for uniform use in all ICAO documents rather than limited to the context of the document from which it was extracted. Following the Lexicon are appendices giving the main categories of international aviation, a classification of aircraft, abbreviations and symbols and trilingual tables of units of measurement.

La méthode de Cross et le calcul pratique des constructions hyperstatiques: théorie et applications. P. Charon. Paris, Eyrolles, c1953. 302 pp., figs., 3,800 fr.

This is a full explanation of the Hardy Cross method of successive approximations applied to the analysis of highly statically indeterminate frame structures. This method of calculation, first advanced by Cross in 1930, is based on simple arithmetic in contrast to older classical methods. The author has illustrated almost every point with equations, tables and diagrams which should help the non-French reader to overcome the language difficulty. The Bresse equations have been used for the basis of these illustrations of general formulae and particular cases. After presenting the theory of the Cross method the author goes on to describe three other methods, based on this one, and put forth by Zaytzeff, Kammuller and Cocchi. The last chapters are devoted to practical applications of the Cross method to the analysis of continuous frames, with reference to the balancing of shears or deflections, of thrusts or joint forces, and of angle changes or joint rotations. One specialized section treats the calculations needed in the construction of skyscrapers. The book concludes with a brief bibliography and a detailed Table of Contents.

Radioisotopes; industrial applications. G. H. Guest. Toronto, Pitman, 1950. 185 pp., illus., $4.50.

These new by-products of atomic energy projects, and their applications in industry, are discussed here in a clear, logical manner. The book begins with some background information on the chemistry and physics involved in the production of radioisotopes. Next follow chapters on the uses of radioisotopes in metallurgical research, in iron and steel production, in friction and lubrication studies, and in applied metallurgy. Other industries which do, or could, make use of this new tool include petroleum, rubber and chemical industries. Radioisotopes in industrial hygiene and public health are also covered as well as radiation sources for industrial radiography and various applications. The last two chapters treat laboratories and precautions in the industrial uses of radioisotopes. Illustrations, references, tables and an index are included.

Route location and surveying, 3rd ed. T. F. Hickerson. Toronto, McGraw-Hill, c1953. 543 pp., figs., $7.50.

Former editions of this text were issued under the titles "Highway Curves and Earthwork" and "Highway Surveying and Planning." The scope is here broadened to include such transportation systems as railways, canals, pipe-lines, airways and airports. In the chapters on route surveys emphasis is placed on the use of all kinds of maps and this, combined with the consideration given to tables and procedures, makes the book an excellent field manual. In this edition seven-place tables of natural trigonometric functions replace the five-place tables of former editions. The organization and duties of surveying parties are discussed. Other subjects treated are the introduction of the unit circular curve, simplified treatment of vertical parabolic curves and the transition spiral, curve superelevation and spiral lengths, the widening of highway curves

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ıd a simplified method for determining ue bearing of a line from sun or star ɔservations. There are also chapters on rthwork, drainage surveys and facilities, ıd railroad turnouts and crossings. here are over 250 pages of mathematical bles followed by an explanation of the bles and an index. The book is illustrated ith line diagrams.

a spectroscopie d'émission et ses applications. Pierre Michel. Paris, Colin, c1953. 224 pp., 260 fr.

The author is the director of one of the nportant spectroscopic laboratories in urope and in this volume he sets forth ıe modern methods of spectra study and escribes their application in the fields of ıemistry, metallurgy and industry. These pplications include the discovery of slight nperfections in alloys and also form an nportant part of modern astronomical tudy. Besides the practical aspects of the ubject the book presents the theoretical ackground of spectroscopy and discusses he various sources of spectra, including he formation of atomic spectra. Methods f studying the spectrum by photographic bservation, photoelectric cells and micro-ensitometers are covered. An index and ome illustrations are found in the book.

Tungsten; its metallurgy, properties and applications. C. J. Smithells. New York, Chemical publishing co., c1953. 326 pp., illus., $8.50 (U.S.).

This is a comprehensive and specialized book dealing with all aspects of this mineral, from the raw material to the industrial uses of its alloys. The introductory chapters outline the mineralogy of tungsten, followed by a step-by-step treatment for the production of metallic tungsten. The manufacture of ductile tungsten and the metallography of the metal are discussed in detail. Then we find chapters on the influence of manufacturing operations on the physical properties of tungsten, including the effect of cold work and annealing. Since this metal has been widely used as a thermal electron emitter a chapter is included on the thermionic properties of tungsten. The most important alloys and their industrial applications, chemical and spectrographic methods for the determination of impurities are other topics covered. In addition to bibliographical footnotes and many tables listing data the book contains 225 illustrations, among them many photomicrographs. The index includes references to the footnotes also.

The welding of austenitic corrosion- and heat-resisting steels. British welding research association. London, The association, 1953. 207 pp., illus., $5.50.

Written from both a technical and practical viewpoint, this book deals mainly with corrosion-resisting steels of the 18/8 chromium-nickel type. It begins with a general review of methods and problems including distortion and cracking, and goes on to describe individual welding processes. These include metal arc, submerged arc, argon arc, oxyacetylene, atomic hydrogen, carbon arc, resistance welding, and oxyacetylene pressure welding. The equipment, recommended techniques and the quality of the resultant welds are covered. Ancillary processes such as cutting methods, heat treatment after welding, surface finishing, inspection and welders' competency tests each have been given a chapter. The final chapters deal with hetrogeneous welds and the welding of the related heat-resisting steels. There are one hundred illustrations and many tables, as well as appendices giving data on makes and specifications of steels. The book concludes with a bibliography and index.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Advanced mathematics in physics and engineering. Arthur Bronwell. Toronto, McGraw-Hill, 1953. 475 pp., charts, diagrs., $7.50.

Fundamental physical laws in many of the more important fields of physics and engineering are expressed in general form by mathematical formulations, forming a basis for the development of numerous applications. The text shows how these fundamental formulations simplify to special cases which often form the starting point in the solution of problems. The

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Alternating current wave-forms, 2nd ed. Philip Kemp. London, Chapman & Hall, Toronto, British book service, 1952. 406 pp., $10.00.

This volume is one of a series of monographs intended to give the electrical engineer a modern orientation of important subjects commonly inadequately treated in textbooks or of which the literature is widely scattered. It discusses non-sinusoidal waves, presenting the facts necessary for a proper understanding of the subject. The properties of complex waves, the effect of iron and of other circuit conditions, harmonics in polyphase systems and transformers, and harmonic analysis are treated.

Analysis of aluminum alloys. G. H. Osborn and W. Stross, eds. New York, Chemical Publishing Company, 1953. 144 pp., $3.50 (U.S.).

This book is a listing of methods of analysis, comprising part of the material gathered by a group of British firms in a survey of practices in member laboratories. It covers, for the common elements, gravimetric, volumetric, photometric, electrolytic, and polarographic methods; and also describes methods for the less common elements such as beryllium, bismuth, and sodium. Two composite schemes are given for the photometric determination of several elements from one weighing. Detailed procedures are given in line with the emphasis on practical application.

Experimental nuclear physics, vol. I. E. Ségre, ed. New York, Wiley, 1953. 789 pp., $16.50.

This is the first volume of a three-volume summary of the main results of nuclear physics research, to cover experimental techniques, significant facts and data, and the broad lines of theoretical interpretation. The five parts of the present volume, each a reasonably complete treatise on a restricted subject, deal respectively with the following topics: detection methods; passage of radiations through matter; nuclear moments and statistics; nuclear two-body problems and elements of nuclear structure; charged particle dynamics and optics, relative isotopic abundances of the elements, and atomic masses. Extensive references to the original literature are given.

The Gantt Chart; a Working Tool of Management, 3rd ed. Wallace Clark. Toronto, Pitman, 1952. 168 pp., $2.50.

A comprehensive explanation of the principle of the Gantt Chart and the form and operation of the major varieties of charts: machine record, man record, layout, project planning, load, progress, and executive direction. Practical applications are extensively used throughout and there is a special chapter on applications in various industrial fields from a machine shop to merchant marine operations. The whole treatment is thoroughly practical.

Heating, ventilating, air conditioning guide. 1953, volume 31. American Society of Heating and Ventilating Engineers, New York, The Society, 1953. 1,560 pp., $7.50 (U.S.).

The fifty-one chapters of this standard reference work cover a wide range of topics: fundamentals of thermodynamics; the physiological bases of heating and air-conditioning; calculation of heating and cooling loads of enclosed spaces; descriptions of systems and apparatus such as steam heating, panel heating, electric heating, refrigeration, and drying systems. It also includes instrumentation, pertinent codes and standards, a glossary of terms, and lists of abbreviations and symbols. There are detailed indexes, and the usual condensed manufacturers catalog section is appended.

Mechanical engineering thermodynamics. D. A. Mooney. New York, Prentice-Hall, 1953. 540 pp., graphs, $9.35 (U.S.).

An introductory textbook for students with college physics and mathematics, including elementary calculus. The usual topics are discussed in the general order of basic concepts, principles, data on substances, and engineering applications, with detailed examples and explanations employed to clarify points of procedure. Considerable emphasis is placed on the background and significance of laws and definitions. References are listed at the end of some chapters and pertinent tables and charts are included.

Oxidation of metals and alloys. O. Kubaschewski and B. E. Hopkins. New York, Academic Press, Toronto, Butterworth, 1953. 239 pp., diagrs. $6.00 (U.S.).

This detailed work, designed to bridge the gap between theoretical study and practical application, provides an appraisal of the state of research in the field and gives an account of the existing ideas on the subject. It includes the examination of oxidation products, methods of measurement, protection of surfaces, and much fundamental data. The list of references includes over 500 citations.

Simplified design of roof trusses for architects and builders, 2nd ed. Harry Parker. New York, Wiley 1953. 278 pp., illus. $4.40.

Basic principles and methods underlying the design of the common types of roof trusses are presented in a form suitable for the man who has not had preliminary training. The principles of graphic statics are first discussed, as an introduction to the determination of stresses in roof trusses. Part III deals with the practical design of steel trusses and solid bolted timber trusses. A new Part IV has been added in this edition covering trusses composed of built-up members utilizing timber connectors of various kinds.

Simplified drafting practice; a modern approach to industrial drafting. W. L. Healy and A. H. Rau. New York, Wiley, 1953. 156 pp., illus., $5.50 (Trade ed.)

The result of a study of drafting practices in the General Electric Company, this book describes practices and routines designed to reduce the time and effort required to make drawings. Practices recommended include simplification of delineation, elimination of non-essentials, extensive use of freehand drawing, and the use of mechanical aids such as drafting machines, typewriters, and computing devices. Contrasting examples of conventional and simplified drawings are presented to illustrate the economies resulting from adoption of the principles discussed.

Substation practice, 2nd ed. T. H. Carr. London, Chapman & Hall Ltd., Toronto, British book service, 1952. 467 pp., $11.00.

This companion volume to the author's, "Electric power stations", deals thoroughly with all aspects of substation design, construction, and operation. The early chapters describe types of substations, structures and outdoor equipment, and plant layout. Switchgear, transformers, converting plant, and protective equipment are also considered. The concluding chapters discuss technical considerations and questions of organization and control. The book is intended to serve as a reference work for engineers as well as a test for students.

Tensors in electrical machine theory. W. J. Gibbs. London, Chapman & Hall Ltd., Toronto, British book service, 1952. 238 pp., charts, diagrs., $6.00.

The elementary aspects of the application of tensor analysis to electrical machines are developed slowly and in great detail in the first half of the book. In this half geometrical terms and language are avoided except for occasional illustration. Subsequent development of the analysis requires the inclusion in the latter half of the book of a brief chapter on differential geometry, leading to the application of tensors to analytical dynamics, and thus to the treatment of rotating electrical machines as combined electrical and dynamical systems.

Vacuum technique. A. L. Reimann, London, Chapman & Hall, Toronto, British book service, 1952. 449 pp. $10.00.

An up-to-date account of the production and measurement of high vacua. The first seven chapters deal comprehensively with the general topic of pumping speeds and pump-line conductances, with the major types of pumps, and with pumping systems and procedures. The next three chapters deal with glass and its manipulation and with glass-to-metal seals. The last two chapters cover respectively the absorption of residual gases and the various kinds of manometers used in high vacua work.

Wave propagation in periodic structures, 2nd ed. Léon Brillouin. New York, Dover Publications, Inc., 1953. 255 pp., (pa.), $1.75. (U.S.)

This volume includes a variety of problems having a common mathematical background, extending from electrical engineering to electromagnetism and wave mechanics of the spinning electron. The book includes explanations of electric filters, rest rays, anomalous optical reflections, and selective reflection of X-rays or electrons from a crystal, and discussions of one-, two-, and three-dimensional lattices.

STANDARDS REVIEWED

ASTM Specifications, American society for testing materials. 1916 Race Street, Philadelphia 3, Pa.

ASTM standards on light metals and alloys. $3.00.

This compilation has been prepared to make these standards available in convenient form. The specifications and methods of test cover aluminum and aluminum-base alloys, and magnesium and magnesium-base alloys. These two groups are in turn broken down into ingots, castings, bars, rods, wire, shapes,

forgings, sheet and plate, tubes, filler metal and electroplating as subheadings.

ASTM standards on soaps and other detergents (with related information). $2.25.

The specifications, methods of test, and definitions included in this publication form a convenient reference manual for use in industry. There are seventeen specifications for many types of soaps and soap products, nine for various special detergents, and nine methods of analysis covering soaps and other detergents. Definitions of terms are also given. Methods of test in the appendices are proposed for rinsing properties of metal cleaners, for buffering action of metal cleaners, and for surface and interfaeial tension of solutions of surface-active agents.

British Standards, British standards institution, 24-28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 1916, part 1: 1953 — Limits and fits for engineering. 10/–.

The purpose of this standard is to provide a comprehensive system of limits and fits acceptable to British industry and also to offer a basis for a universal standard. It makes available in inch measure the same range of fits as the International Standards Association has provided in Europe. Tables of metric equivalents are also included and the same method of designating fits is applicable to both systems of measurement. The recommendations apply particularly to fits between cylindrical parts, designated as 'holes' and 'shafts'.

B.S. 1957: 1953 — Presentation of numerical values. 3/–.

This standard attempts to present a consistent procedure in the presentation and interpretation of numerical values, especially in regard to the number of figures to be used and the procedure for rounding. The values may represent technical data, experimental results, or requirements in specifications and drawings, or may take the form of tables. General principles and working rules are illustrated with examples.

B.S. 1958: 1953 — Tools for soldered socket-spigot joints for lead and lead alloy pipes. 2/6.

Tools used in the preparation of lead and lead alloy piping for straight soldered socket-spigot joints up to 1½ in. internal diameter are here covered. Specifications are given for dimensions and materials, with five pages of illustrations to aid the user. The appendix gives notes on the method of making a soldered socket-spigot joint.

B.S. 1965: 1953 — Seamless steel butt-welding pipe fittings. 3/–.

Specifications are given for the dimensions and tolerances, materials and method of manufacture, heat treatment, tests, pressure and temperature ratings, and marking applicable to these fittings. The standard covers 45° elbows; 90° elbows; return bends (180°); concentric reducers; eccentric reducers; and caps; but welding neck flanges are not included here.

B.S. 1966: 1953 — Domed ends for tanks and pressure vessels. 2/6.

An attempt has been made here to standardize the sizes and shapes of ends most commonly used. The standard is based largely on mild steel ends. It specifies the boundary dimensions of three types of dished and flanged, pressed or spun ends usually used as end closures of pressure vessels, tanks and similar equipment. Tolerances are given for circularity, thickness, and profile, with tables of dimensions in respect of inside or outside diameters, depth of dishing, dishing radius, knuckle radius and lengths of straight flange.

B.S. 1971: 1953 — Corrugated furnaces for cylindrical boilers. 5/–.

This new illustrated standard specifies requirements for corrugated furnaces for both land and marine cylindrical boilers

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AUTOMATIC
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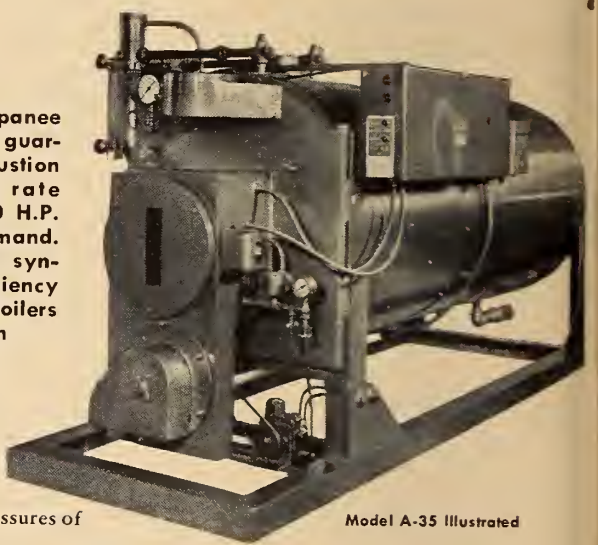
When you install a Napanee Automatic Boiler, you are guaranteed at least 80% combustion efficiency. The firing rate on boilers from 75 to 500 H.P. varies according to the demand. The air and oil supply is synchronized to give high efficiency of fuel at all loads. On boilers from 10 to 75 H.P., off-on controls provide maximum efficiency.



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- Oil or gas firing
- Guaranteed 80% combustion efficiency
- 15 to 500 H.P. in working pressures of 15 to 200 lbs.
- No brick setting or large smoke stack required
- Easily accessible for cleaning and maintenance
- No dust, no smoke, self-contained automatic unit
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- Exclusive Napanee firing method for uniform radiant flame
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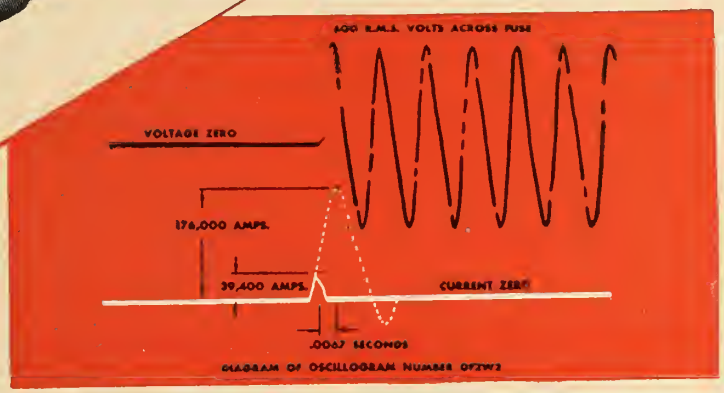

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and covers the Fox, Morison, Deighton, and Suspension Bulb types of furnaces with various throat designs and typical connections for riveting or welding. Dimensions of corrugations and lengths of furnace are given, together with formulae for determining the minimum thickness of the furnaces. Materials, construction and heat treatment are also covered.

B.S. 1974: 1953 — Large aluminium alloy rivets. 4/–.

The types of rivets covered in this standard are small snaphead, conical head, small pan-head, rounded or flat countersunk, and shallow rounded or flat countersunk head. Specifications are provided for the materials, dimensions and head shapes of the rivets of nominal sizes ranging from ½ in. to 1 in. diameters. A table of dimensions for each type is included and nominal diameters of the rivets are defined. Head-forming tests and shear tests on the rivet stock and on the manufactured rivets are covered.

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Architectural & engineering law. Bernard Tomson. New York, Reinhold, c1951. 424 pp., $7.00 (U.S.)

Basic mechanics of fluids. Hunter Rouse and J. W. Howe. New York, Wiley, c1953. 245 pp., illus., $4.50 (U.S.)

Calcul des conduites d'eau avec cheminées d'équilibre. Louis Couffignal, éd. Paris, Gauthier-Villars, c1953. 78 pp. $3.00. (Manuels de calculs techniques, vol. 1).

Canada: descriptive atlas. Ottawa, Department of citizenship and immigration, 1951. Unpaged, illus., maps, $1.00.

Cast bronze. H. J. Roast. Cleveland, American Society for Metals, c1953. 458 pp., illus., $4.00 (U.S.)

Covered bridges of New England, revised ed. C. E. Wagemann. Rutlant, Va., Charles E. Tuttle co., c1931. 152 pp., illus., $5.50.

Diesel vehicles; operation, maintenance and repair, 6th ed. F. J. Camm, ed. London, Newnes. Toronto, British book service, 1953. 107 pp., illus., $1.50.

Elements of electricity, 4th ed. W. H. Timbie and Alexander Kusko. New York, Wiley, c1953. 631 pp., illus. $6.05.

Engineering drawing. J. V. Lombardo L. O. Johnson and W. I. Short. New York, Barnes & Noble, c1953. 432 pp. illus., (pa.) $2.00 (U.S.) (College outline series).

Engineering valuation and depreciation, 2nd ed. Anson Marston, Robley Winfrey and J. C. Hempstead. Toronto, McGraw-Hill, c1953. 508 pp., illus., $9.60.

Filter design data for communication engineers. J. H. Mole. London, Spon, Toronto, British Service, 1952. 252 pp., charts, diagras., $12.00.

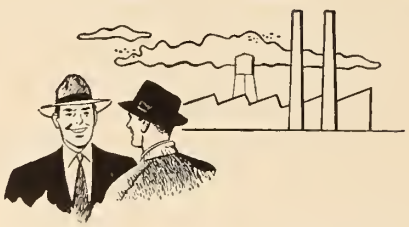
History of strength of materials. S. P. Timoshenko. Toronto, McGraw-Hill, 1953. 452 pp., illus., $12.00.

How to understand and use TV test instruments. M. S. Kiver. Indianapolis, Howard W. Sams & co., 1953. 147 pp., illus., (pa.) $3.00 (U.S.)

Microwave spectroscopy. Walter Gordy, W. V. Smith and R. F. Trambarulo. New York, Wiley, 1953. 446 pp., illus., $8.80.

Modern electric lamps. D. A. Clarke. London, Blackie, 1952. 205 pp., illus., 20/–.

Newnes' slide rule manual, 5th ed. F. J. Camm, London, Newnes, Toronto,



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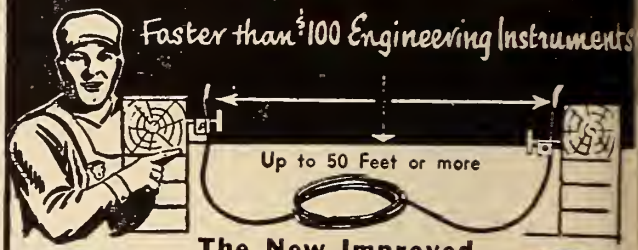

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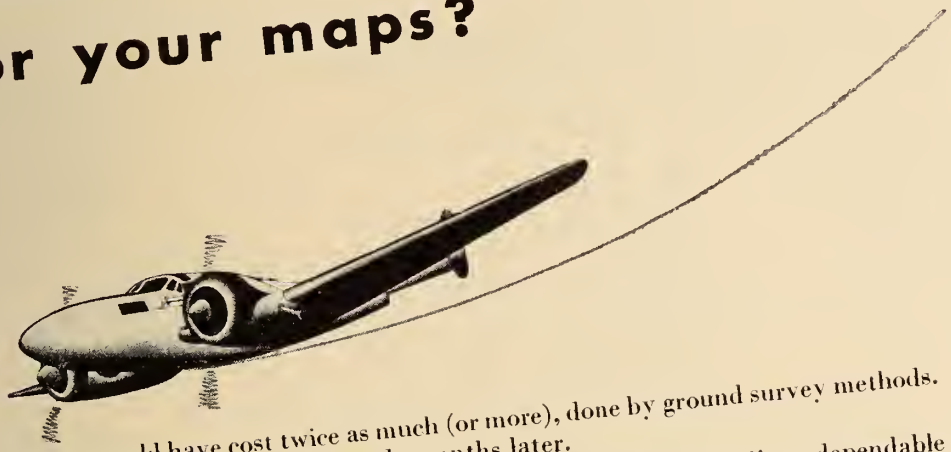

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British book service, 1952. 112 pp., illus., $1.25.

The origin of life, 2nd ed. A. I. Oparin. New York, Dover, c1953. 270 pp., (pa.) $1.70 (U.S.)

Planning elementary school buildings. N. L. Engelhardt, N. L. Engelhardt jr., Stanton Leggett. New York, F. W. Dodge, c1953. 275 pp., illus., $12.50 (U.S.)

Presswork and presses. J. A. Grainger. London, Machinery, 1952. 258 pp., illus., $15.00.

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TV manufacturers' receiver trouble cures, volume 3. M. S. Snitzer, ed. New York, Rider, c1953. 119 pp., diagrs., (pa.) $1.80 (U.S.)

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Theory of functions of real variables H. P. Thielman. New York, Prentice Hall, c1953. 209 pp., $6.65 (U.S.)

UHF antennas, converters and tuners M. S. Kiver, Indianapolis, Howard W. Sams & co., 1953. 134 pp., illus., (pa. $1.50 (U.S.)

UHF converters; their design and how they work. Indianapolis, Howard W. Sams & co., 1953. 42 pp., illus., $1.0 (U.S.)

Water supply and sewerage, 3rd ed. E. W. Steel. New York, McGraw-Hill 1953. 582 pp., illus., $9.60.

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Alloy rods company. Technical bulletins:

The facts about low hydrogen electrodes, by R. K. Lee and J. O. Cavanagh.

American society for testing materials. Special technical publications:

No. 90-B — Metal cleaning bibliographical abstracts, 1842-1951, prepared by J. C. Harris.

No. 137 — Symposium on fatigue with emphasis on statistical approach — II.

No. 139 — Symposium on statistical methods for the detergent laboratories.

No. 148 — Manual on industrial water, 1953.

British electrical and allied industries research association. Annual reports:

42nd annual report, 1952-53.

. . . Technical reports:

No.G/T271 — Flameproof electrical apparatus: flanged joints, one half-inch in radial breadth, with atmospheres of normal butyl alcohol and air, by H. Robinson, and H. L. Williams. No. G/T274 — Flameproof electrical apparatus: flanged joints, one half-inch in radial breadth, in mixtures of acetone vapour and air, by H. Robinson, J. T. W. Roper and H. L. Williams. No. G/T278 — The ignition of methane-air gas mixtures by capacitive spark discharges, by H. G. Riddlestone. No. V/T105 — Deterioration of insulation by electrochemical agents: moisture detection by tests at very low frequencies, by G. Mole and D. C. G. Smith. No. W/T23 — Pest control by high-frequency electric fields — critical résumé, by A. M. Thomas. No. W/T26 — The use of electricity to increase soil temperature, by E. W. Golding.

Business screen magazine. Annual buyer's guide issue of qualified film producers:

No. 1, vol. 14 — Production review 1953.

CCH Canadian Limited. Income tax acts:

19th edition, 1953 — Canadian income tax act.

Canada. Dominion bureau of statistics. Yearbooks:

The Canada year book, 1952-53.

Canada. National research council. Canadian government specifications board. Specifications:

3-GP-Index — Numerical and classified index of specifications for petroleum and associated products.

3-GP-61 — Oil; fog.

3-GP-530 — Alcohol; denatured.

3-GP-851 — Compound; inhibitor, corrosion (for water or redistilled ethylene Glycol).

3-GP-852 — Compounds; oil and water level indicating.

8-GP-1A — Sieves; testing, woven wire.

15-GP-10 — DDT (Dichlorodiphenyltrichloroethane).

15-GP-14 — Insecticide; DDT, dust.

15-GP-15 — Insecticide; DDT, 50 per cent, water-dispersible powder.

15-GP-17 — Insecticide; DDT, 5 per cent, oil solution (residual spray).

15-GP-23 — Benzene hexachloride (BHC).

15-GP-24 — Lindane.

43-GP-4 — Adhesive; liquid vegetable.

43-GP-5 — Compound; sealing, dip-coating.

43-GP-6 — Compound; protective strippable hot dipping.

43-GP-1472 — Adhesive; label (water resistant).

46-GP-1 — Blades; hack saw.

47-GP-1 — Syringes; all-glass, luer.

47-GP-2 — Needles; hyperdermic, for Luer syringes.

Canadian standards association. Approvals laboratories:

List of approved equipment, 4th ed. 1952.

List of approved equipment, 4th ed. Supplement A, 1953.

Edison electric institute and National electrical manufacturers association. Standards:

EEI No. 53-1 (NEMA No. 114-1953) — EEI-NEMA standards for distribution transformers, overhead type.

Institute of physics. Monographs for students:

Fundamentals of thermometry, by J. A. Hall.

The magnetic circuit, by A. E. de Barr

Practical thermometry, by J. A. Hall.

Soft magnetic materials used in industry, by A. E. De Barr.

Machinery market. Yearbooks:

M. M. year book, 1953.

Den Norske ingeniorforening. Yearbooks:

Arbok, 1953.

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C299 — Dry-chemical hand fire extinguishers.

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Parking authorities. E. G. Mogren. Saugatuck, Conn., Eno foundation for highway traffic control, c1953.

Pioneering in aeronautics: recipients of the Daniel Guggenheim medal, 1929-1952. New York, Daniel Guggenheim medal board, 1952.

Surface temperatures of the Great Lakes. F. G. Millar. Ottawa, Dept. of transport, Meteorological division, Air services branch, 1951.

A tradition lives: the story of The Gazette, Montreal. Montreal, The Gazette, 1953.

From the ground up — from raw ore
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Canadian hands fashion the ore to its many purposes,
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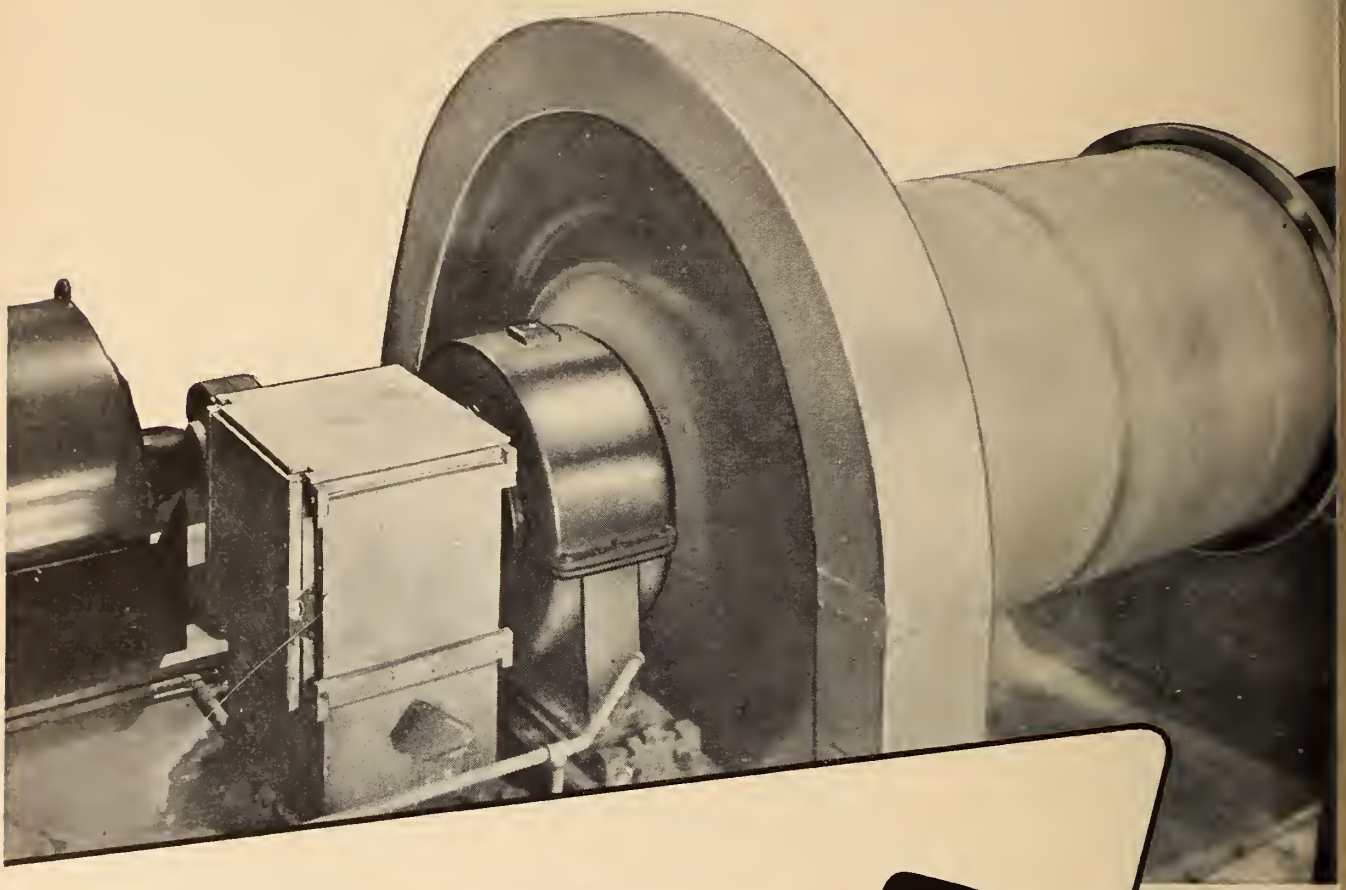

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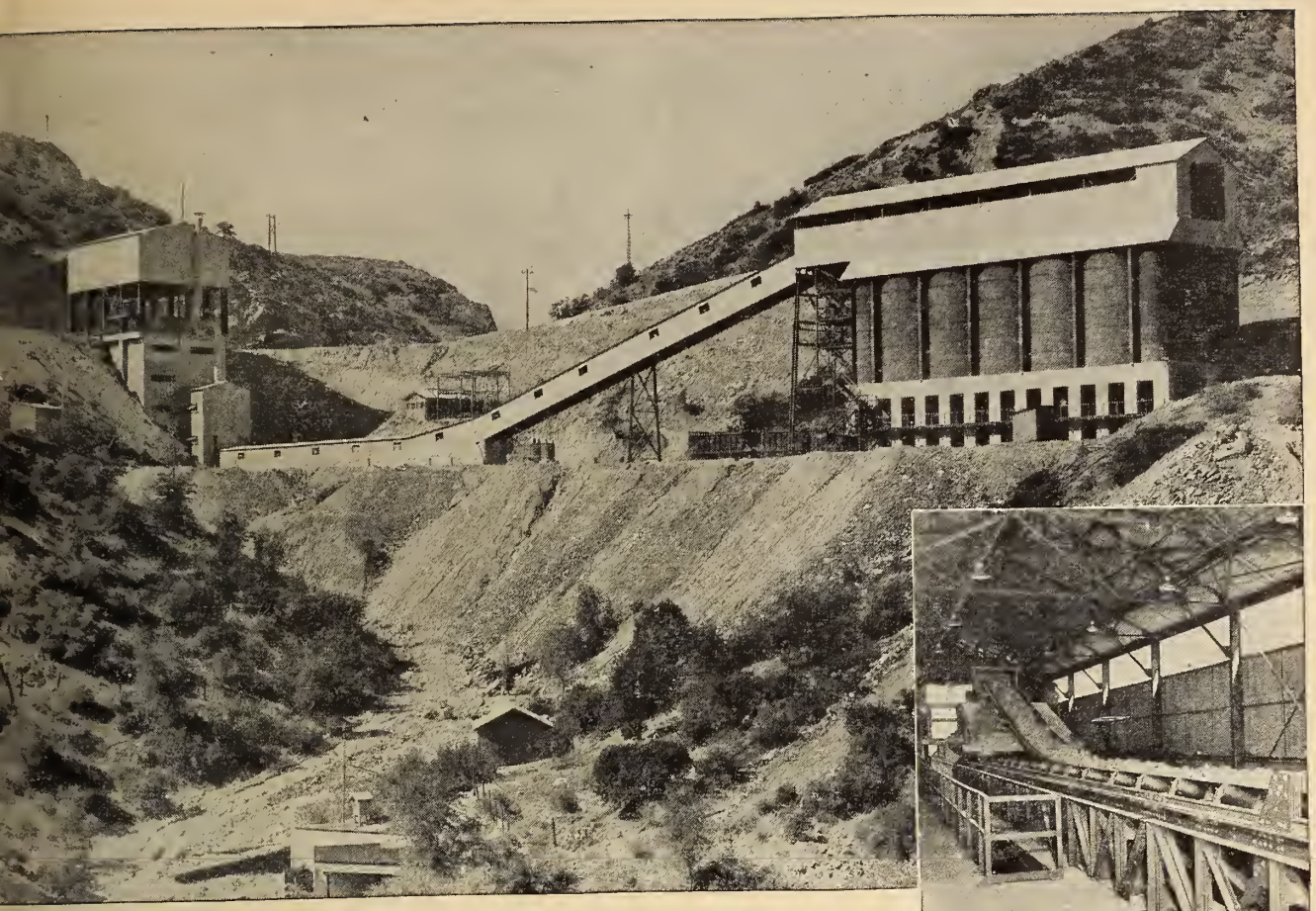

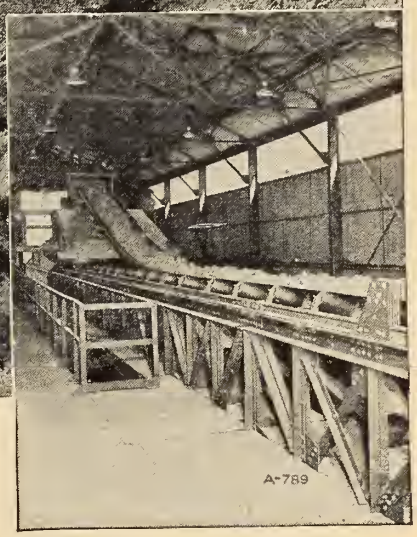

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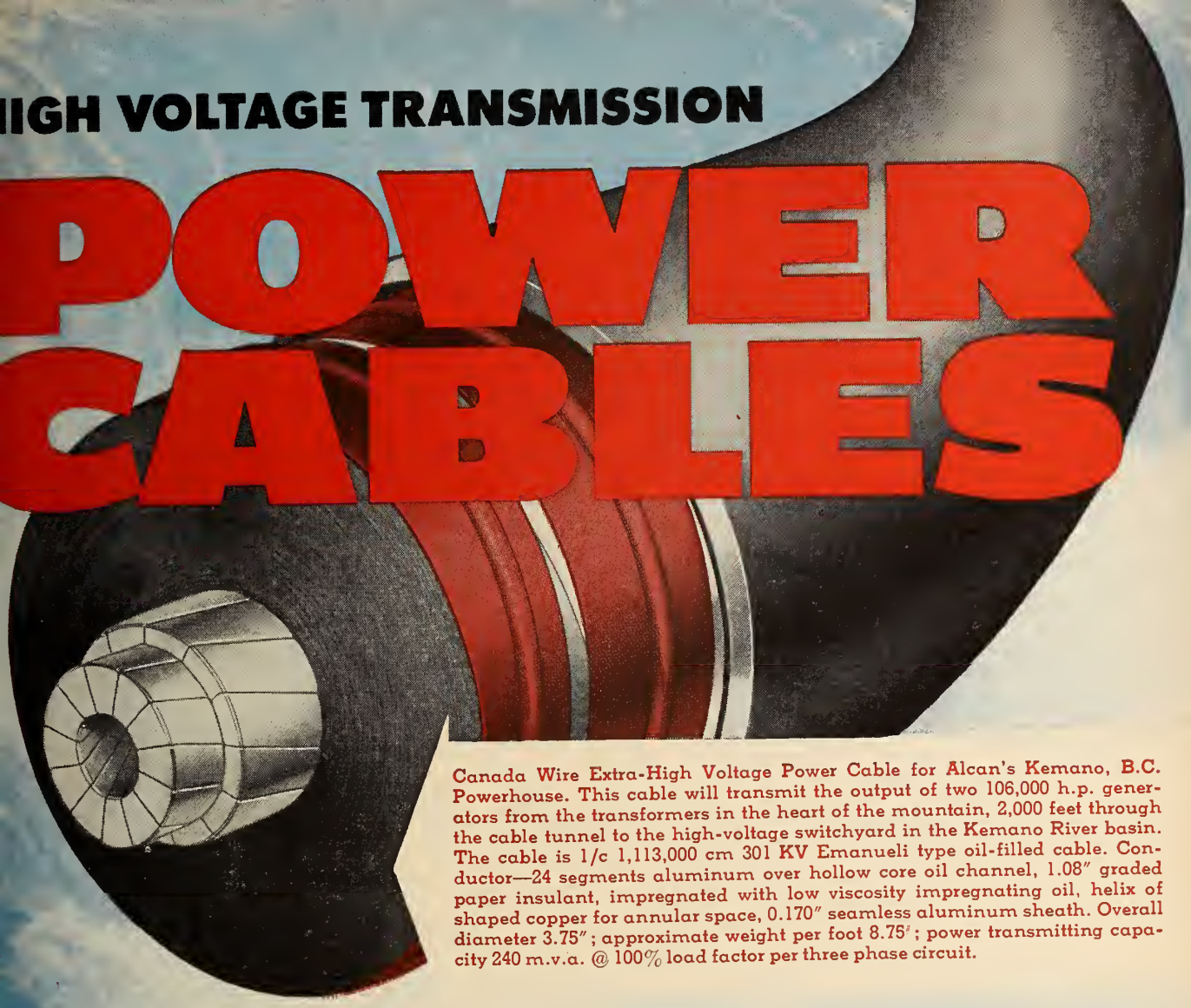

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c, 650,000 cm, 120 KV Emanueli Oil Filled submarine cable, E.C.—Baie d'Urfe, Quebec.

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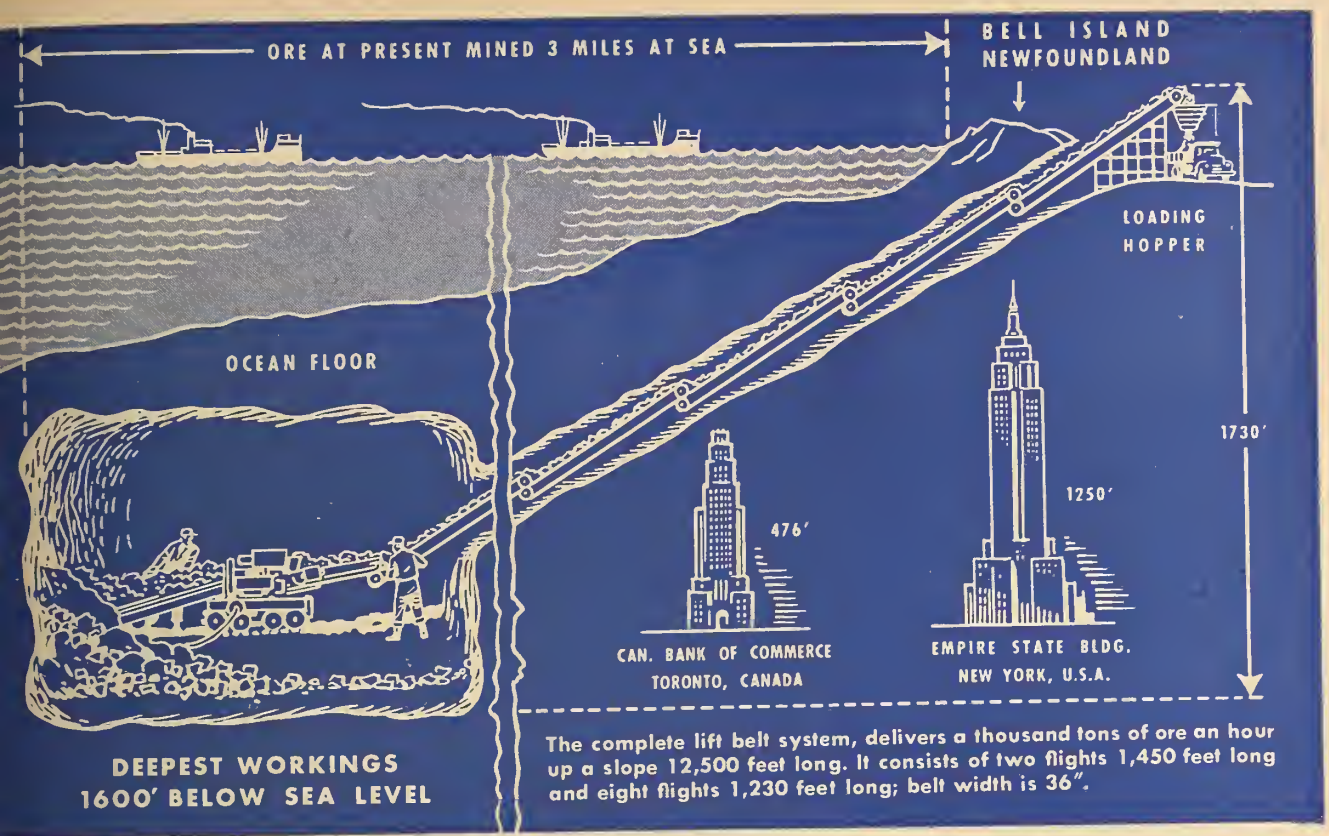

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...5-Mile Belt System lifts Iron Ore 1730 FEET at 1000 tons an hour...

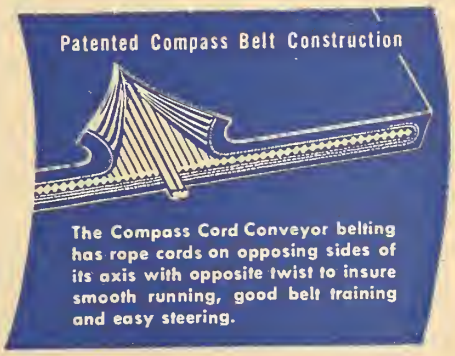
The world's most unusual mine is probably the Wabana Iron Mine in Newfoundland, owned and operated by The Dominion Steel and Coal Corporation of Sydney, N.S. One of the world's richest iron mines, its underground operations extend three miles out from shore, 1,600 feet below sea level. For years this important source of ore was worked by slow, intermittent loading. Later, mechanical equipment and track transport were used in an effort to bring the iron ore to the surface more rapidly.

High present and future ore demands from the Wabana Mine necessitated a more efficient means of handling the output. To raise the daily tonnage to a new high, Goodyear was selected to design and build belts for a conveyor system that would treble production. Five miles of 36" wide Goodyear belting were required to complete the system.

Specifying its world-famous Compass Cord Belts, Goodyear belted this slope conveyor system of ten "flights"—to lift the ore a thumping 1,730 feet to dwarf every known lift—setting a *world's record for vertical climb.* This system of ten belts—each bodied with rope cords in the load-carrying section—will haul a thousand tons of ore each hour up the slope.

Goodyear has built "rubber railroads" that have set tonnage records the world over. Of the fifteen highest slope lifts in the world, thirteen, including the top three, are equipped with Goodyear belts. The world's longest single flight conveyor—installed in one unit—just over two miles, centre to centre, is Goodyear built.

If you have any unusual conveyor or drive problems let Goodyear help you solve them. Write or call your nearest Goodyear Branch—Saint John, N.B., Quebec City, Montreal, Toronto, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver.

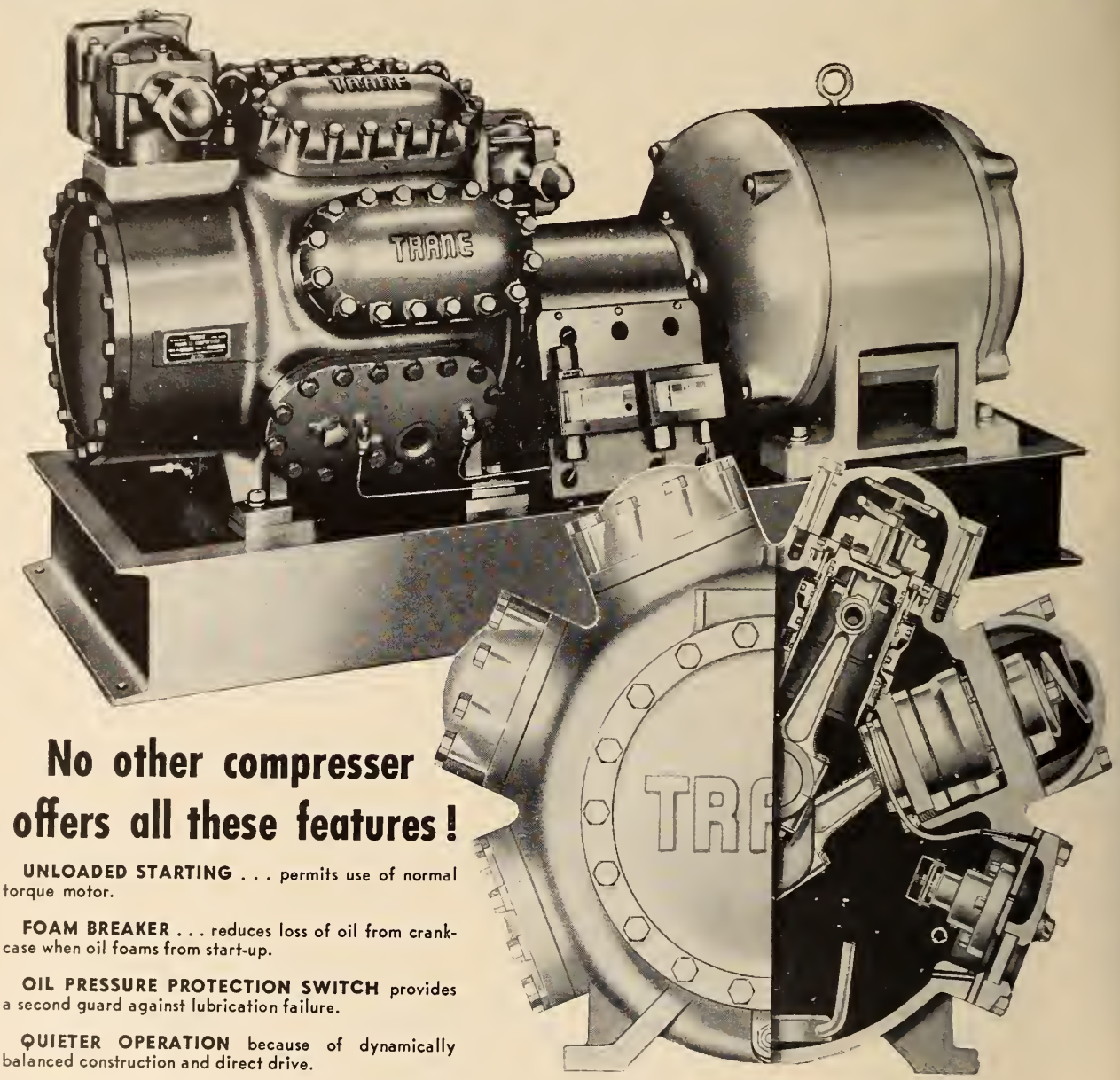


GOODYEAR

INDUSTRIAL RUBBER PRODUCTS ENGINEERED FOR THE JOB

You need THIS COMPRESSOR to give customers

UTMOST SATISFACTION



No other compresser offers all these features!

UNLOADED STARTING . . . permits use of normal torque motor.

FOAM BREAKER . . . reduces loss of oil from crankcase when oil foams from start-up.

OIL PRESSURE PROTECTION SWITCH provides a second guard against lubrication failure.

QUIETER OPERATION because of dynamically balanced construction and direct drive.

SIMPLIFIED INSTALLATION with fewer connections to make on job—it's factory assembled!

MODERN DESIGN with two piston sizes, 2, 4 and 6 cylinders, 10- to 50-ton capacity.
Available with shell-and-tube condenser above compressor.

SMOOTHER OPERATION because of carefully balanced light-weight aluminum pistons and connecting rods.

The New TRANE RECIPROCATING COMPRESSOR

For FULL INFORMATION about the TRANE Reciprocating Compressor, contact the TRANE representative in your area, or write Trane Company of Canada Limited, 4 Mowat Avenue, Toronto 3, Ontario.

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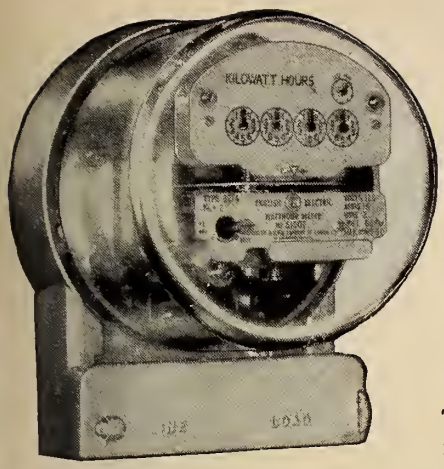


longer bearing life

Here's why

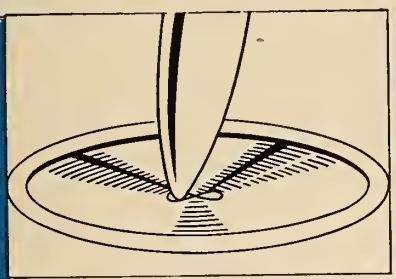
The wear in meter bearings is caused by vibration, side thrust and normal rotation.

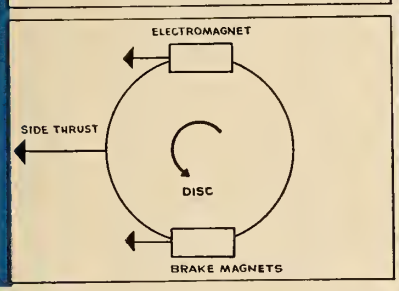
The voltage coil flux which acts continuously night and day, whether the meter is measuring load or not, produces in the disc a 120 cycle vibration and a 60 cycle vibration. These vibrations are at right angles and cause the lower pivot to describe a figure "8" path on the jewel. During a year the pivot in an ordinary meter travels about 40 miles in this manner while the pressure on its point may exceed 70 tons per square inch—a formidable combination for wear.

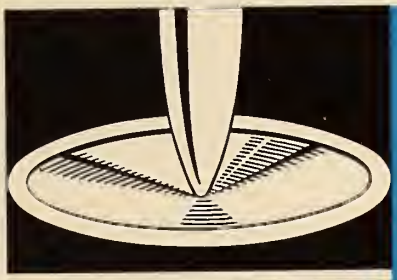
The life of the bearings of the new English Electric meters has been increased enormously by:

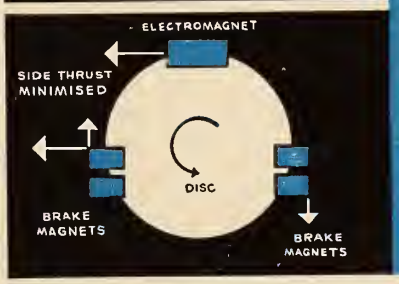
1. Providing two pairs of double pole permanent magnets arranged so as to—
   (*a*) Cancel out most of the vibration and thus reduce the annual pivot travel to less than 6 miles.
   (*b*) Halve the side thrust.
2. Reducing the speed of rotation which reduces the rotational wear and also reduces the total pivot travel.

OTTOM PIVOT AND WEL in an ordinary er using this com- ation of driving ectromagnet and king permanent gnet system. Driv- force and braking rce produce side rust equal to their









BOTTOM PIVOT AND JEWEL in English Electric type B21 meter with balanced double brake magnets and electromagnet system. As the two braking forces act in opposite directions their effects on side thrust cancel, minimizing the total side thrust and parasitic forces.

PERMANENCE OF CALIBRATION is ensured by the use of one-piece laminations and high coercive force brake magnets.

EXCEPTIONAL ACCURACY over a wide load range is obtained by low speed of operation; high degree of linearity in the electromagnet design; and high ratio of permanent magnet damping to A.C. damping flux.

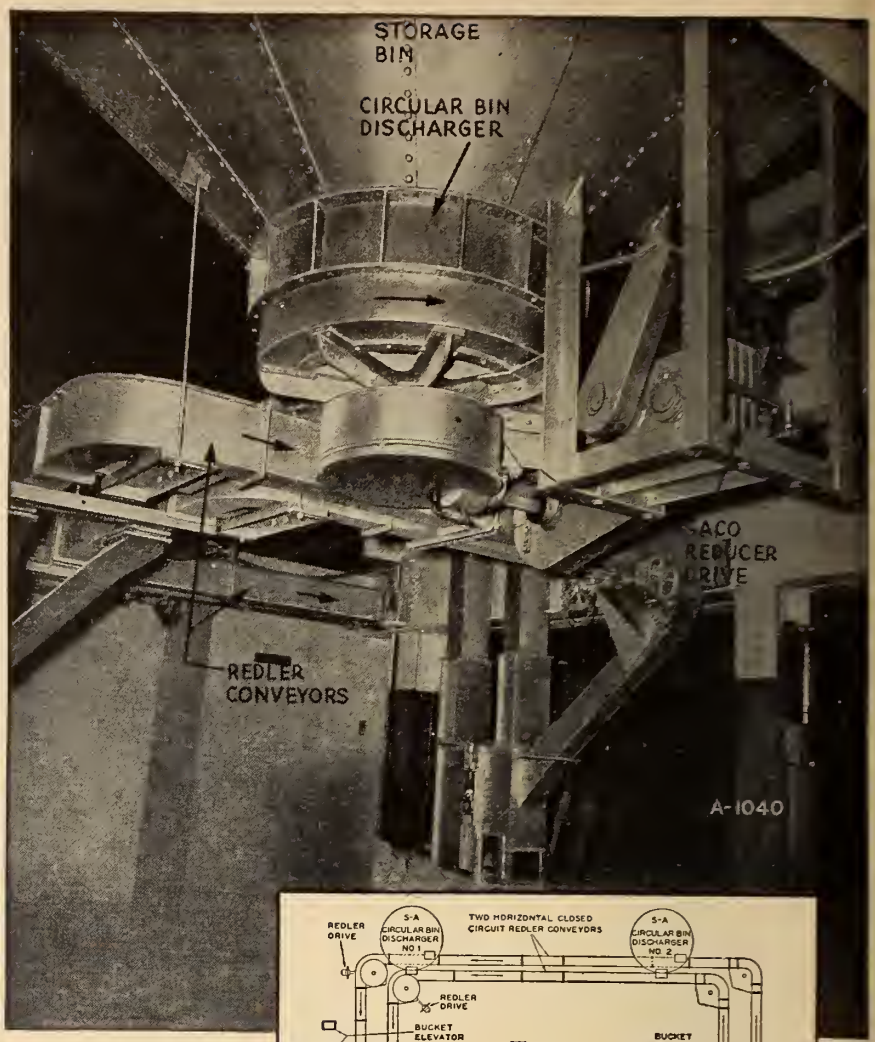
PA5321B

'ENGLISH ELECTRIC'

WATTHOUR METERS

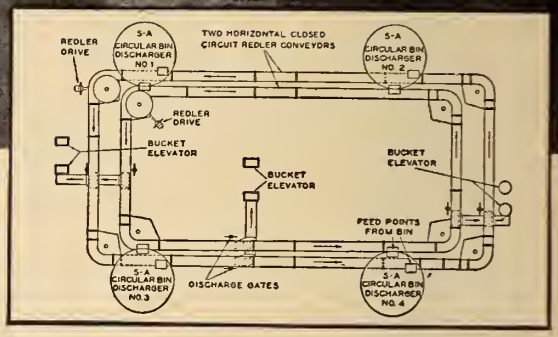
Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

English Electric Company of Canada Limited *Head Office and Factory: St. Catharines, Ontario*



Pushbutton Delivery System . . . .

BULK INGREDIENTS READILY FLOW . . . . . IN *CONTROLLED* VOLUME



In the modern plant of this century-old brewery, as well as in many other process industries, a controlled, uninterrupted flow of bulk materials is essential for efficient, economical operations. This S-A handling system moves malt and corn grits from storage to processing quickly and cleanly . . . completely mechanized with pushbutton controls.

S-A Circular Bin Dischargers are teamed up with a pair of horizontal closed-circuit REDLER conveyors. Arching and clogging of materials in bins is eliminated . . . discharge to conveyors is positive, even and quiet . . . no need for vibration or hammering.

If you need a bulk conveyor installation that will give operating convenience with economy, take your problem to S-A engineers . . . they have the experience and the equipment to help you find the low cost solution. Write today.

THE F & M SCHAEFER BREWING CO.
Brooklyn, New York

This bulk handling system gives controlled flow of two different materials . . . with quick changeover from one to the other. Projecting finger flights and rotating cone in each S-A Bin Discharger feeds materials through gate controlled spouts to the REDLER conveyors which are arranged concentrically under the four bins. Materials are conveyed around to discharge points where bucket elevators receive and lift materials to brewing operations on upper floors. (see plan view, above) Surplus materials are recirculated in the closed-circuit REDLERS until needed . . . no danger of overflow.

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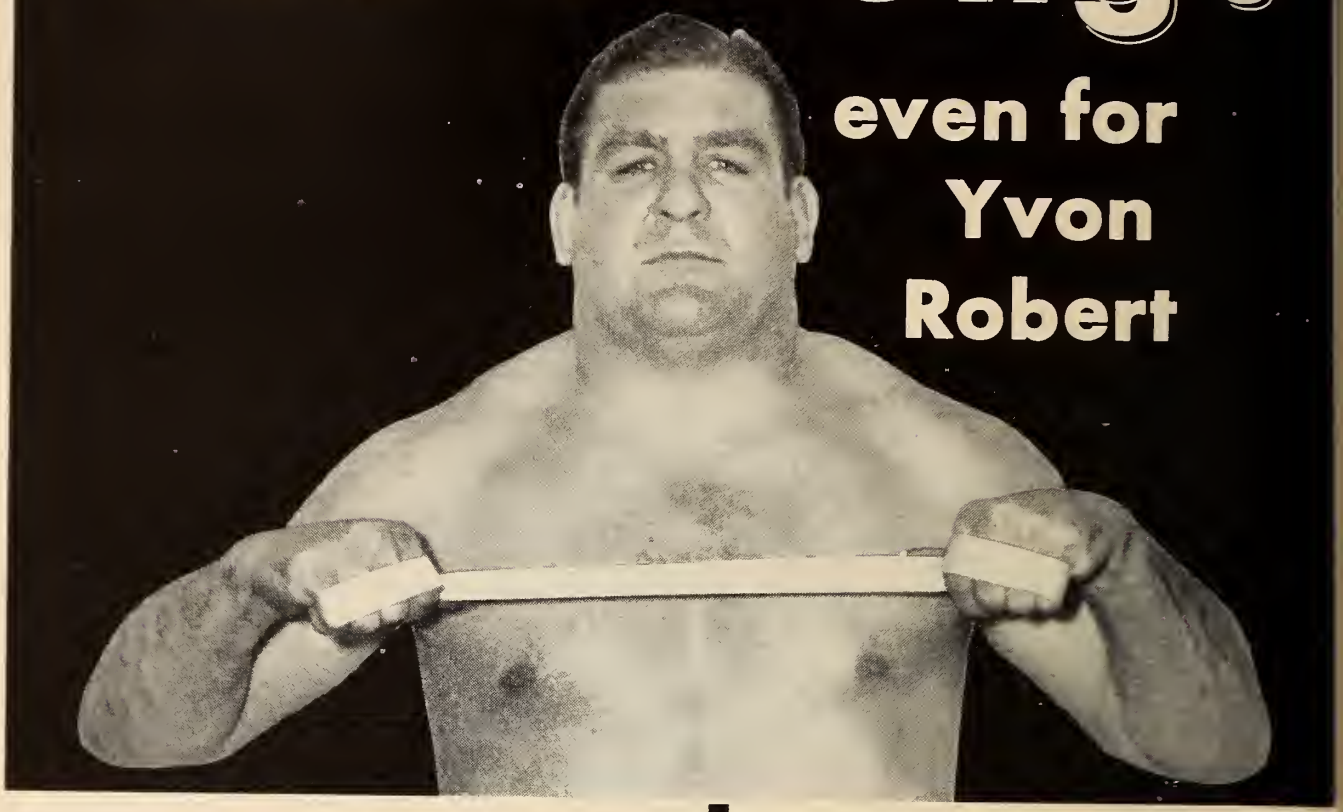

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STANDARD STEEL-FRAMED
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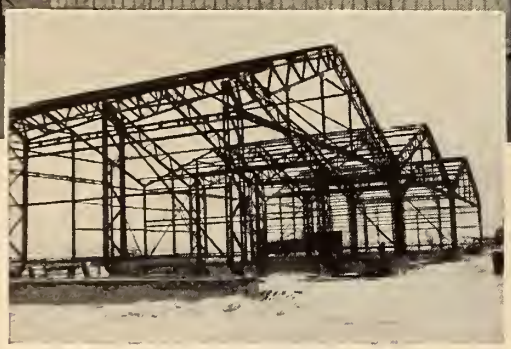

"Coseley" Standord Structurol Steel Fromework of Canadair Test Hongor Building

Photas, caurtesy of Canadair Limited

Check all steps from ground to apex.

From foundations to roofs all "Coseley" Standard Steel Buildings prove themselves, foot by foot, practical, efficient and dependable and, foot by foot, 15 to 20% lower in cost than any other comparable structures.

Progressive industries everywhere are investigating the possibilities of "Coseley's" cost-saving building methods as applied to their own activities.

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- SAFE — made doubly so by their many exclusive features —
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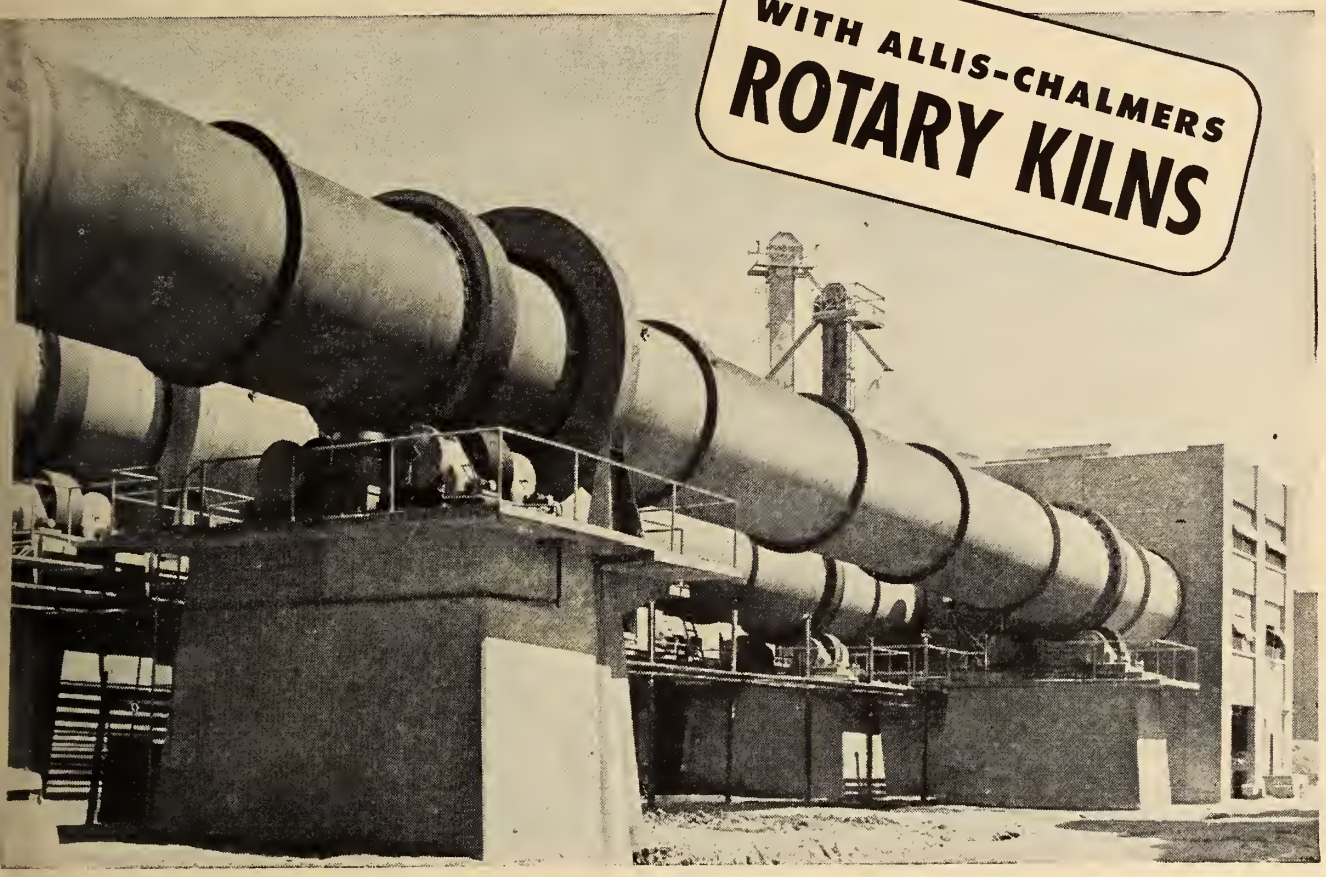

A-C Kilns Give You These Benefits:

- **Heat recuperating chain system saves fuel.**
- **Kiln design provides continuity of operation.**
- **Maximum capacity at lowest possible fuel consumption.**

THE feed end of the A-C rotary kiln may be equipped with a heat recuperating chain system which efficiently transfers heat from hot gases to wet material. This chain system provides a large heating surface which effects the exchange of heat, gives low flue gas temperature and cuts dust loss.

The kiln's relatively small diameter and long length provide the slenderness ratio necessary for good fuel economy. In a long kiln, the calcining zone is extended and provides a longer retention time at lower temperatures, reducing fuel consumption. The A-C kiln also has air-cooled ends for high temperature applications.

Whether your problem is lime recovery, cement manufacture or pyro processing, Canadian Allis-Chalmers manufactures a complete line of kilns, coolers and dryers to meet your every need. For full information call the CA-C Sales Office nearest you or write to Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Quebec for Bulletin No. B6368.

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CANADIAN ALLIS-CHALMERS

A-C ALLIS-CHALMERS

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From a modest beginning, Upton Bradeen and James today enjoys the confidence of a large section of Canadian industry. Wherever mill supplies and machine tools are used, U.B.J. stands for facility in supply, technical ability, quality and service on equipment from the four corners of the earth, through U.B.J. offices from coast-to-coast.

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To meet the terrific stresses, the main structural parts of landing gear units on the CF-100 are made from Type 4340 Nickel-Chromium-Molybdenum steel.

Modified, this material can be heat treated to a tensile strength of 290,000 pounds per square inch. This Nickel alloyed steel provides remarkable toughness at this high strength level that results in an extra margin of dependability and resistance to occasional overstressing.

The outstanding mechanical properties of Type 4340, including strength, toughness, and resistance to shock and fatigue, make it a well-proven economy on tough jobs.

Atlas Steels Limited, Welland, Ontario, are Canadian producers of 4340 Nickel steel and also a slightly higher alloyed steel known as Ultimo 4.

for the toughest jobs

4340

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INCO *proven* SERVICE

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, copper-base and other alloys containing Nickel. This information is yours for the asking. Write for "List A" of available publications.

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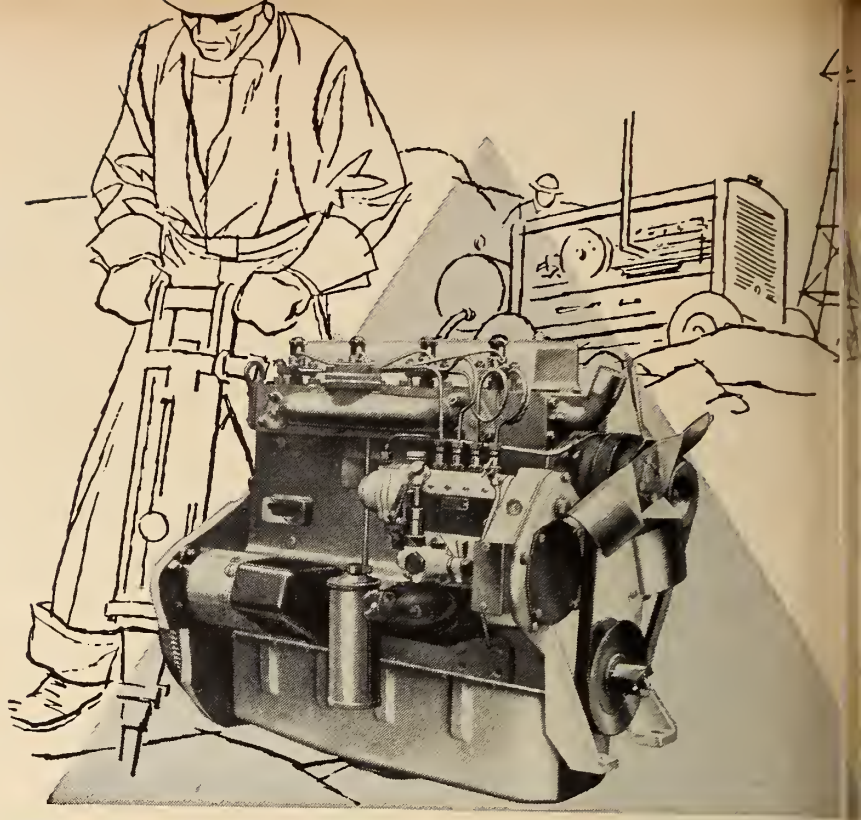

PERKINS L-4 4 CYLINDER DIESEL

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speeds up to
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Designed specifically for industrial use, the Perkins L-4 is a versatile high-speed diesel engine--built to sell at a low price! You can use it for driving generating sets, pumps, compressed air equipment, welding sets and many other jobs. And, you can count on it to operate reliably and economically over long periods.

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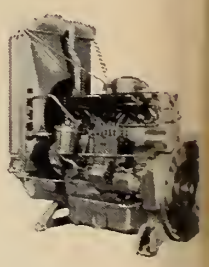
For complete facts on the Perkins L-4 Diesel Engine, get in touch with us. And, if you require any engine to fit a special need, Perkins Service Engineers will gladly help you with your problem.

another **powerful** Perkins engine



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Developing 32/85 H.P. at 1000/2400 R.P.M. Proven throughout the world in a wide variety of applications, the powerful P-6 has an outstanding record of trouble-free operation.

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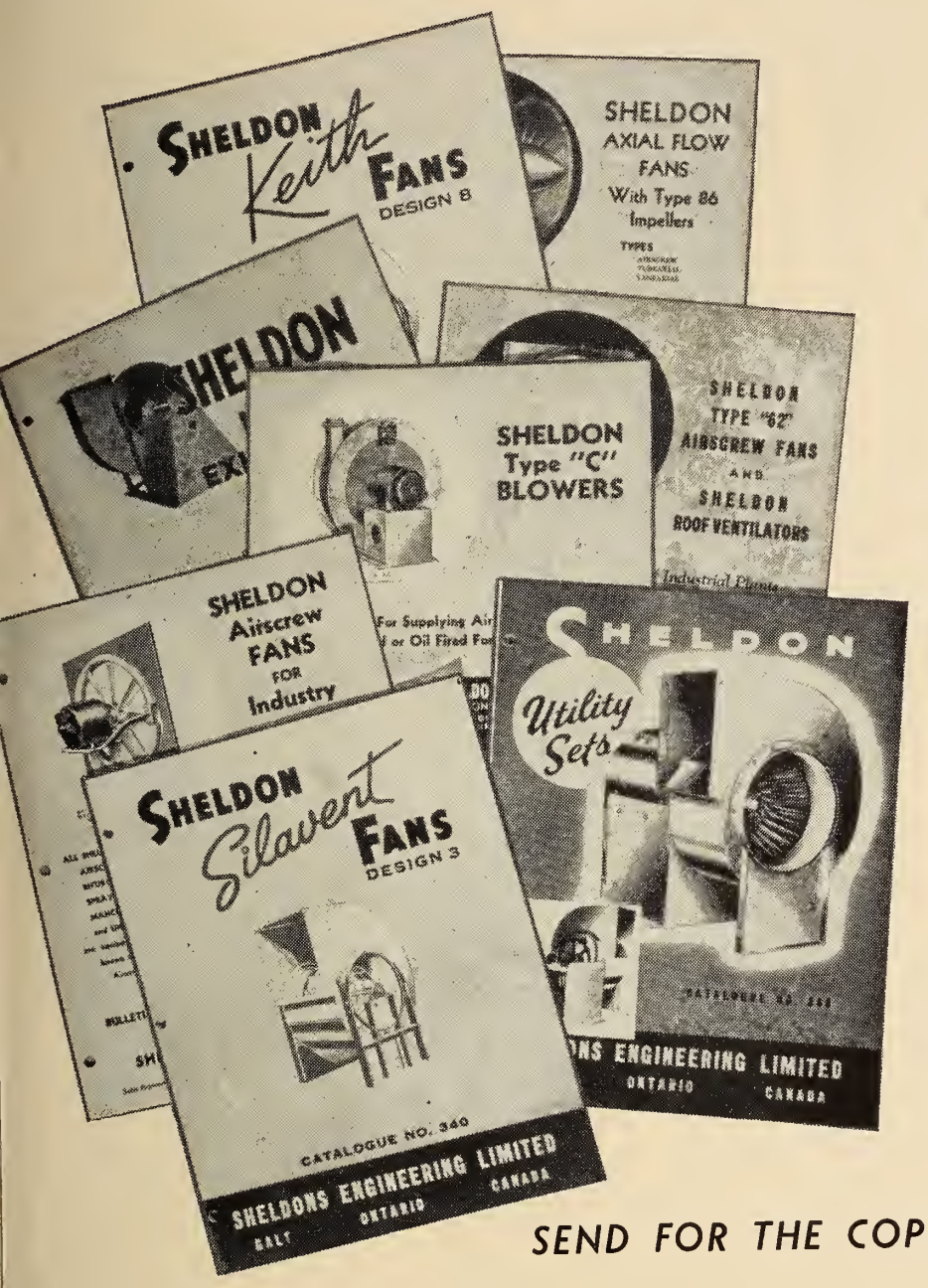

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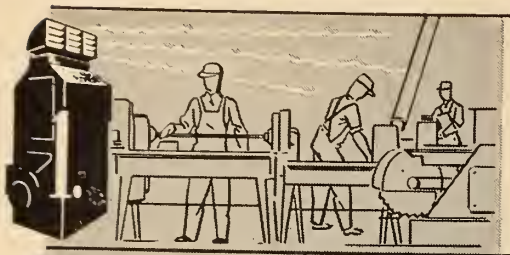
HERE ARE *5 ways*

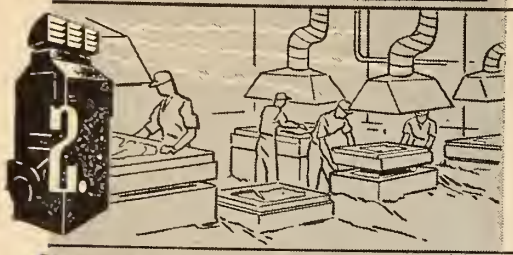
A DRAVO *Counterflo* HEATER* CAN WORK FOR YOU!

*DIRECT-FIRED



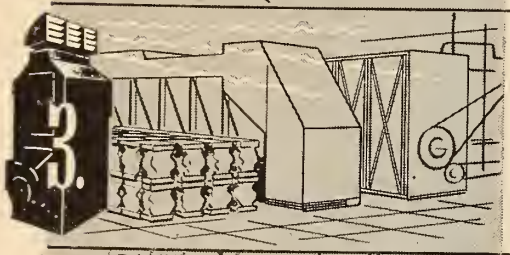
COMFORT HEATING *(commercial and industrial)*

Dravo Heaters have a 150-foot air throw and recirculate warm air at the working level, giving maximum comfort with minimum roof heat loss. No expensive pipe covering, radiators or ducts required. Quick warm-up; automatic on-off or modulating controls.



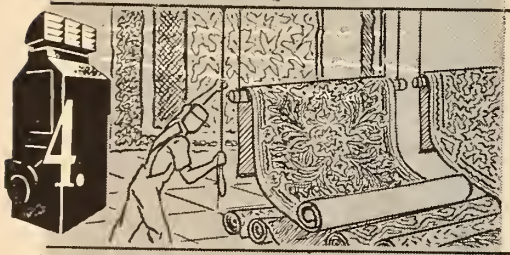
TEMPERING MAKE-UP AIR

Where dust-filled or fume-filled air must be removed from a building by exhausters, this air can be replaced and tempered by Dravo Heaters. Equal pressure is maintained . . . working conditions are kept comfortable.



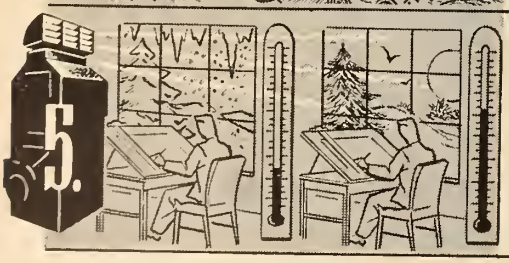
HEAT CURING

Dravo Heaters can be used independently or in combination with other equipment for process curing concrete, plastics, paper, fibre containers, rubber and many other products. Automatic temperature controls keep air flow at desired temperature.



PROCESS DRYING

Moisture content of air can be controlled or removed entirely by using fresh or recirculated air. Immediate response to temperature controller demand makes it ideal for drying paint, farm crops, wood products, rugs (after cleaning) and many other processes.



YEAR-'ROUND VENTILATION

In addition to comfort heating, Dravo Heaters provide fresh-air ventilation in warm weather and can be easily tied in with air-conditioning systems.

DRAVO HEATER *Plus* VALUES . . .

- Low initial cost . . . users report 30% to 60% savings on installation.
- Direct-fired . . . law fuel consumption . . . burn gas or oil . . . readily canverted.
- Long service life, low maintenance . . . stainless steel combustian chamber eliminates refractory lining.
- Easily moved to any location to fit your requirements.
- Flexibility . . . can be mounted horizontally or vertically on floor, walls or ceiling.
- Available in sizes from 400,000 to 2,000,000 Btu/hr.

WRITE FOR MORE INFORMATION. It's worth your while to look into Dravo Counterflo Heaters for ony of these five functions shown obove. You'll be glad you did.

DRAVO

HEATING DIVISION

MARINE INDUSTRIES LIMITED

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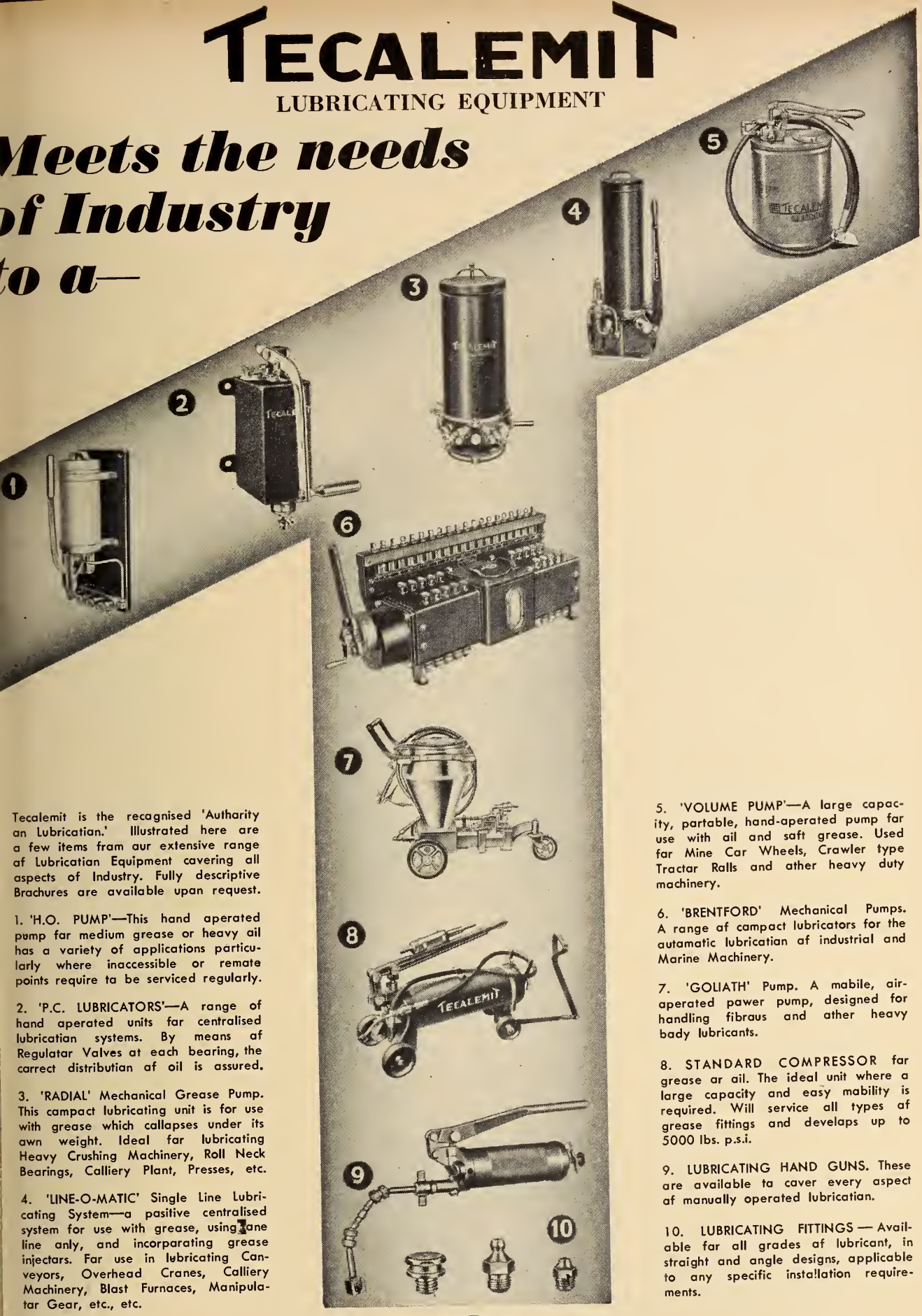
LUBRICATING EQUIPMENT

Meets the needs of Industry to a—



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2. 'P.C. LUBRICATORS'—A range of hand aperated units far centralised lubricatian systems. By means af Regulatar Valves at each bearing, the carrect distributian af oil is assured.

3. 'RADIAL' Mechanical Grease Pump. This campact lubricating unit is for use with grease which callapses under its awn weight. Ideal far lubricating Heavy Crushing Machinery, Roll Neck Bearings, Calliery Plant, Presses, etc.

4. 'LINE-O-MATIC' Single Line Lubricating System—a pasitive centralised system for use with grease, using ane line anly, and incorparating grease injectars. Far use in lubricating Canveyors, Overhead Cranes, Calliery Machinery, Blast Furnaces, Manipulatar Gear, etc., etc.

5. 'VOLUME PUMP'—A large capacity, partable, hand-aperated pump far use with ail and saft grease. Used far Mine Car Wheels, Crawler type Tractar Ralls and ather heavy duty machinery.

6. 'BRENTFORD' Mechanical Pumps. A range af campact lubricators for the autamatic lubricatian af industrial and Marine Machinery.

7. 'GOLIATH' Pump. A mabile, air-aperated pawer pump, designed for handling fibraus and ather heavy bady lubricants.

8. STANDARD COMPRESSOR far grease ar ail. The ideal unit where a large capacity and easy mability is required. Will service all types af grease fittings and develaps up to 5000 lbs. p.s.i.

9. LUBRICATING HAND GUNS. These are available ta caver every aspect af manually operated lubricatian.

10. LUBRICATING FITTINGS — Available far all grades af lubricant, in straight and angle designs, applicable to any specific installation requirements.

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Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

John Alcorn. — John Alcorn has been appointed to Cooper-Bessemer's foreign sales office. Announcement was made by Stanley E. Johnson vice-president in charge of sales for the Cooper-Bessemer Corporation. In his new capacity Mr. Alcorn will be assistant to M. Pollock, president of Cooper-Bessemer Overseas, Cooper-Bessemer International and Cooper-Bessemer of Canada, Ltd.

●

New Robertson-Irwin Office.—The Toronto office of Robertson-Irwin Limited, manufacturers of Q-Floor, Q-Panel and other industrial and commercial building products, previously located at 1255 Bay Street, has been moved to 641 Yonge St. J. A. Sweet is the Toronto branch manager.

●

H. M. Braid.—Hugh M. Braid has been appointed to the position of supervisor, steel industry sales, for Minneapolis-Honeywell Regulator Co., Ltd. The announcement was made by John H. Fox, general manager of sales. Mr. Braid will continue to operate from the Company's Hamilton office.

●

Monsanto Changes.—Stuart P. Aikman, is export sales supervisor for the newly created export sales department of Monsanto Canada Limited. Previous to his present appointment Mr. Aikman was in textile chemical and plastics sales. These duties have been taken over by John C. Bonnett.

Other Monsanto changes are: John A. Lawrence will handle textile, paper, chemical and pharmaceutical sales. He will be assisted in Quebec by Kevin McCabe, and in Ontario by David E. Laurin.

●

Westinghouse Appointments. — W. E. Walsh has been appointed district apparatus and supply manager and R. Graves is now district stores manager in the Montreal district of Canadian Westinghouse Company, Limited.

●

Copco Sales.—G. W. Blomdal, managing director of Canadian Copco Ltd., has announced the appointment of H. R. Miles as sales engineer. Mr. Miles is attached to Copco's newly formed compressor and engineering tools division. He will make his headquarters at the Company's Montreal head office.

●

J. T. Henderson.—Dr. John T. Henderson, M.B.E., of the Division of Physics, National Research Council, has been made honorary treasurer of the Royal Society of Canada.

●

Petroleum Consultants.—J. C. Sproule & Associates, Petroleum Exploration Consultants, have announced the opening of a British Columbia branch under the management of R. H. Laurence and in affiliation with Victor Dolmage. The address is 1318 Marine Building, Vancouver 1, B.C.

●

Reliance Electric Expansion—Reliance Electric & Engineering (Canada) Limited announce the opening of their western regional office in Calgary. Reliance manufactures, in Welland, Ontario, a wide range of electric motors, transformers and adjustable speed drives.

The new office is under the direction of W. Alex Williamson, western region manager and it will be the headquarters for Reliance in Western Canada. The new office is located in the Shaldo Building, Suite 202, 223 Seventh Avenue East, Calgary.

●

Wallace and Tiernan.—Wallace & Tiernan have opened a new plant and office at Warden Ave., north of Eglinton East (Scarborough Township) near Toronto. The mail address is Box 54, Toronto 13.

●

Fraser Muter.—H. P. Hawkins, general manager of the industrial products division of the B.F. Goodrich Company of Canada, Limited, has announced the appointment of Fraser Muter as eastern division sales manager.

●

Swedish G.E. — The Swedish General Electric Limited announce the appointment of H. A. Janson as president following the retirement of F. P. Holliday on June 1st. The Company announced, at the same time. the appointment of John Morse, M.E.I.C., as chairman of the board.

The executive offices of the Company have been moved to Montreal.

●

Government Department Changes.—H. R. Malley has resigned as director of the ammunition division, Department of Defence Production. He will now devote full time to his increasing responsibilities as president of Crown Assets Disposal Corporation.

Dr. H. H. Saunderson, M.E.I.C., has been appointed director of the ammunition division.

Reflecting the improved supply position in the field of strategic materials, the non-ferrous metals, priorities, and steel divisions will be combined into a new materials division. J. P. C. Gauthier, director of priorities, has been appointed director of the new division. N. B. Davis, who has been head of the non-ferrous metals division will continue as a consultant for the department on non-ferrous metals problems. K. S. Harris, who has been head of the steel division since its establishment, is returning to his work as a business consultant.

●

J. M. Buchanan.—J. M. Buchanan has been appointed special assistant to the superintendent, zinc department of The Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C.

●

Margison Babcock Promotions.—A. D. Margison, M.E.I.C., vice-president and general manager of Margison Babcock and Associates Limited has announced the promotion of six of the engineering staff to the status of associates of the firm. The new associates are, H. R. Musson, supervisor of heating, ventilating and air conditioning section. D. L. B. Hamlin, M.E.I.C., chief structural engineer; K. N. Craig, supervisor of power plant and piping section; R. A. Cunningham, M.E.I.C., supervisor of field inspection section; W. A. Stewart, M.E.I.C., supervisor of municipal section; F. I. L. Dyke, supervisor of electrical section.

Messrs. Musson, Craig and Dyke will report to G. R. Beavers, senior associate

Bridging the Years
1882–1953

1886

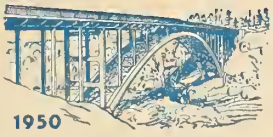
While the Dominion Bridge Company Limited, during its long history has become pre-eminent in many new types

1914

1938

of steel fabrication, it is still the leader in its original field – bridge building. We illustrate some of the notable

1946


1950

engineering achievements of the past seven decades.

1886 – First C.P.R. Lachine Bridge. When built this was the largest of its type in the warld.

1938 – Lians Gate Bridge, Vancauver. Largest suspensian bridge in the British Empire.

1950 – First Aluminum highway bridge in the warld, at Arvida, P.Q.

1914 – Cisco Bridge, over Fraser River near Lyttan, B.C.

1946 – Ste. Rase Bridge near Mantreal. Believed ta be the longest cantinuous welded girder bridge in the warld.

1929 – Jacques Cartier Bridge across the St. Lawrence river at Montreal.

1929

STRUCTURAL DIVISION*
DOMINION BRIDGE
COMPANY LIMITED

*Other Divisions:
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WAREHOUSE
BOILER

Plants at: MONTREAL · OTTAWA · TORONTO
WINNIPEG · CALGARY · VANCOUVER
Assoc. Companies at: AMHERST · QUEBEC
SAULT STE-MARIE · EDMONTON

and chief engineer of the building services department. Messrs. Stewart and Cunningham report to J. J. Stewart, senior associate and chief engineer of the inspection and municipal department.

●

Decalcomania Promotions. — F. Ralph Broad has been appointed president of the Canada Decalcomania Co. Ltd. Harvey S. Hutcheon has been appointed sales manager of the Company.

●

New Equipment and Developments

Argon Shipments. — Tremendous increases in the use of the rare gas argon, especially in the welding field, by Canada's industries have made it necessary for the Canadian Liquid Air Company, Canada's sole producer of argon, to ship the gas in bulk to one large consumer.

Special large capacity trailers are transporting argon from Liquid Air's Montreal plant to Canadair in the suburbs of the city — where "Sabre" jet fighters and other aircraft are made.

Canadair is one of the country's largest users of argon, the gas being required for inert gas shielded arc welding processes, in the manufacturing and repair of aircraft.

Operation of this bulk supply system follows standard L.A. pipeline distribution practice. One full trailer at a time is connected up to a control panel at Canadair which regulates the pressure and flow of the gas as it is fed to pipelines within the plant. Also connected to the control panel is a reserve gas storage battery with the same capacity as a full trailer. By means of special automatic change-over arrangements, this reserve gas may be sent into the pipelines in an emergency and ensures an uninterrupted supply at all times.

●

C.I.L. Nylon. — Expanded facilities doubling the production capacity of the nylon plant of Canadian Industries Limited are now in operation at the Kingston, Ont., plant of C.I.L.

The expansion added 80,000 square feet of floor space, bringing the total to 420,000. Along with it, various services, such as water intake facilities were enlarged. The addition, like the rest of the plant, is air conditioned.

There are now 1,195 people employed at the plant and virtually all were recruited from the Kingston area.

Training of most new employees has been done on the job and this training has been supplemented by special programs to meet specific technical needs.

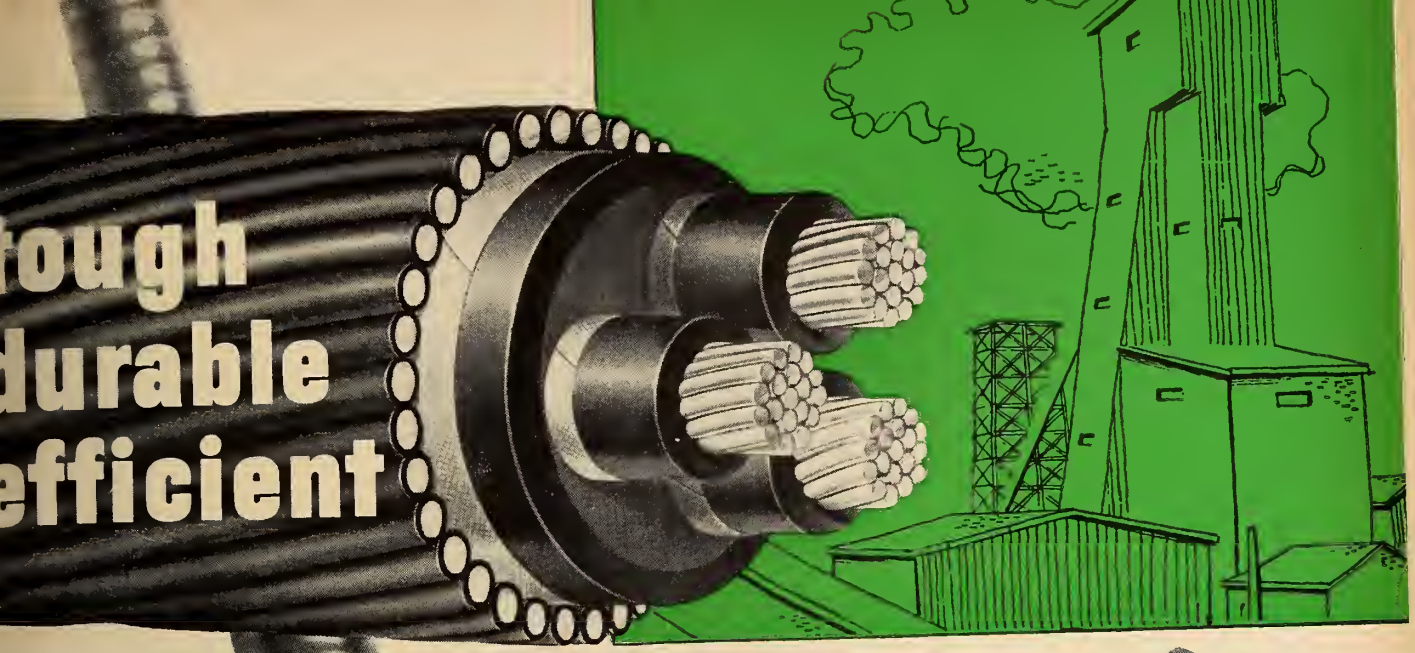
Production of the plant in 1952 was about 5,000,000 pounds of yarn and about 2,500,000 pounds of staple fibre. Additional production resulting from the expansion, has been made possible through arrangements for an added supply of imported raw materials pending the start-up of the new nylon intermediates plant at Maitland, Ont., 60 miles east. The Maitland plant is expected to begin initial production of nylon's basic ingredients, adipic acid and hexamethylene diamine, this month. Its total output will be shipped to Kingston by rail.

●

G.E. Research.—The General Electric Company has announced that in the next few years plans to increase its scientific staff working on fundamental research by 50 percent from a present force of 1,000 to 1,500 was announced by Ralph J. Cordiner, president at the G-E diamond anniversary observance in Schenectady recently.

●

Ignition Exciter.—A new ignition exciter for turbo jet engines that provides more positive ignition at higher aircraft speeds or altitude has been announced by Canadian General Electric Company's Industries Department. The unit has been approved for use on four production models of jet engines. The new exciter, of the capacitor discharge type, delivers energy at a constant rate virtually independent of altitude. It requires less average input power, thus releasing more electrical capacity for use without increasing aircraft generating equipment. The unit will deliver rated energy to the spark plug even when input voltages are reduced as much as 50 per cent.



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efficient

Phillips mining cable

MINE SHAFT CABLE The mine shaft cable illustrated above is graphic evidence of Phillips' capacity to meet any and every electrical conductor requirement of the mining industry. Construction features are 1) tinned copper conductors covered by 2) rubber insulation. The insulated conductors are sheathed in a 3) non hygroscopic filler enclosed in a 4) neoprene jacket. The entire cable is then covered by a 5) tough bedding material and finally protected by an armour of 6) neoprene or P.V.C. covered steel wire.

ARMOURED TECK CABLE
Neoprene jacket

ARMOURED TECK CABLE
P.V.C. Jacket

Down through the years of tremendous development in this important industry we have filled thousands of orders in mining areas throughout Canada. Phone or write. We will be pleased to put a skilled representative at your service.

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Weighing 3 lbs. 4 oz., approximately 25 per cent less than the conventional ignition transformer it replaces, the new exciter produces a powerful, short-duration repetitive ignition spark. A hermetically sealed gap-switch arrangement controls the repeating high-power spark independent of airspeed, altitude, or climatic conditions.

Complete information may be obtained from Canadian General Electric Company, Limited, 212 King St. West, Toronto.

●

Welding Electrode. — A new welding electrode, designed for build-up work and hard-surfacing applications wherein the deposited metal can be machined or flame hardened, has been announced by C.G.E. apparatus division.

The new electrode, designated G-E Type W-98, is a heavy covered flame-hardening rod that can be used in all positions. The arc is of the steady-spray type, similar to that produced by the E-6013 electrode.

The new electrode can be used in build-up work on road machinery parts, gears, pinion teeth, pump housings, shafts, sprockets, ship hawse pipes, and so forth. It is recommended where a higher hardness deposit is desired than that obtained with electrodes used for under layers.

The new electrode is colour marked by a brown end and a white spot. It utilizes alternating or direct current, and is manufactured in ⅛ to ¼ inch sizes.

●

Igniter Cord.—Igniter cord, a new device claimed to be safer and more efficient than older methods, has been adopted by The International Nickel Company of Canada, Limited, for use in drift driving at its mines in the Sudbury district of Ontario.

The chief aim in International Nickel's development of igniter cord was the safety advantage gained through having to light only one fuse. This is particularly desirable where the path of retreat from the working place is difficult and time-consuming, or where staging has to be removed. With the use of igniter cord it is possible to delay the actual lighting of the round for a considerable time by employing a fuse of sufficient length as a "master fuse" so that the igniter cord circuit is not lit until everyone has reached a place of safety.

Complete information may be obtained from Nickel Information Service, 25 King St. W., Toronto 1, Ont.

●

Kitimat Caissons. — Construction and placing of three large caissons, which form foundations for the dock at Aluminum Company of Canada's Kitimat project, has been completed by Kitimat Constructors.

One of the most difficult stages of the mammoth development, the caisson project is comparable with the construction of three six-storey reinforced concrete buildings and the launching of three 10,000-ton ocean-going freighters.

J. B. Carswell, M.E.I.C., chairman of Kitimat Constructors, said, "this is the first operation of its type to be undertaken in Canada, and it was completed in the record time of three months".

Construction of a graving dock 1,000 feet square and establishment of well points and a system of pumps around its entire perimeter, set the stage for the caisson program.

This was necessary to reclaim at tidewater a working area adjacent to the site of the permanent dock.

The caissons were poured on their side and each was 250 feet long, 45 feet wide and stood 60 feet high. The concrete placing was a round-the-clock operation of 10,300 yards in a continuous pour.

Design of the caisson interiors into 26 chambers, caused workers to remark "The biggest darned Scotch cases we'd ever seen".

Before they could be put into place the sites had to be graded by special equipment supplied by B.C. Bridge & Dredging Co. Ltd. Timber bulkheads close up the lower portion of the caisson chambers so that they could be put to sea on their sides. Inner bulkheads were built to create balancing chambers into which water could be pumped.

●

New Generator. — Arthur Lyon & Co. (Engineers) Ltd., Stamford, Lincs., England, have developed a new line of self-excited salient pole machines. The Stamford generator is a revolving armature machine in which self-excitation is produced by transforming and rectifying a portion of the a-c output. The circuit diagram shows how a substantial constant voltage is obtained by providing a varying excitation to compensate for changes in load and lagging power factors.

Excitation of the field winding is obtained from a 3-phase rectifier "S" which is fed from the secondary windings connected in series of a current transformer "Q" and voltage transformer "R".

At no load the excitation is supplied by the voltage transformer. With increasing load and additional component of current proportional to the load current is produced in the current transformer and provides the increased excitation needed to offset the fall in voltage that would otherwise accompany an increase in load.

The circuit also counteracts the tendency for voltage to fall with decreasing power factor. This is done by the following means —The current transformer has an adjustable air gap in the core which introduces a 90° phase shift between the primary and secondary currents. It follows that at unity power factor the component of the field current (f3) due to the current transformer leads the component (d) due to the voltage transformer by about 90°, the resulting field current being proportional to (e3). Complete details may be obtained from Newage (Canada) Limited, 1174 Bay St., Toronto, Ont.

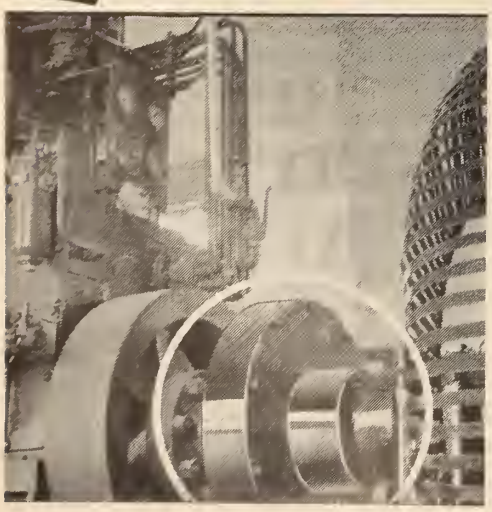
●

New Brown Boveri Control—Announcement is made by Brown Boveri (Canada) Ltd., of a new apparatus for the control of light intensity.

Known as the "Thyralux", the equipment is designed for a-c power with service voltages up to 500 v., for the

BIG DIESEL DRIVES NEED BLM "SHOCK-FREE" STARTING!

There's nothing mysterious about the BLM Automatic Clutch. It simply applies natural centrifugal force to the job of transmitting power — sure, smooth, shock-free! That's why the BLM Automatic Clutch is proving so efficient and dependable in large Diesel drives like this installation hooked up to a big generator. Specify your power — diesel or gasoline engine, electric motor or turbine — for ¼ to 10,000 H.P. — leave the rest to us.



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Write for catalogue showing typical installations, charts, graphs, etc.

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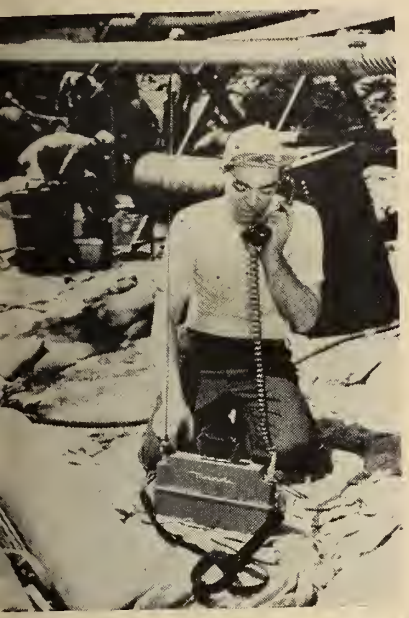

th his Motorola 2-Way Radio the man on the ot is able to order a load precisely when he's ready for it.

om this central station, the dispatcher keeps in nstant communication with his entire fleet, eliminates wasted trips.

ut on the job, this driver reports delivery of a od via Motorola 2-Way Radio, asks for instructions for his next run.

Delivery of thousands of tons of concrete—on time—to cover vast areas of new plant flooring is controlled on this job with Motorola 2-Way Radio. Lost time is eliminated, the job runs smoothly. Across Canada truck fleet operators are learning that Motorola 2-Way Radio is a money-saving tool. Qualified Rogers Majestic representatives will be pleased to help you plan a Motorola 2-Way Radio installation to fit your particular needs. Mail this coupon today.

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control of fluorescent gas discharge tubes, both of the low voltage type and cold cathode type, ("Slimline", and Neon). Light intensity is varied by the time control of the current flow on each half cycle of the alternating current. The use of thyraton tubes enable the equipment to operate with such advantage as, continuous intensity control between zero and maximum, simple operation by remote control and high efficiency with negligible power loss.

Further information and technical data are available from Brown Boveri (Canada) Ltd., 1015 Beaver Hall Hill, Montreal, Que.

●

New Link-Belt Plant.—More than 500 civil leaders, engineers and industrialists visited the new Scarboro, Ont., plant of Link-Belt Limited at the official opening of the new premises.

The new plant has a shop and office area of 72,000 square feet. It is located on a 20-acre tract, which provides ample space for enlargement to several times its present size. Designed and built by the Austin Company, it is laid out for efficient, straight-line production.

The manufacturing plant has two longitudinal production bays, each 60-feet wide, with 36-foot clearance below trusses. A transverse bay, 60-feet wide, has overhead clearance of 45 feet. Each production bay is equipped with two overhead travelling cranes. A single crane is located in the transverse bay.

The entire building is structural steel frame truss construction. Exterior walls of the manufacturing plant are corrugated asbestos siding. The walls of the office building are facebrick, backed up with concrete block, steel sash and pre cast stone. Interior finish is metal lath and plaster.

●

Kapuskasing Expansion. — An era of population growth and business expansion for the northern Ontario town of Kapuskasing was predicted, on July 27th, by Ontario Hydro chairman Robert H. Saunders. Commenting on the municipality's joining of the "Hydro family", Mr. Saunders referred to the great undertakings in the northern regions of all the Canadian provinces. He singled out Northern Ontario where development enterprise is producing especially important results.

"The output of northern Ontario mines and forests is of enormous importance, not only to the continuing expansion of our Ontario economy, but also to the economies of our friends and allies among the North Atlantic Treaty nations."

Commenting on the strategic location of Kapuskasing, Mr. Saunders said that it is between the proven natural resources of the Timmins, Kirkland Lake, Cobalt and Sudbury areas on the one hand and the potential of the vast territory to the northwest on the other.

●

Eye Wash Fountain. — Crane Limited offers the Haws eye wash fountain, approved by safety engineers. These fountains are intended for instant first aid for eye injuries. They are sold as "An effective protection and relief against foreign matter injuring the eyes, face or clothing".

●

B.-A. Shawinigan Opening. — A large number of Canadian and American business leaders, assembled at the opening of the new $4,000,000 petrochemical plant of B.A. Shawinigan Limited were told that plans were already afoot for its expansion into additional products.

V. G. Bartram, president of B.A.-Shawinigan Limited and of its joint owner, Shawinigan Chemicals Limited, forecast the early expansion of B.A.-Shawinigan's facilities. He said "this is only a beginning. We visualize, already, further developments which may result in adding new products, to assist in expanding further the Canadian chemical industry and thereby the whole Canadian economy."

In the past Canada has been spending about $2,000,000 a year on the importation of phenol, while the only large production of acetone has been at Shawinigan Falls, from calcium carbide which can now be diverted to other uses.

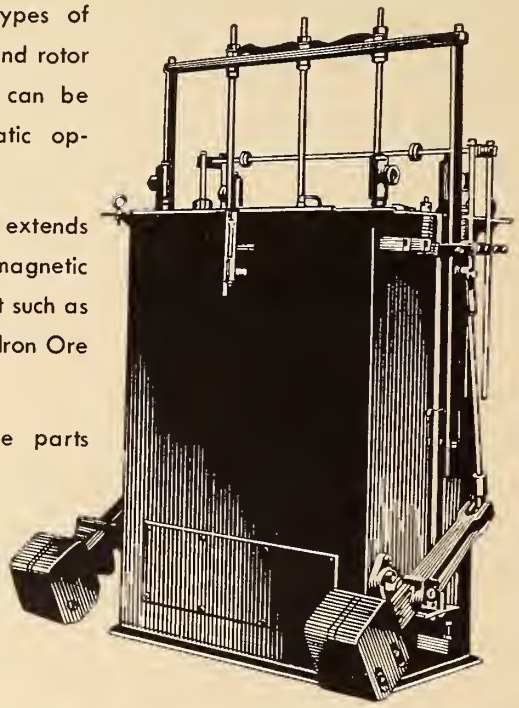
The new B.A.-Shawinigan plant is expected to be able to supply all of the present Canadian demand for phenol, and also the increased needs in the future.

Commenting on the capital investment in petrochemical plants in Canada during recent years, Canada's Minister of Resources and Development, Honorable Robert H. Winters, said, "estimated capital investment in petrochemical plants in Canada in recent years is about $125,000,000, or 60 per cent of the chemical industries total, and located principally in Alberta, the Sarnia district in Ontario and Montreal East. Our proven oil resources," Mr. Winters said, "are about 40 times what they were in 1946 and our reserve of natural

WABANA SELECTS ALLEN WEST CONTROL GEAR

10 ALLEN WEST liquid pattern rotor starters are used to control the 300 HP motors driving the 2½ mile conveyor belt, designed to carry 12,000 tons of ore daily.

Selected to give a smooth continuously variable acceleration, economical in first cost and maintenance, these types of equipments are supplied for wound rotor motors up to 2,500 HP. They can be arranged for hand or automatic operation.



The complete Allen West range extends from pushbutton across-the-line magnetic and manual starters to equipment such as the above, supplied to Wabana Iron Ore Mines.

Standard equipment and spare parts available from Montreal stocks.

Established upwards of 25 years in Canada, with agents in all principal cities, we can meet your needs for all classes of industrial motor controls.

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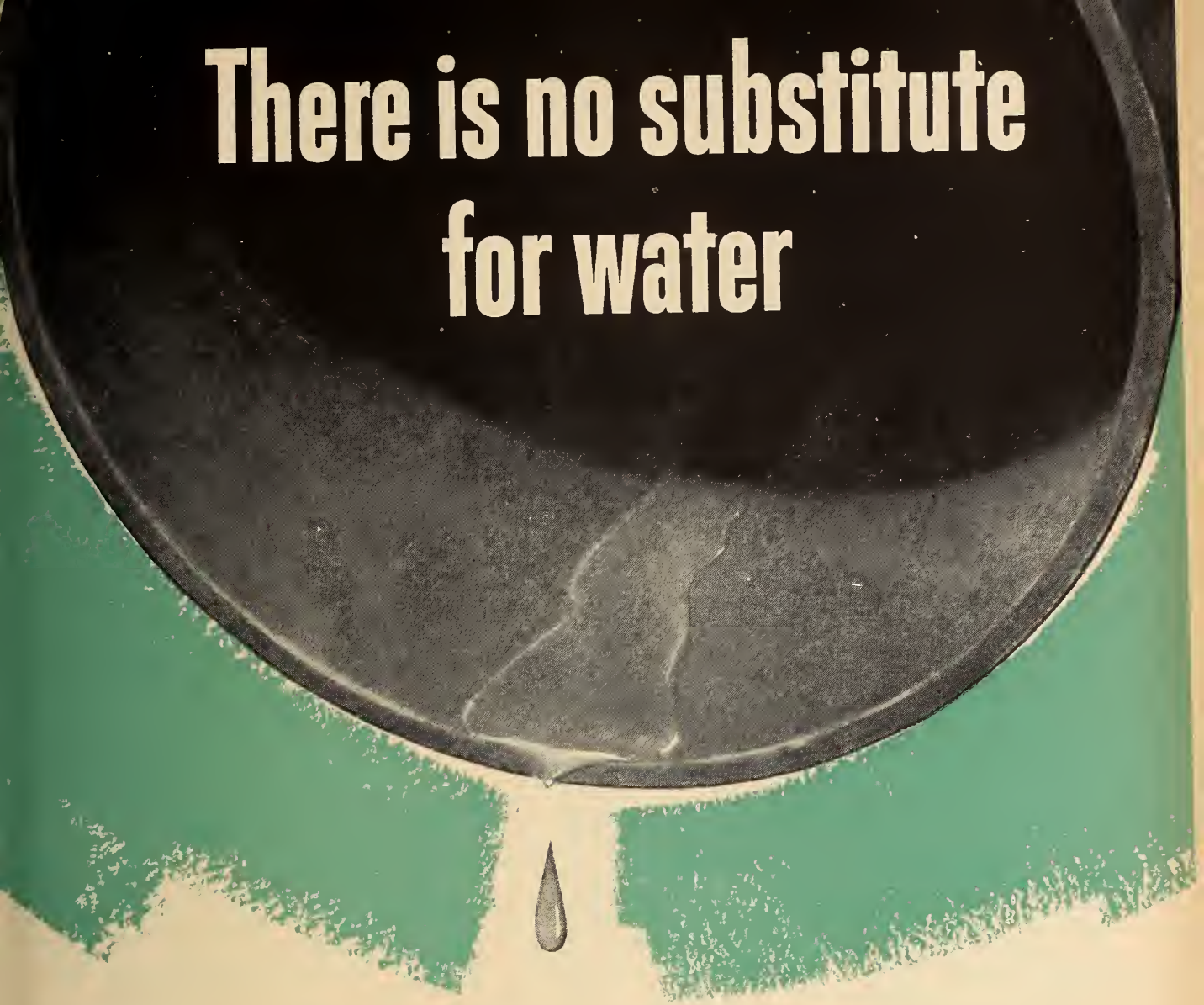

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othing has ever taken the place of water among the sic needs of man. And nothing will ever take the place safe, sure, *experienced* engineering in developing a pendable water supply.

Layne's reputation as the world's most experienced veloper of well water systems was earned by engineer- g skill every step of the way—from on-the-spot geo- gical surveys to the precision designing of each pump for its particular job. For the best in well water systems, there is no substitute for Layne engineering.

Let Layne engineers help you PLAN AHEAD on your water needs

Layne welcomes the opportunity to share in long-range planning for water-system needs. We'll be glad to make a survey and give you our recommendations, without obligation. Write now for water well and pump catalogs.

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VERTICAL TURBINE PUMPS

INTERNATIONAL WATER SUPPLY, LTD.,
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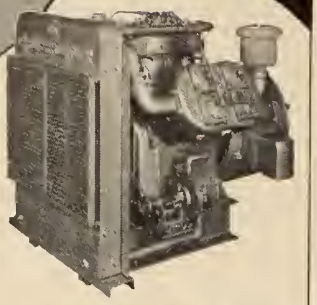
Profit-making Spots at Wabana

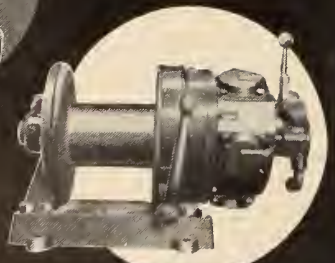


Three miles offshore and 1600 feet below sea level—Gardner-Denver WB Compressors, electrically driven, furnish air close to the headings—eliminate transmission losses of long air lines.

In the medium and high seams in No. 4 Mine—Gardner-Denver CF93 Automatic Feed Drifters have speeded up the drilling cycle.

In the narrow seams in No. 6 Mine—lightweight Gardner-Denver S48 Sinkers and FLAY4 Air Feed Legs are easily-handled time savers.

Handy for dewatering—Gardner-Denver VP4 Pneumatic Sump Pumps automatically save air when water level is low.



For utility hoisting in the mines — Gardner-Denver HK Air Hoists pull strong and steady.

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THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

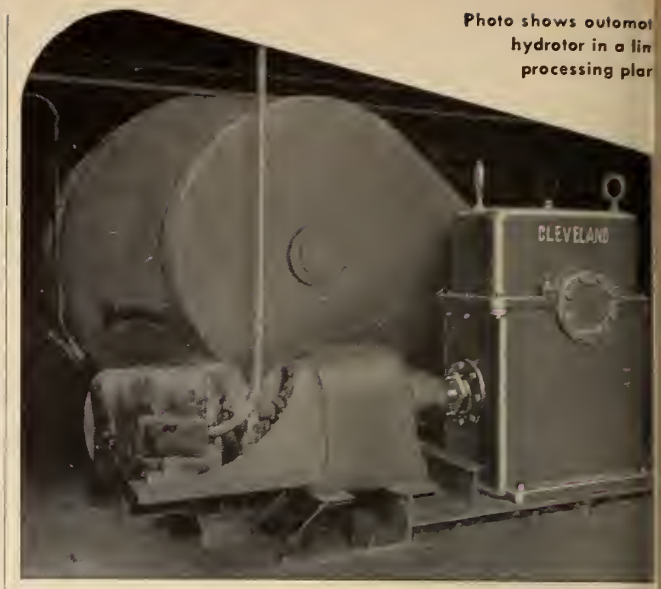

Photo shows automot hydrotor in a lim processing plan

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●

ew Naval Vessels.—The Rt. Hon. C. Howe, Hon.M.E.I.C., Minister of De-nce Production announced on July h that contracts will be awarded to nadian shipbuilding yards for the nstruction of six minesweepers for the oyal Canadian Navy. These vessels e in addition to the 14 minesweepers ow under construction. They will re-ace the six that are being transferred NATO, as part of Canada's mutual d program.

●

elding Contest Rules.—The following a translation of the rules of an Inter-tional Contest sponsored by the Per-anent International Commission of cetylene with headquarters at 32, oulevard de la Chapelle, Paris 18, rance. The contest is open to any dividual or group of individuals or ociety of any country. The object of ie competition is to promote applica-ons of the oxy-acetylene or air acety-ne flame.

ermanent International Commission of Acetylene

nternational Contest for Paper on the Applications of Oxy-Acetylene Flame

Rules

Article 1—Creation of contest:

The "Commission permanente internationale de l'acétylène, de la soudure autogène et des industries qui s'y rattachent", in order to promote applications of the oxy-acetylene flame or the air-acetylene flame, such as welding, soldering, brazing, bronze welding, oxy-cutting, hardening, hard-faeing, metallizing, heat treatment, etc., launches a contest involving written report on the foregoing subjects. It should be unpublished, or if published only after January 1st, 1953.

Articles 3—Candidates:

The contest is open to any individual or group of individuals or society of any country, with the exception of members of the jury. The same candidate may present more than one paper at the contest under different motto.

Article 4—Presentation of papers:

The papers should consist of 5 typewritten copies in English or in French, on recto, on paper of size A_4 (21 x 29, 7 cm) 8¼ x 11½". Illustrations, drawings should be submitted if necessary and the same number of copies is required.

The papers should have a maximum of 20 typewritten pages, single spaced (figures in addition) and should be accompanied by an abstract, indicating the scope of the work and the principal findings.

The papers should not carry any sign mentioning origin or author, but they should have a motto.

Article 5—Mailing the papers:

The five copies of each paper, accompanied by illustrations, shall be placed in an envelope, bearing the motto of contestant and the designation "Memorandum". This envelope, including another one sealed, with the inscription of the contestant's motto and containing a sheet with name, address and motto, shall be mailed in another enclosing enveope, with the designation: "INTERNATIONAL CONTEST 1953" and it will be addressed to:

General Secretary Office,
Commission Permanente
Internationale,
de l'Acétylène et de la
Soudure Autogène,
32, boulevard de la Chapelle,
Paris 18, France.

Article 6—Time period for contest:

The contest is open from January 1st, 1953 to December 31st, 1953. All papers should be received at the above address by December 31st, 1953, at 18.00 H.E.C.

Article 7—Awards:

The contest has a fund totaling 500,000 French Francs which—according to the article 9—should be apportioned in several prizes. The value of each prize will be 50,000 French Francs at least.

Article 8—Jury:

The examination of the presented papers as well as the attribution of prizes will be the duty of the jury formed of permanent members of the subcommission "Soudure oxy-acétylènique" of the C.P.I. which may select by unanimous decision a person whose help may be useful.

Article 9—Attribution of prizes:

The jury decides by majority and has an absolute authority regarding the attribution of prizes. In case the works do not deserve an award, the jury can reserve partial or total attribution of prizes, postponing the nomination to another contest.

Article 10—The rights of authors:

The prize winning works become the property of C.P.I. which aequires the rights of publication and translation indicating in each case the name of the author.

The copies of papers for which no award is granted, will be at the disposal of the respective authors.

The patents remain the property of the authors and they are entitled to obtain personally protection of their projects.

The C.P.I. will not be responsible in matters related to priority or vindication of industrial property.

Article 11:

The contestants participate with the understanding that they will submit to the rules and other prescriptions of this text.

●

Canada Creosoting Modernization.—A. H. Martin, president of Dominion Tar & Chemical Company Limited, has announced that a program of extensive modernization of plants of the Canada Creosoting Company Limited has progressed to the point where initial steps were taken on July 20th and 21st to demonstrate new treating preservatives and procedures at the Trenton plant.

Included in the completed modernization program is a new boiler plant, an extensive system for the mechanized handling of cross-ties, an artificial seasoning installation and facilities for the supply of treated material using Pentachlorophenol.

The Trenton plant of the company is one of 12 similar plants which are scheduled for modernization.

●

New Ontario Shopping Centre.—Ground was broken on June 29th for the Humbertown Shopping Centre in the outskirts of Toronto. Comprising nine acres on Royal York Road, just north of Dundas St., in the heart of Humber Valley Village, it is a $2 to $2½ million development.

Three years in the planning stage, the centre embodies design and merchandising features hitherto found only in the most advanced centres in the U.S.

○

June Time Losses.—Although time loss during June, 1953 was higher than in the preceding month, it was less than a tenth of the time loss during June, 1952, according to a preliminary summary of strikes and lockouts released by the Minister of Labour, the Hon. Milton F. Gregg, on July 17th.

Preliminary figures show that 31 strikes and lockouts were in existence during June, 1953, involving 6,452 workers with a time loss of 57,346 man-working days, as compared with 30 work stoppages in May, 1953, with 4,748 workers involved and a time loss of 36,127 days.

●

New Leak Detector. — Canadian General Electric Company Limited offers the G.E. halogen-sensitive leak detector which has been redesigned to permit easier detection of leaks in closed systems.

This portable instrument can detect a leak so small that only 1/100 ounce of gas will pass through the opening in a year. It has gained wide acceptance in testing for leaks in refrigerator and air conditioning systems, tanks, boilers, piping, and other products that must be leak proof and into which a halogen gas can be introduced as a tracer.

Complete details may be obtained from the Company.

●

Spring and Plating Plant. — Construction of a new spring manufacturing plant and metal plating plant for Ontario Steel Products Company Limited at Milton, Ontario, will be started shortly by the Austin Company Limited.

Selection of the site at Milton followed an extensive survey in which engineers of the Austin organization analyzed nine strategic communities within the Toronto-Hamilton-Oakville sector.

The spring plant will be 240 by 360 feet. It will have only ten interior columns, or one column for each 8,640 square feet of floor space.

It is anticipated that the first building will be completed by the end of this year and in full operation early in 1954. The project will employ between 150 and 200 men and women.

●

Rubber Paving. — The first piece of rubber pavement for a New York City

(*Continued on page 1107*)

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USINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1103*)

'eet was laid in July on First Avenue tween 24th and 25th streets. This is rt of a country-wide program being onsored by the Natural Rubber ıreau.

A similar strip was laid three years o at 12th Street on the West Side evated Highway. Millions of cars ve already travelled over this piece experimental paving and it is claimed at the results are entirely satisfactory. owever, the test was not regarded as nclusive by engineers of the Borough 'esident's office, for while it stood up ell, it was not subject to heavy truck affic. The lane just laid on First venue will provide the heavy traffic ieck.

The City put down one block of sheet phalt type paving over granite blocks, ncluding the intersections, approxiately 2300 sq. yds. of pavement was id, using 1½ inches of the natural ıbber asphalt mix. Commenting on the oject, a New York City official said: Adding the powder does add a bit to ıe original cost. We hear though that ı the long run, these roads save money. ' that's true we want to know about it. 'he best way to find out is to put one own".

●

hip Air-Conditioning. — In keeping ith the ultra-modern fighting equipıent being installed in Canada's newest ghting vessels, they are all to be quipped with the latest type of reigeration and air conditioning systems. Necessary in maintaining the accuracy f delicate instruments in severe climaic conditions, the equipment will add reatly to the comfort and efficiency of he crew as well.

To meet the terrific strains imposed y rough seas and battle conditions on quipment normally installed in static ocations, the John Inglis Co. Limited f Toronto has designed and is supplyıg systems to meet these rigorous deıands.

Total amount of the equipment and xact details are not available, for ecurity reasons, but it is known that he apparatus represents an important levelopment in air-conditioning equipıent capable of operating perfectly unler the most difficult conditions.

●

Mercury Switches. — Mercury switches, he versatile little devices with a mulitude of uses in repetitive action units, re now being manufactured in Canada or the first time by Minneapolis-Honeywell Regulator Co. Ltd. in Leaide.

The present production rate is 150,000 witches a year, W. H. Evans, vice-president and general manager, anıounced.

Several problems had to be solved before production of switches was beun. It was necessary to obtain the purest mercury available before efficient nits could be manufactured. Even riple-distilled mercury, the purest commercial type available, did not meet he exacting requirements at M-H. The company therefore found it necesary to set up their own purifying proess for the removal of the undesirable oxides.

Another major problem confronting Honeywell was the supply of a special type of glass for the switch tubing. This glass of low lead content had to be manufactured to precise specifications. Although similar to oven or laboratory heat-resisting glass it still differed substantially enough to warrant a completely different manufacturing process.

An unique feature of mercury switch manufacturing at Honeywell is the blowing of the small glass tubes for these devices. Young women were specially trained by the company in the art of glass blowing. In the first few weeks of production rejects were numerous due to the precise requirements and the employees' inexperience but now they seldom make an imperfect tube.

Probably the greatest asset of the mercury switch is its simplicity. All that is required for the switching action is a simple tilting mechanism. The actual make-and-break takes place noiselessly in a completely sealed tube which is immune to dust, dirt and corrosive atmosphere. The contacts are free from corrosion and pitting which eliminates maintenance costs. All this adds up to economy and long life. Actually, tests have proved that some Honeywell mercury switches have operated for many millions of cycles.

Most of the switches produced at Leaside are used in the manufacture of Honeywell controls.

●

Polystyrene. — Construction of a new unit for the production of polystyrene in sheet form has been announced by Dow Chemical of Canada Limited. The new unit will be built at Sarnia, Ontario, as a further expansion of the present plastics manufacturing facilities. Commercial production of this new Styron plastic sheet is expected early in 1954. At present all of Canada's requirements are being imported.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Ferranti Meters. — Ferranti Electric Limited, Mount Dennis, Toronto 15, have produced an excellent brochure "Ferranti FM Single Phase Watthour Meter". This publication describes the FM Watthour meters manufactured by the Company. For copies ask for Bulletin No. 53.

●

Shovel Film. — Marion Power Shovel Company, Marion, Ohio, have just released a 16-mm. colour-sound film describing the new 191-M Shovel. This is claimed to be the world's largest and most powerful shovel on two crawlers.

The movie is 12½ minutes in length and was filmed during the construction of two large dams in the midwest U.S.A.

To arrange for a showing please communicate with the public relations department of the company at the address given above.

●

Lift Trucks. — A new six-page, two colour bulletin decribing and illustrating its "Gas-O-Matic" fork lift truck has been published by The Baker-Raulang Company.

The "Gas-O-Matic" is Baker's unique new electric-transmission truck which uses no clutch, transmission, controller or resistors.

One page of the bulletin explains the principle of the "Gas-O-Matic" system with drawings, and tells how the truck achieves the 40 per cent fuel savings, 40 per cent maintenance-cost reductions and 50 per cent greater life expectancy which the manufacturer claims for it.

Also included in the bulletin are complete 'Gas-O-Matic" dimensions and specifications, photographic illustrations of the new truck's major design features.

●

Westeel Window Catalogue. — Westeel Products Limited have just produced a new issue of their popular Standard Industrial Window Catalogue. The new catalogue incorporates a number of additions and revisions not available in the original issue. Copies of the new catalogue may be obtained by sending a request, on your letterhead, to your nearest Westeel office. Ask for Standard Window Catalogue No. 40.

●

Fine Otis Publication. — Otis Elevator Company, Limited, Hamilton, Ontario, have available a limited number of copies of a beautifully produced publication called "The First One Hundred Years".

It was issued by the parent company of the world-wide Otis organization and intended primarily for stockholders and employees. The publication traces the one hundred years of continuous operation of the Company and presents in very graphic form the development of the elevator and escalator.

This is a well-produced publication and because the supply is limited, requests should be made on official letterhead.

●

Dominion Rubber Publication—A new folder describing Vidamp machine mountings has been issued by the textile division, Dominion Rubber Company Limited.

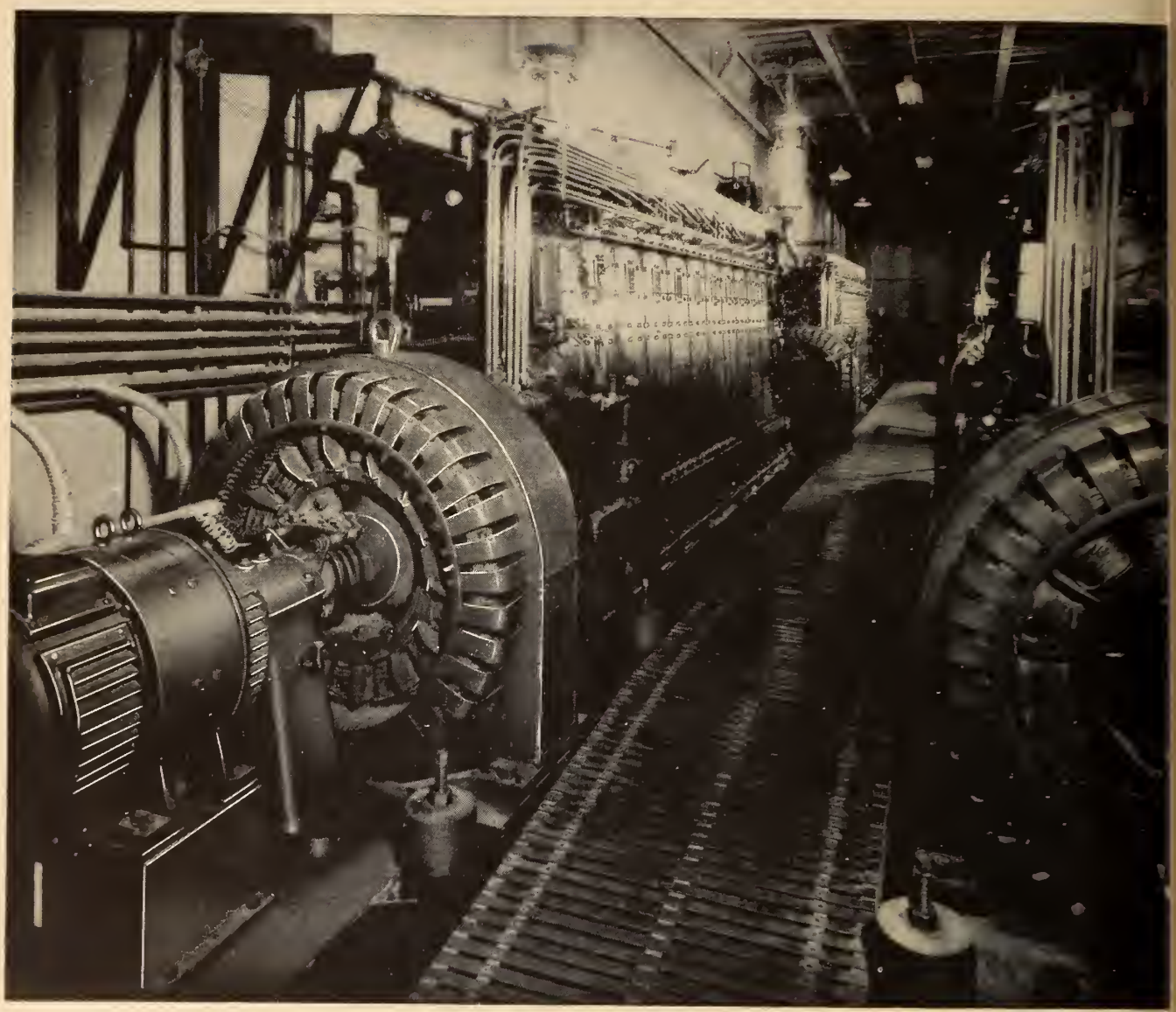
Vidamp is shown to be a modern method of machine mounting. Basically a felt and a cement engineered especially for this use Vidamp is easily installed and gives positive mounting without the use of lag bolts. Vidamp also reduces noise and machine shock, thus increasing operating efficiency of both machines and personnel. Maintenance costs of mountings are eliminated, and Vidamp pads may be used over again if machines have to be moved.

The folder shows typical Vidamp installations in machine shops, steel mills, textile mills, and publishing houses. Copies are available from textile division, Dominion Rubber Company Limited, 84 Margaret Avenue, Kitchener, Ontario.

●

Industrial Diamonds.—Canadian Koebel Diamond Tools Limited, 18th Street & Towns Road, New Toronto, Ontario, offer *Journal* readers copies of their 16-page booklet, 'Koebel Diamond Core and Drill Bit Selector".

DIESEL GENERATORS



These English Electric generator sets driven by diesel engines are 312 KVA, 2400 volt, 60 cycle, 3 phase, 514 RPM machines used for a standby plant. Across the country English Electric generators of all sizes are, and have been, operating successfully through their daily jobs.

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PA5312

Prestressed Concrete Grandstand at the Baseball Stadium, Sherbrooke, Que.

by

G. M. Demarque, M.E.I.C.,

Chief Engineer,
The Preload Co. of Canada. Ltd..
Montreal.

Engineers, particularly Canadian engineers, are sometimes accused of being too conservative. That the allegation is not always true is excellently illustrated by this paper, which deals with a method of construction the details of which were developed and applied by Canadians, using Canadian materials—one which promises to be used to a greater extent in future as its advantages become better known. Mr. Demarque's paper was presented to the recent Halifax annual meeting.

When the wooden grandstand at the baseball stadium was burned down at the end of 1951, the Council of the City of Sherbrooke, Quebec, owner of the stadium, decided to replace it with a more permanent structure. Concrete was selected and because economy in steel was a prime factor, the major part of the superstructure was designed for prestressing. Contracts were awarded in July, 1952, and work started at once.

The new grandstand has 4,000 seats. It covers a total area of 21,130 sq. ft., a little more than half of which is sheltered by a cantilevered roof. The plan (Figure 1) is about that of a boomerang, the developed length along the outer line being 407 ft.

For standardization, the structure consists of a series of identical rigid frames, spaced uniformly at 14 ft. c-c. on the outer line and supporting the bleacher and roof slabs. The total length is divided into five sections by four expansion joints provided by doubling the supporting frames at the joints.

The elevation of a typical frame is shown in Figure 2, which shows:

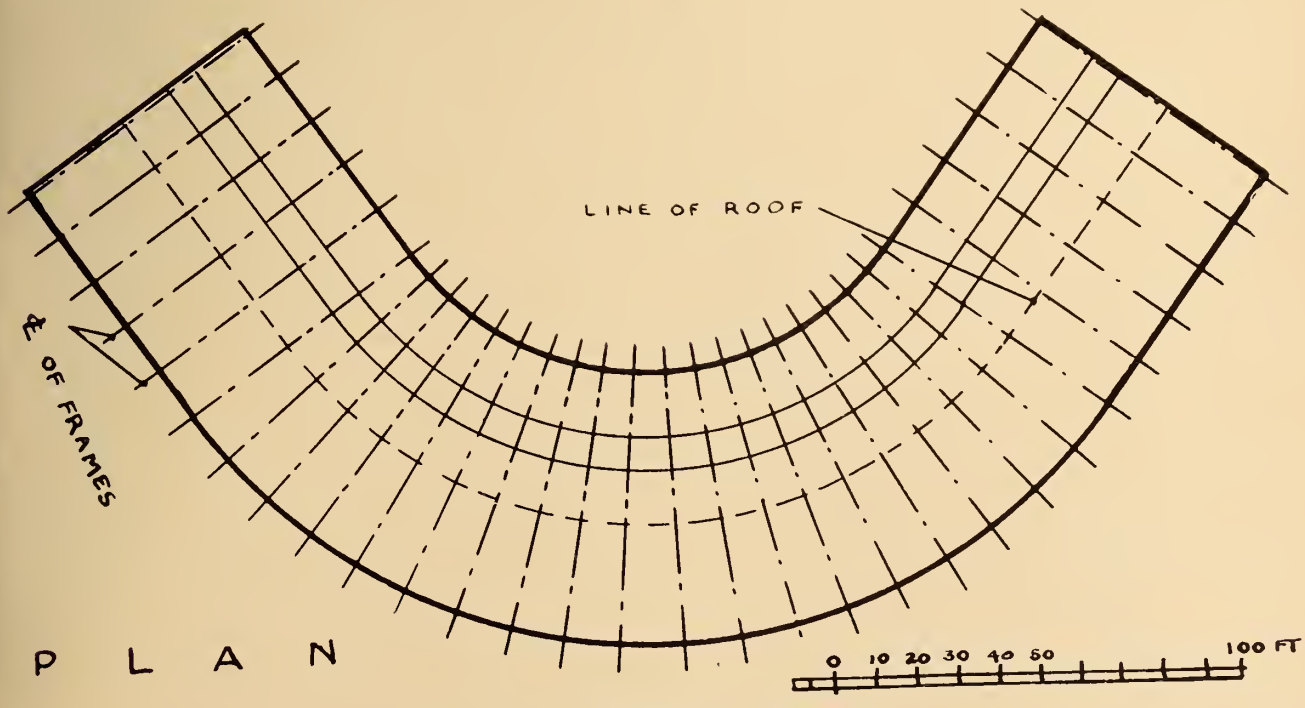

Fig. 1. General plan view of stadium.

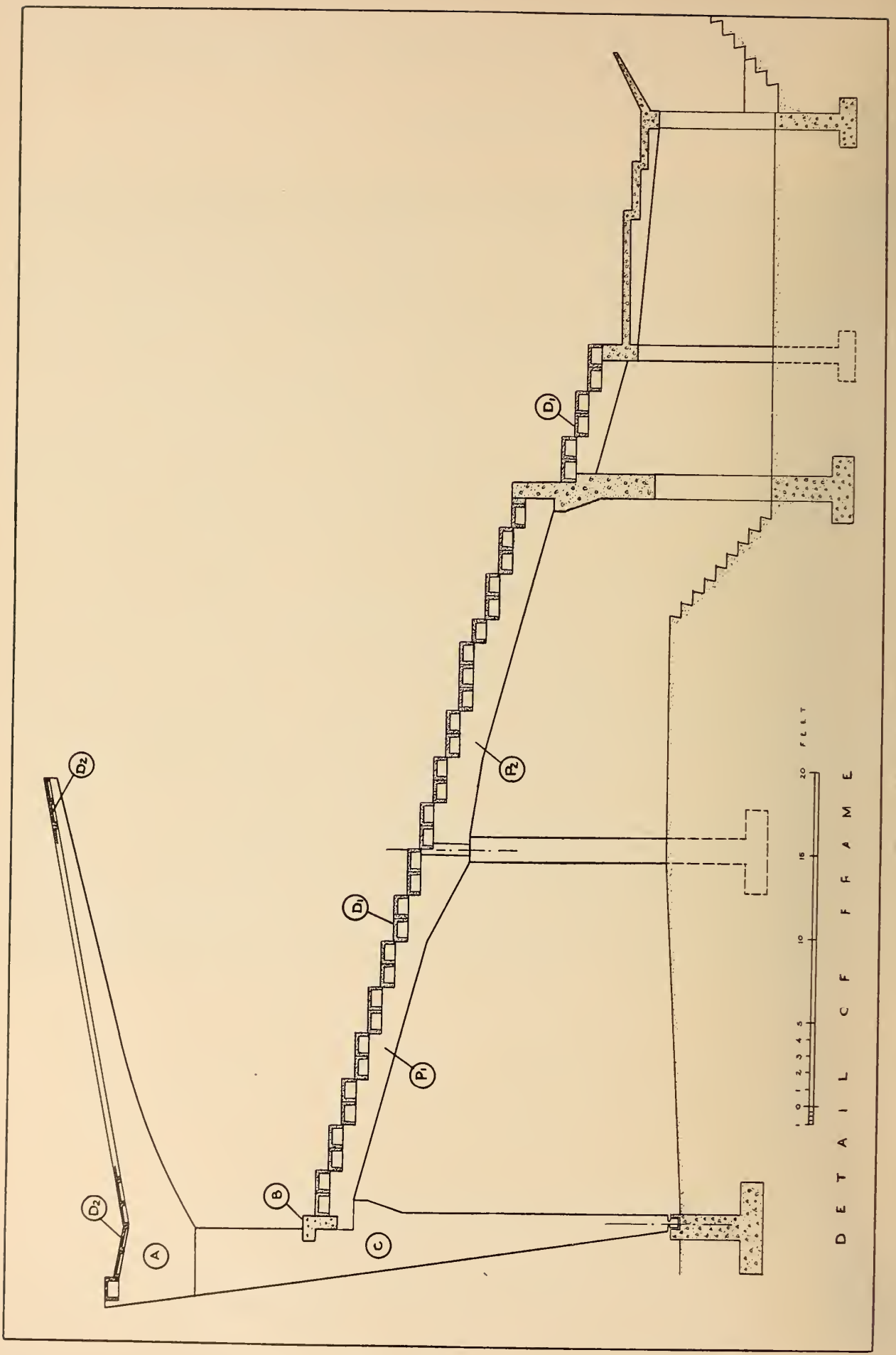

Fig. 2. Sectional elevation of typical frame.

1. The reinforced concrete part poured in place, including the foundations, the two intermediate columns, the two longitudinal walls, the lower beams, the slab forming the lower part of the bleachers, and the longitudinal tie beam, B.

2. The prestressed section, including the frame, the bleacher slabs and the roof slabs.

The lower part of the structure maintains the transverse stiffness of the structure. Longitudinal rigidity is provided by the walls, the longitudinal tie beams and the slabs, through their connections to the supporting beams. The prestressed concrete frames and slabs were all precast, then erected and assembled.

Loadings were: 100 lb./sq. ft. on the bleachers — and 40 lb./sq. ft. on the roof. It was assumed that the snow load would not be applied simultaneously with the bleacher live load. Stability was checked using a wind pressure of 30 lb./sq. ft. of exposed surface, acting simultaneously with two-thirds of the snow load.

Two different methods were applied to the prestressing: the "post-tensioning" method for the frames, using steel cables and end anchorages and the "pre-tensioning" method, using single wires and no special anchorages for the slabs.

Frames

There are 24 standard frames supporting the load of a complete bay, and 10 side-frames supporting only half of this load. The 34 frames are identical except for the amount of prestressing dictated by loading conditions. Because of their size and shape, the frames were made of four different pieces, which could be easily cast and handled. These four members, which were made in a casting yard at the site, are shown in Figure 2:

1—A tapered column, C.
2 and 3—Two sloping beams, P_1 and P_2, supporting the bleachers.
4—A cantilevered beam, A, supporting the roof and projecting 27 ft.

Column C was erected first, with its prestressing cables loose and extending from the top, the stresses due to handling being taken by conventional steel reinforcement. Then Beams P_1 and P_2 were placed. These were prestressed on the ground to enable them to support their own dead load plus the dead load of the bleacher slabs. The bleacher slabs were then placed on successive bays.

The gaps at the ends of the beams, and also the 10 in. thick joint between the slabs on top of the beams were concreted. Provision was made for insuring that the concrete, poured on top of the beams, would act monolithically with the precast section.

Then the cantilever beam, A, fully prestressed on the ground, was erected on top of the column, the cables projecting from the latter being threaded through holes in the beam. The cantilever was set on a thin mortar bed on top of the column. When this bed had set the column cables were tensioned and anchored, making column and cantilever a single unit.

After placing the roof slabs and the completion of the top part of the cantilever beam in the manner previously indicated, continuity cables, threaded into holes through Column C, the two sloping beams and the abutment wall, were tensioned and anchored. These cables completed the prestressing of the beams and prestressed their end connections, so that the structure acts as a rigid frame.

Hinges were provided at the foot of Column C and at the top of the intermediate reinforced concrete column. These hinges were made by reducing the section of concrete and using diagonal reinforcing bars crossing each other at the mid point of the reduced section.

Prefabrication of Members

The general dimensions and weights of the various precast elements were:

Column C — 12 in. thick, 28 ft. 11 in. long, width increasing from 1 ft. at foot to 4 ft. at top; weight 6 tons.

Beam P_1 — 12 in. thick, 21 ft. 3 in. long, 20 in. average depth; weight 3 tons.

Beam P_2 — 12 in. thick, 20 ft. 3½ in. long, 20 in. average depth; weight 3 tons.

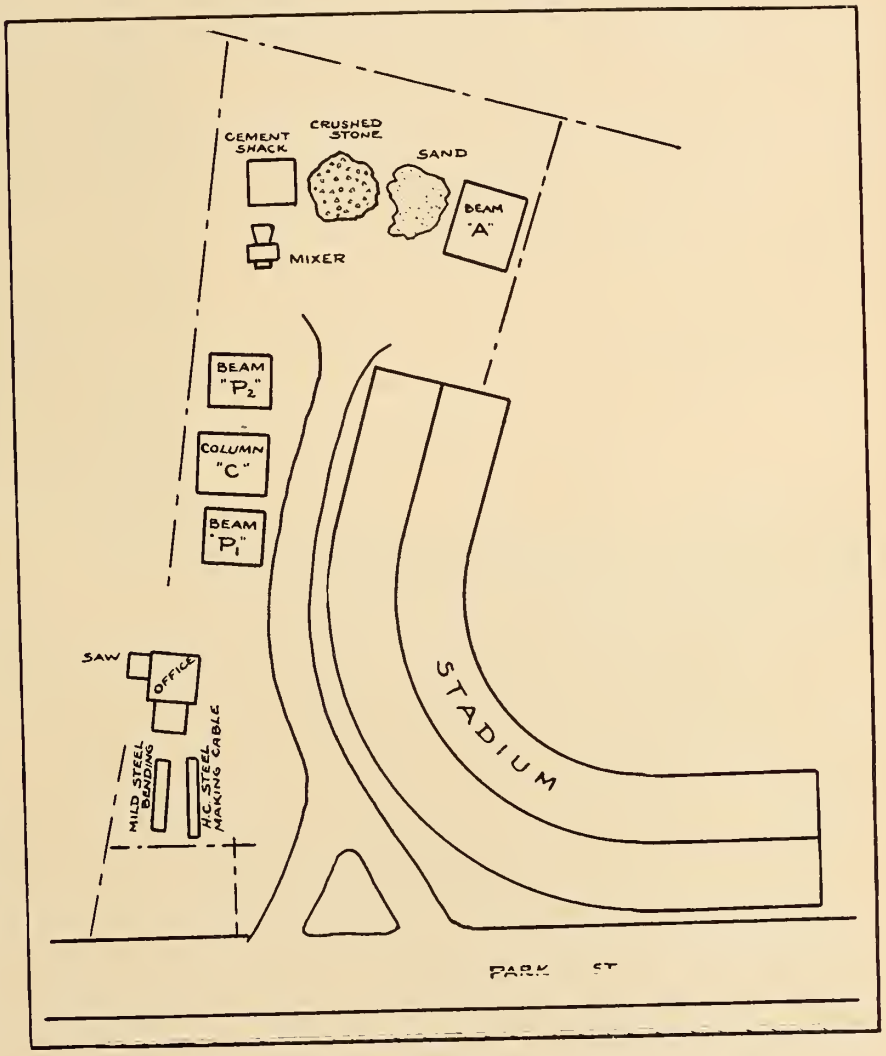

Fig. 3. Plan view showing general layout for construction.

Cantilever A — 12 in. thick, 31 ft. $10\frac{1}{2}$ in. long, depth decreasing from 4 ft. to 6 in.; weight $4\frac{1}{2}$ tons.

The unusual shape of the pieces, combined with their weight and the fact that working space was limited and the ground surface irregular, presented difficult problems of set up and handling. Storage space was nonexistent. Therefore it was decided to erect the elements as soon as completed in order to use the same equipment for all handling, moving and erecting operations. A 20-ton motor crane with a 70-ft. boom was used for this purpose. Th general layout is shown on Fig. 3

Cables

The prestressing cables were o cold-drawn high-carbon wire, 0.19 in. dia., furnished from the mill i 3 ft. coils. A special machine wa

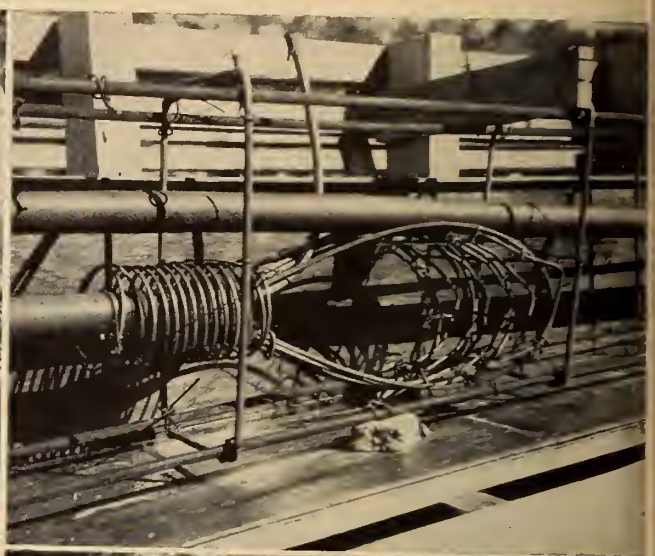

Fig. 4 (above left). Making a cable.

Fig. 5 (above right). Cable anchorage.

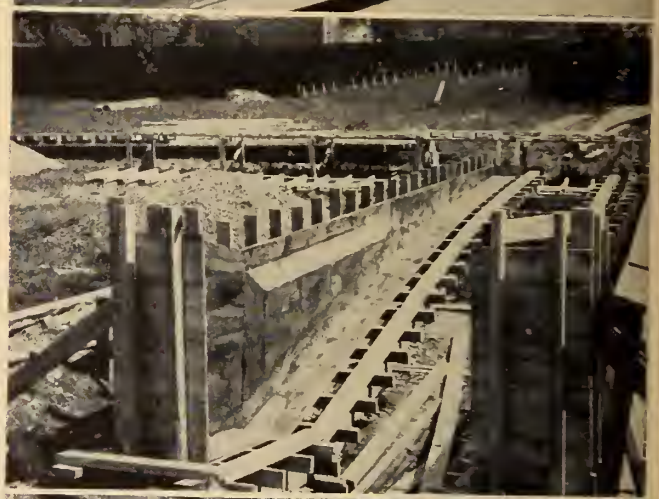

Fig. 6 (right). Typical forms for precast units; these are for the cantilever roof beams.

Fig. 7 (below left). Concrete bearing cylinders at ends of cables, with special reinforcing under them.

Fig. 8 (below right). Prestressing a bleacher beam; note the special jack used.

lesigned and built for straightening nd recoiling to 7 ft. diameter, prior o shipment to the job.

Tests made on the straightened vire showed an average failure stress of 220,000 psi. The reason for the recoiling of the wire was that as lelivered, it has a permanent curvature which makes it impossible to nake up proper cables. Recoiling to 7 ft. diameter does not permanently deform the wire and it remains straight when uncoiled.

After cutting to length, the wires were stretched on a bench (Figure 4), assembled 12 in a unit around a light-gauge spiral spring core, and tied firmly. The completed cable has a diameter of about one inch.

Some of the cables — those in the columns and cantilevers — had dead ends embedded in the concrete (Figure 5); in such cases, the cable was made of six pairs of wires forming loops. The six loops were maintained at the proper spacing by two grids of mild steel wire, which also served to distribute the load on the concrete.

The cables were completed by being threaded into 1¼-in. asphalt-coated fibre tubes. When several tube lengths had to be used on a single cable, the joints between them were carefully spliced and taped. The purpose of this tubing is to prevent bond with the surrounding concrete and to provide space for grouting.

A small quantity of mild steel bars was used to take care of handling stresses and wire grids and coils (see Figure 5) were placed in each anchorage area to distribute the relatively high local concentrated loading.

Forms

Strong and rigid forms were essential to attain the desired accuraey. Wood was used throughout as the quantity was not large enough to justify the extra cost of steel. The beds (Figure 6), were supported side by side on a heavy timber structure in such a manner that the top surface of each element as cast was horizontal. The removable side forms were made of 1-in. board panels with a ¼-in. plywood facing. The heaviest panel could be easily man-handled. For each element, five bottom forms and two and a half sets of side forms were used. The same forms were used repeatedly. They were given several coats of protective paint as a protection against damage by water, and greased with form oil before each concreting operation.

The successive steps in the prefabrication of the different elements of the frame were as follows:

1. Preparation of the form; installation of reinforcing; placing prestressing cables and anchorage blocks.
2. Pouring concrete.
3. Curing.
4. Partial prestressing and moving from the bed.
5. Completing the prestressing.

There is nothing out of the ordinary about the first operations except that care was required in placing the cables in their right locations and in tying them firmly to make sure they did not move when the concrete was placed. Special reference should be made to the method of reserving holes in the different elements for the future passage of cables; 1¼-in. rubber tubes, lubricated and tied to the form, were cast in the concrete and later pulled out.

Precast concrete cylinders (Figure 7) spirally reinforced, 4 in. diam. by 4 in. high, with a central hole permitting the threading in of the free end of the cable, were also placed against the ends of the forms. These cylinders, made of high grade concrete, were cast in special moulds on a small vibrating table.

The concrete, brought from the mixer in wheelbarrows, was shoveled into the form, placed and vibrated internally. Specifications required a 5,000-lb. concrete strength at 28 days; the problem was to get enough strength at an early age to allow prestressing after a short period of curing. This was solved by the use of XXX cement and a water-cement ratio not exceeding 0.46. A 1:2:2 mix by volume was used.

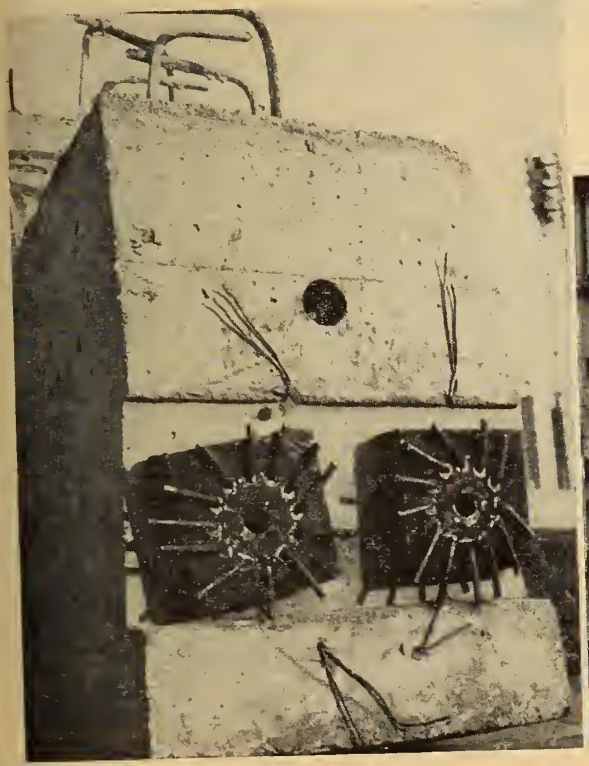

Fig. 9 (left). Anchor plates after completion of prestressing.

Fig. 10 (below). Bleacher slabs.

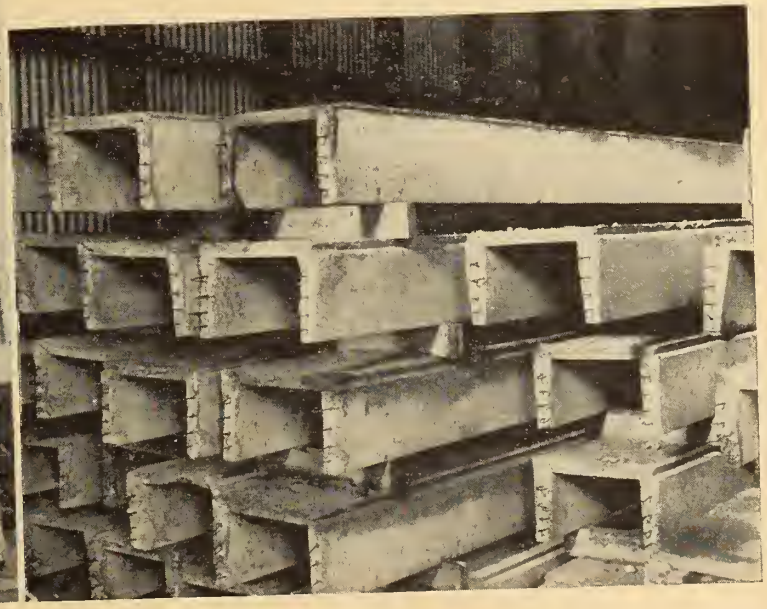

Fig. 11. Roof slabs.

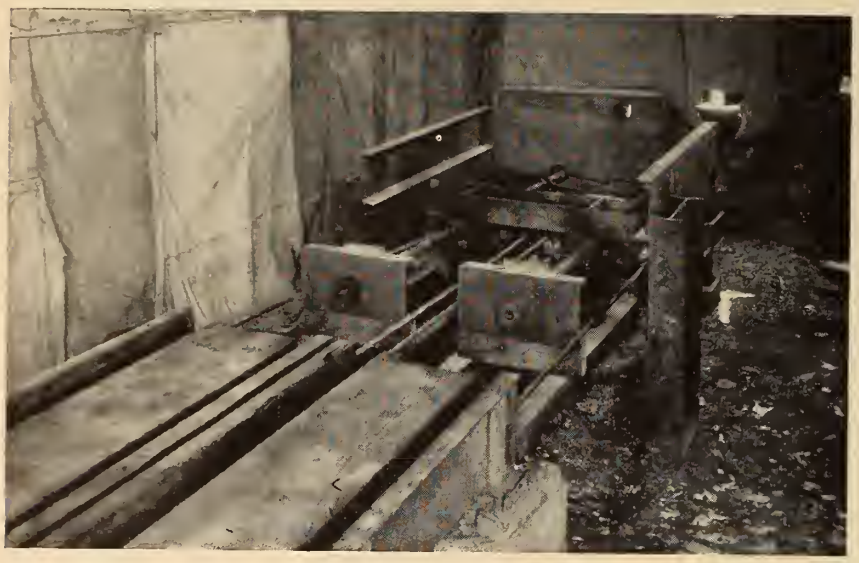

Fig. 12. Movable anchorage at end of roof and bleacher casting bench.

Sand was purchased locally, but since there was only very poorly graded gravel available locally ½-in. crushed limestone was brought in from Actonvale, 45 miles away. With an admixture of Darex AEA as a plasticizer, the mix gave a 2-in. slump, and was easily placed. After four days, the average compressive strength varied between 3,600 and 4,000 psi., as measured with an impact test hammer.

Normal curing was employed with water sprays and canvas covering, following the stripping of the side forms, usually the day after pouring.

Partial prestressing applied only to the cantilever beams. On the fourth day after pouring, one cable of these members was stressed to its full tension and anchored. It was then possible to lift the beam from its casting bed without damage.

All other pieces were removed from their moulds on the third day, and set on temporary skids. The 20-ton crane handled all the pieces with special lifting slings and bars. Lifting hooks were provided on the top faces of the columns, and cut off after erection. The beams did not require the use of special hooks, as the stirrups projecting from their top faces were used.

The prestressing was then applied to the bleacher beams and completed on the cantilevers. The cables in the bleacher beams, short and reasonably straight, were stressed from one end only; an anchor plate was placed at one end of each cable and the cable pulled from the other end and anchored under tension.

The Preload anchor plate is a 4 x 4 x 1¼ in. steel plate, drilled with a central hole, and with 12 small conical holes disposed symmetrically about its centre. Each of the 12 wires in the cable is threaded into one hole and the plate is forced against its concrete seat. A specially designed 40-ton hydraulic jack (Figure 8) is then placed with its head centred in the central hole. The wires are wedged by pairs to the collar of the cylinder, and all are pulled at the same time. Tension in the wires is checked by the pressure gauge at the pump and by measurement of the elongation of the wires. Actually, the tension is built up a little higher than required, maintained for several minutes, and the wires are then anchored by means of small case-hardened split wedges, hammered into the holes of the plate. Then the pressure in the jack is slowly released. The wedges recede slightly and fit themselves in their holes, creating a permanent anchorage of the wires, which are then cut off and bent back against the plate as shown on Figure 9. The initial stress given the wires takes into account the subsequent loss due to the set of the anchors, to the creep of the steel, and to shrinkage and plastic flow of the concrete. It may be mentioned that this type of anchorage and tensioning apparatus was conceived, designed and built in Canada.

In the elements of the frames of the grandstand, the stress in the wires before anchorage was built up as high as 172,000 psi. Depending on the cable, the working stress, after all losses, varies between 134,000 and 140,000 psi., never exceeding two-thirds of the failure stress. The 172,000-psi. stress corresponds to a force of about 30 tons applied to the concrete through the anchor plate, the bearing surface of which is 12.86 sq. in. This represents a bearing pressure of 4,650 psi., which was safely supported by the concrete.

After completion of the tensioning, the cables were grouted with a cement mortar through the centre hole of the plate to protect them against corrosion. Actually this operation was often performed after the erection of the member.

The Slabs

The bleacher and roof slabs (Figures 10 and 11) cover a total area of 27,900 sq. ft. They are of the channel type, 16½ in. wide, with top slab 1¼ in. thick. The bleacher slab is

10 in. deep, the roof slab 4 in. deep. Both are prestressed by four high-carbon wires each 0.135 in. diam., in each leg, the maximum clear span being 13 ft. One top edge of each bleacher is provided with a key-shaped groove, permitting a joint between adjoining slabs to be made in the field. Both upper corners of the roof slabs have a similar recess. The free ends of the reinforcing wires are hooked: the hooks are later embedded in concrete poured on top of the beams between the ends of the slabs, insuring a positive connection.

A total of 1,001 bleacher slabs, of lengths varying from 8 ft. 6 in. to 13 ft. 9 in., were used in the structure, and 622 roof slabs of lengths varying from 10 ft. 4 in. to 13 ft. 7 in. Actually some of the 10-in. slabs were used in the roof to form either its rear edge or the edges of the openings around the existing steel lighting towers.

The average weight per square foot of the 10-in. slab was 44 lb.; it was only 24 lb. for the 4-in. slabs. The maximum weight of a slab was about 800 lb. for the 10-in. type, and 400 lb. for the 4-in. type, making their handling easy.

Making these slabs required a more elaborate set-up than the prefabrication of the frame members. Therefore a sub-contract for this work was let to a firm specializing in this type of product.

Their plant consisted of a bench 220 ft. long carrying two continuous steel moulds side by side, with provision for expansion. At each end of the bench a sturdy abutment, independent of the moulds, was fitted with an anchorage, fixed at one end, and movable at the other (Figure 12). A system of hydraulic jacks and heavy threaded bars actuates the movable anchorage.

The parallel reinforcing wires were drawn straight along the bench and anchored at both ends. The positioning of the wires in the mould was controlled by separation plates which also served as end forms for each slab. A gap of about 6 in. was left between the end plates of two adjoining slabs. The required tension is given to all wires simultaneously by operating the movable anchorage. Some transverse reinforcement — fine wire mesh and small diameter bars — were placed in the mould, which was then ready to be filled with vibrated concrete.

The concrete, brought from the mixer in buggies, was a mix of XXX cement — 7 bags 1 cu. yd. — Jolliette sand, and ¼-in. crushed limestone, with an admixture of a plasticising agent to maintain good workability despite a low water-cement ratio.

After completion of pouring, a canvas tunnel, hanging from the roof, was lowered so that it completely covered the bench. Then live steam was circulated in the tunnel through perforated pipes. The temperature was gradually brought up to 150° F. and this accelerated curing was continued for 12 hours. Sample cylinders were cured at the same time to give an effective control on the operation.

After the concrete had attained a strength of about 3,000 psi., the heating was stopped, the tunnel removed, the tension apparatus released and the wires cut off between the separation plates. These operations released the tension forces, which were transmitted to the slabs by the combined effect of bond and wedge action at the ends. Then the slabs were lifted from their moulds and brought to the storage yard, where the free ends of the wires were hooked. They were now ready to be loaded on floats and shipped to the job. The haul to the job was over a hundred miles, but breakage, always due to imperfect bracing of the load, was not excessive.

Erection and Completion

The sequence of erection of the different elements has already been outlined and there is little else to add. Guy ropes fitted with turnbuckles were used during column erection to control alignment. After some of the columns had been placed, the reinforced concrete tie beam, B, was formed and poured. Figures 13 and 14 show a column being set and a roof cantilever being placed. All the bleacher slabs were placed with the 20 ton crane.

The average time for placing the different elements was:

Column.....	2 hours
Bleacher beam..	½ hour
Cantilever beam	1½ hours

Fig. 13. Setting a column.

Fig. 14. Placing a roof cantilever.

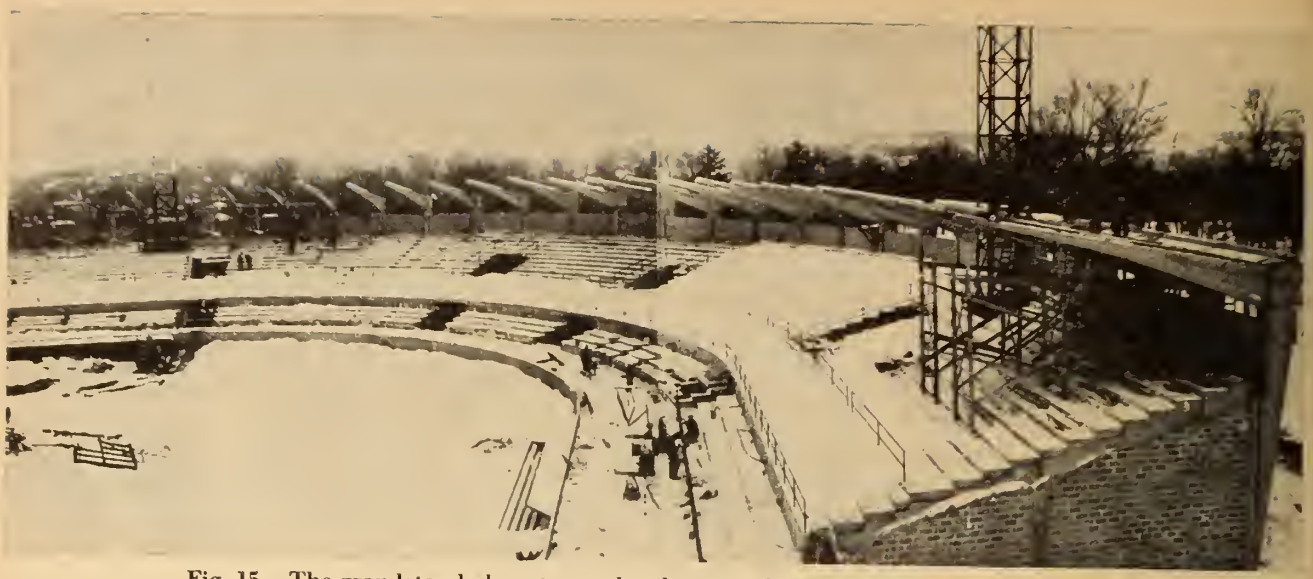

Fig. 15. The grandstand almost completed; most of the roof slabs yet to be placed.

Bleacher slab... 3 to 4 minutes

The continuity cables through the columns and bleacher beams were tensioned after the completion of the structure. This operation was carried out from the lower end of the cable, after fixing the anchor plates at the column end. The required elongation of this cable was about 4 in.

Following this operation, the joints between the slabs were packed with a cement-sand mortar and sealed with a plastic top joint about ¾ in. thick. The last operation was covering all exposed anchor plates with cast in place mortar encasement.

Tests — Factor of Safety

Several unofficial tests were run on the bleacher slabs. One of them was witnessed by a group of about 100 members of the Institute who visited the job on November 8, 1952. Official tests were also performed on the same type of slab in the laboratory of L'École Polytechnique de Montréal. All these tests showed the perfect elasticity of the slab under loads well in excess of the design load. Failure always occurred by extension of the legs under loads exceeding two and a half times the design live-load.

No test was specified for the frames themselves. However, the tensioning of the cables was in itself a test of the quality of the materials by submitting them to much higher stresses than those ever to be produced by normal loads.

According to the calculations, the safety factor against failure, with respect to live-load, is 4.8 for the bleacher beams, 4.0 for the cantilevers and 3.8 for the columns.

Conclusion

At the beginning of this paper, economy in steel was mentioned as a major reason for the choice of prestressed concrete for the superstructure of this grandstand. As a matter of fact, the actual saving in steel can be estimated at about 65% of the quantity which would have been required, had ordinary reinforced concrete been used.

Undoubtedly also there was some saving in the overall quantity of concrete. On the average, there is 0.56 cu. ft. of concrete per sq. ft. of horizontal projection, and 1.92 lb. of steel, i.e., 93 lb. 1 cu. yd.

Another saving was in forms and scaffolding. An average of only 1.1 ft.bm of lumber per square foot was used for the whole job.

Regarding overall economy: the cost to the City was $7.35/sq. ft. of projected area of bleachers and roof together; this figure includes the cost of plumbing, of electrical work and of seats. It may be compared to $6.65/sq. ft. in 1949-50 for the grandstand of the Molson Stadium in Montreal, which was built without any roof or wooden seats.

This work is a demonstration of how basically unsound are the fears of some who claim that prestressed concrete is not adapted to our way and our means. This structure was entirely designed and built by Canadians, with Canadian materials and equipment, and using methods developed in Canada. The construction required only careful supervision, and honesty and understanding from the men on the job; these qualities are not too difficult to find in this country.

Acknowledgments

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Precast Slabs — Hesmont Concrete, Ltd., Montreal, Que.

Field Superintendent for Preload Co. — Joseph Allaire.

Field Engineer for Preload Co. — René Martineau, Jr. E.I.C. √

Directory

See page 1163 for particulars re our new 1953 Membership Directory.

Modern Instruments of Physical Oceanography and their Use in Waters of Interest to Canada

by

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Defence Research Board of Canada, Dartmouth, N.S.

A paper presented to the Annual General and Professional Meeting of The Engineering Institute of Canada, Halifax, May 20, 1953.

New and modern devices for measuring temperature and salinity of ocean waters have opened up a new era in hydrography. The instruments here described record the rapid changes in sea behaviour, the knowledge of which is necessary for accurate asdic (sonar) submarine detection.

The use of this equipment during 1950 on the Royal Canadian Navy's "Operation Cabot", a survey of Gulf Stream waters between Cape Hatteras and Grand Banks, is described, and some of the findings are recorded.

The publication of Rachael Carson's best-seller "The Sea Around Us" has served as an introduction to oceanography to a great many people. The interest in this book lies largely in the attractive presentation of little known ideas but, in addition, it indicates a public recognition of the fact that the applications of oceanography are becoming of increasing importance in both peace and war. It is some of these applications, and particularly the instruments which made them possible that will be covered in the following paper.

Oceanography is a relatively new science. The first major oceanographic cruise (and still rated as one of the greatest) was the British Challenger Expedition of 1873-1876. Around 1900, as an aid to fisheries research, permanent stations for marine studies began to be established. Well equipped expeditions for ocean exploration were sent out both before and after World War I.

The principal instruments used on these expeditions were water-sampling bottles and reversing thermometers, used in a technique known as "occupying a hydrographic station". These instruments, when lowered from a stopped ship, made it possible to obtain the temperature and salinity of the water at discreet depths below the ship. This still remains the most accurate way of obtaining temperature and salinity at depth in the sea.

The development of submarine detection by the use of sound transmitted by sea water (a technique known either as Asdic or Sonar) gave a military aspect to oceanography, since efforts to increase the range and effectiveness of this gear

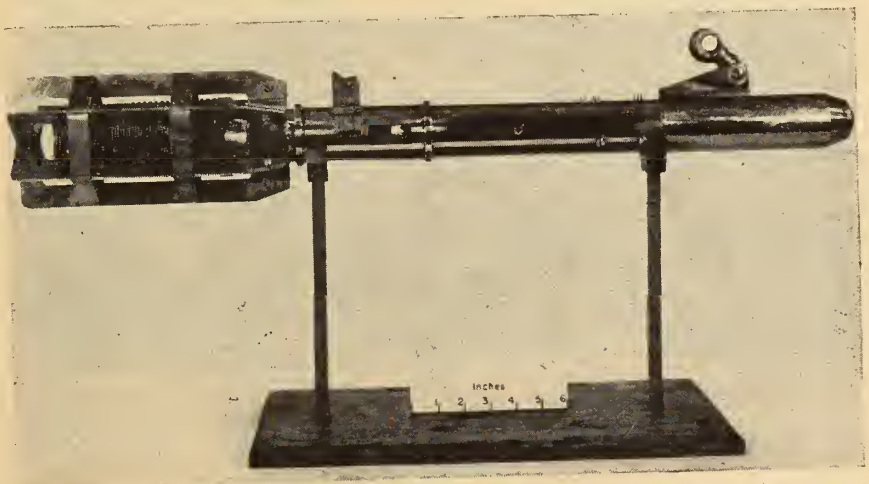

Fig. 1. The bathythermograph—a rapid temperature-depth measuring instrument.

were found to be limited often by the properties of the sea itself.

When sound beams pass through water which is not uniform in temperature or salt content, they are refracted. They may be bent in such a way that an attacking submarine will escape detection in what is known as the shadow zone. At other times this refraction can cause abnormally long ranges. Thus long or short ranges may be experienced, depending on the stratification of the water column, which in turn largely depends on the warming effect of the sun and the mixing action of the wind.

Hence, shortly after the outbreak of war it became urgent that asdic operators be aware of the thermal structure of the water through which they were passing. It also became important for those planning naval operations to know the water conditions likely to exist in a particular area at a particular time.

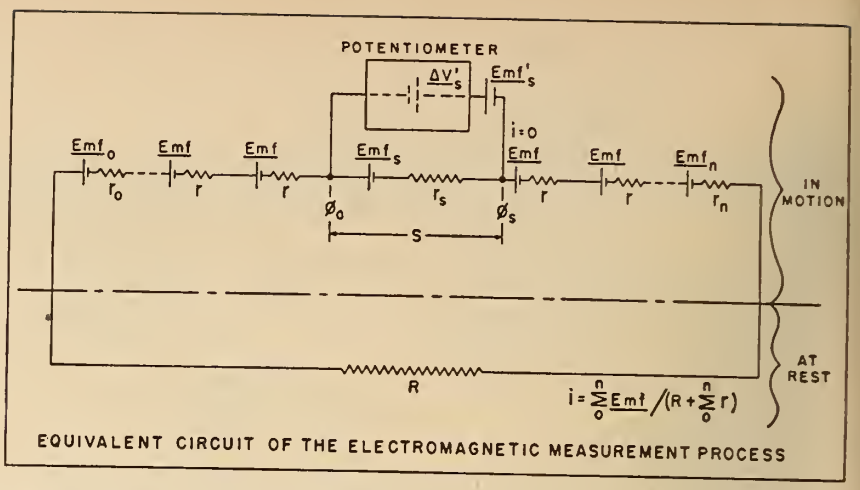

Fig. 3. In this circuit the motional Emf'_s induced in the measuring apparatus is precisely equal to Emf_s induced in the moving sea. The potential drop across the directed interelectrode length s is $\Delta\phi_s = Emf_s - ir_s$. Therefore the signal measured at the potentiometer is $\Delta V'_s = Emf'_s - \Delta\phi_s$ which reduces to ir_s where i is the electric current flowing in the sea between the electrodes and hence is a measure of the water current (courtesy W.H.O.I.).

The Bathythermograph

Until shortly before World War II, no method existed of conveniently and quickly determining the thermal structure of the upper few hundred feet of the ocean. This need was met by the invention of the bathythermograph by Spilhaus in 1939 (Fig. 1).

This instrument can be lowered from a ship while underway. It gives a continuous graph of temperature versus depth from the surface to as deep as 900 feet, thus covering the most likely depths of submarine operation. This has now become a major tool of the oceanographer, as well as being standard equipment on almost all United States and Canadian warships. Hundreds of thousands of observations have been recorded and filed covering all the oceans.

The bathythermograph (BT) consists of a rocket-shaped body with a holder for a smoked slide mounted on a bellows, which moves the holder with changes of depth. In the tail of the instrument a thermal element operates a stylus, which moves across the slide approximately at right angles to the depth motion. A trace is formed on the slide, which will be a straight line if the temperature remains constant with increasing depth, or a crooked line if the water contains varying thermal gradients. This trace is viewed through a specially calibrated grid, from which the temperature variation with depth can be read.

Fig. 2. N.R.E. bathythermograph calibrator. A refrigeration unit below the table cools the water in the storage tank at the left which is circulated through the water jacket of the pressure tank on the right. Pressure is applied by the large pump at right of centre and checked by the gauge tester. Electric heaters in the base of the pressure tank are used for raising the temperature in the desired steps as indicated by the long-stemmed thermometer in the top of the tank. This tank handles five B.T.'s at one time.

B.T. Calibrator and Sea Sampler

As these instruments require recalibration from time to time, test facilities are required, which must be capable of reproducing accurately the full temperature and pressure range of the bathythermograph. For several years such a calibrator, designed and built at the Naval Research Establishment, has been in use at that laboratory (Fig. 2). Recently a second one has been put into operation at the Pacific Naval Laboratory on the West Coast.

These facilities play an important role in the Canadian oceanographic and asdic programs. They provide the means of first checking and thereafter recalibrating at intervals the bathythermographs received

rom the manufacturers in the Jnited States and Great Britain.

A further development of the athythermograph is the sea sam-ler of Spilhaus and Miller. This has ring of twelve wedge-shaped bot-les placed around an extended ba-hythermograph body. The device s so arranged that, after a lowering, as the instrument is raised through he water, the bottles close in suc-cession at present depths, thus samples of the water are obtained or salinity or other chemical ana-lysis.

As this, like the bathythermo-graph, can be used underway, a sec-tion of the ocean can be surveyed at a much faster rate than was ever possible by the hydrographic station technique. The depth of sampling is, of course, limited to that of the BT, and the accuracy is considerably less than by the older technique.

The S.T.D.

In addition to these mechanical recording devices, an electrical Sali-nity-Temperature-Depth recorder (STD) has been developed by the Woods Hole Oceanographic Institu-tion. This measures the temperature by means of a resistance thermome-ter, and the depth by a helical bourdon tube operating a variable resistance.

The conductivity of the seawater between two platinum electrodes spaced a few inches apart is meas-ured. This is combined with the temperature by an electro-mechani-cal computer in the recorder to give the salinity. The sensing unit is lowered over the side of a ship on a wire and so records, on a calibrated paper chart in the ship, the tem-perature and salinity of the water, as well as the depth of the sensing unit.

Here again speed of recording is sacrificed at the expense of accu-racy, as this instrument's salinity and temperature values are only about one-tenth as accurate as by the reversing thermometer and the titration of water samples. However for some purposes, such as surveys of estuaries and across current boundaries, its accuracy is quite adequate.

The GEK

The measurement of currents at sea, particularly in water too deep for anchoring, has long been a prob-lem. A device developed since the war by William Von Arx(1) of the Woods Hole Oceanographic Insti-tution, known as the Geomagnetic Electrokinetograph or GEK (also nicknamed Jog Log) has made such measurements possible.

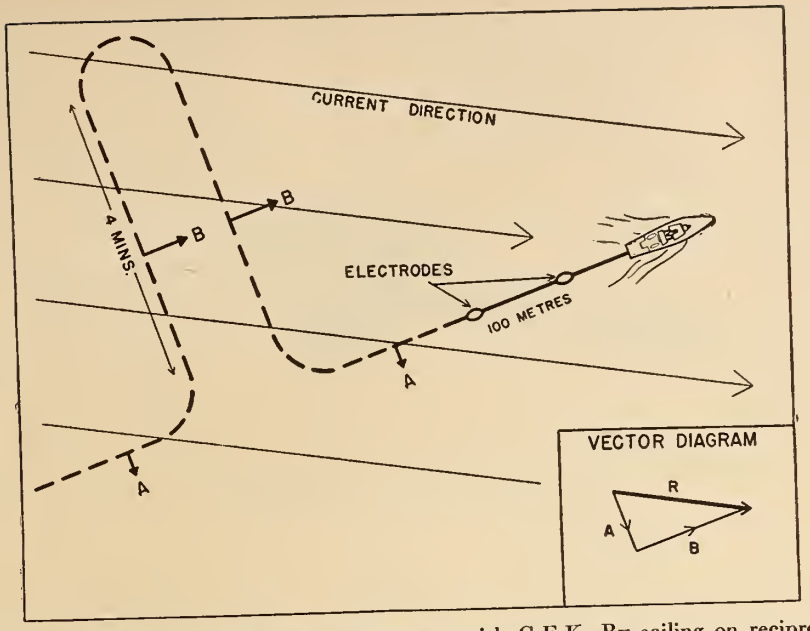

Fig. 4. Sailing Plan for current measurement with G.E.K. By sailing on reciprocal courses equal and opposite measurements of the current are recorded on the moving chart paper allowing a zero current check to be made. Using this zero the values of the vectors A and B are found and combined to give R, the resultant current.

This operates on a principle stated by Faraday in 1832 that:

"where water is flowing, there electric currents should be formed; thus, if a line be imagined passing from Dover to Calais through the sea, and returning through the land beneath the water to Dover, it traces out a circuit of conduct-ing matter, one part of which, when the water moves up or down the channel, is cutting the mag-netic curves of the earth, whilst the other is relatively at rest."

One hundred and sixteen years later, in 1948, the flow of the English Channel was measured in such a manner. More recently the same method has been applied to the Straits of Florida, by putting elec-trodes in the sea at either side and measuring the potential between

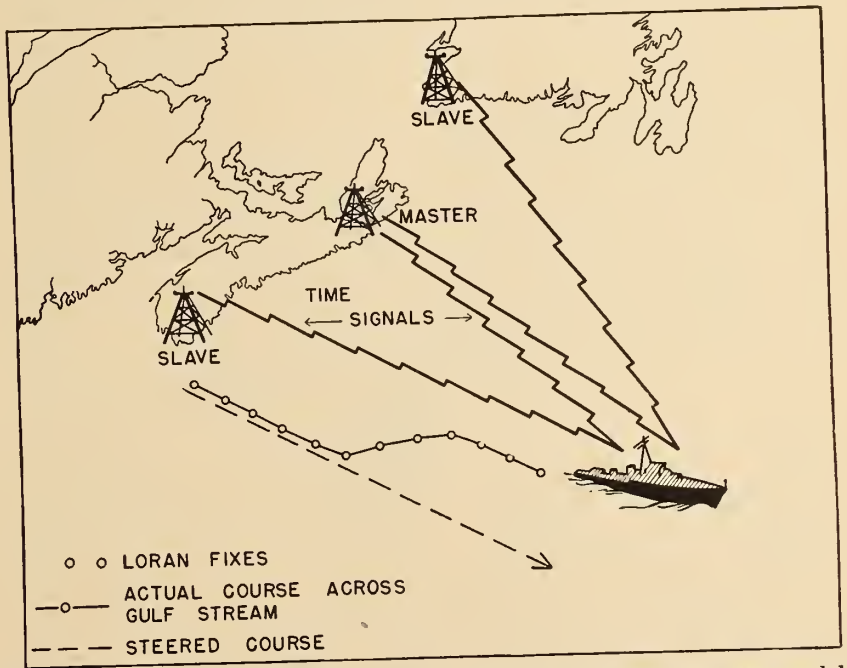

Fig. 5. By frequently plotting the position of the ship as given by Loran and by comparing this with the steered course, the set of the ship and hence the current at right angles to the ship's course can be found. In this figure such a plot (not to scale) is shown.

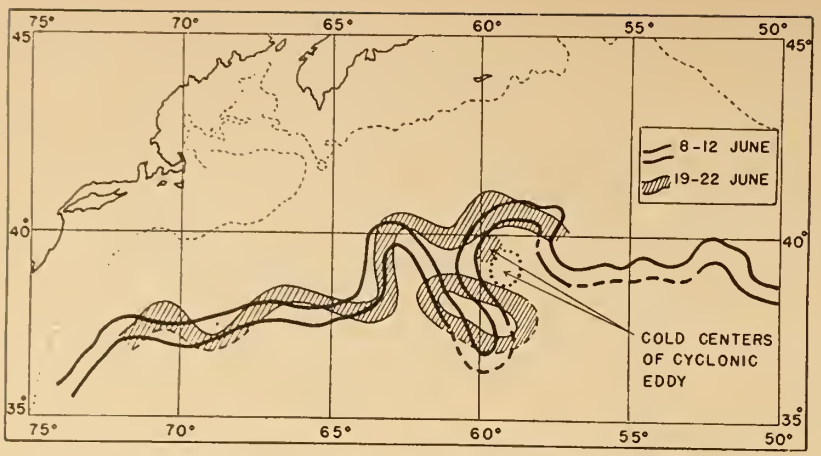

Fig. 6. Positions of the "warm core" of the Gulf Stream during first and last periods of Operation Cabot (courtesy W.H.O.I.).

them by the use of a telephone cable across the Strait. A similar project to measure the total flow of the Gulf Stream by using the Halifax-Bermuda cable is now in progress.

The essential physical equipment that constitutes the sea-going version of this, the surface Electrokinetograph, is a pair of electrodes mounted one hundred meters apart on a two-conductor cable. This cable is long enough to stream them astern, away from the influences of the ship. There is also a recording potentiometer on board to which they are connected (Figs. 3 & 4). With this equipment and the ship's compass, observations are made under way of the direction and the potential difference between the electrodes.

These potential differences are due to water motion at right angles to the course, and change sign when the current sets the ship to port or starboard. Through measurements of the potential difference on two courses at right angles, the component velocities in the two directions are known. The resultant of these velocities gives the surface water current in that locality.

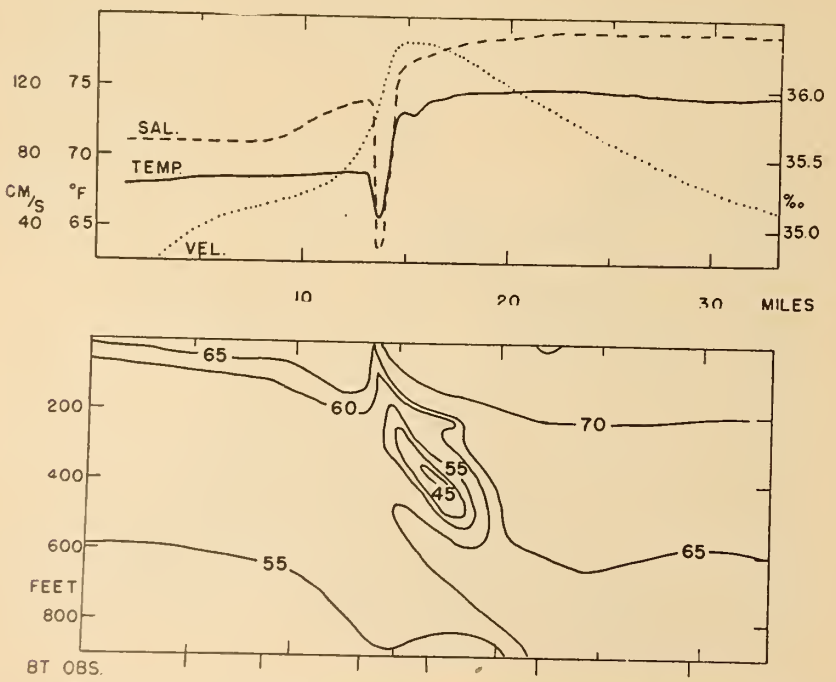

Fig. 7. *Detail of a crossing of the Gulf Stream during Operation Cabot.* Upper section gives surface temperature and salinity from S.T.D. and the surface velocity component normal to the ship's course from G.E.K. Lower section gives the vertical isothermal profile from B.T.'s showing location of cold low salinity water at the edge of the Stream (courtesy *Journal of Marine Research*).

The Echo Sounder

For centuries the only available method of finding the depth of the sea was by lowering weights or other devices on a line from a ship. Sometimes miles of piano wire were used for this purpose. In 1920 the first echo sounder was invented. This instrument sent into the water pulses of sound directed at the bottom of the sea, and measured the time of the returning echoes.

As the velocity of sound in seawater was known, the instrument was calibrated to read directly in fathoms. Modern versions of this are now fitted in all ships, down to and including small fishing craft. These are usually capable of obtaining soundings to a depth of about 250 fathoms. Within the last ten years echo sounders have become available commercially, capable of sounding to depths of 4,500 fathoms (27,000 feet).

A number of research vessels, including the Canadian Naval Auxiliary Vessel *Sackville*, operated by the Atlantic Oceanographic Group of St. Andrews, New Brunswick, are now equipped with such gear. Surveys carried out with this type of equipment in the last five years by various agencies have shown that the ocean bed is far from being the smooth plain envisaged from the early soundings made by line.

Thus, for example, a whole range of submerged mountains as high as the Rockies, whose existence was not suspected, has been found south of Nova Scotia. Only one, the Kelvin Bank, appears on Admiralty Charts of five years ago. As shown in the excellent article in the February 9th issue of *Life* magazine, similar mountain ranges, canyons, etc. have been found in all the oceans.

The Loran System

A necessary adjunct to rapid oceanographic surveying is good navigation. Facilities for this have been greatly improved in recent years by the development of the Loran system, which makes possible accurate fixes of position over much of the ocean (Fig. 5). In this system an operator on a ship measures the difference in time between radio pulses received from a pair of stations on the land.

Such differences, when plotted on a chart, form curves. The ship will be at the position on the chart where the curve for the measured time difference between one pair of stations intersects that for another pair. As this can be done in a few minutes, if conditions are favourable, fixes can be obtained at frequent in-

ervals. Thus the actual course of ne ship can be plotted, even nrough rapidly varying currents.

Operation Cabot

With the exception of the deep ea echo sounder, all the equipment nentioned has been fitted at various imes in the Naval Research Establishment's ship H.M.C.S. *New Liseard*. This gear proved exceptionlly valuable in the six-ship survey f the Gulf Stream, known as "Operation Cabot", which took place in June 1950.

On this cruise, *New Liskeard* recorded the surface salinity and temperature continuously, by towing the measuring head of the STD Recorder on a pipe over the side. Bathythermograph lowerings were made every half hour (some 700 in all), while a sea sampler was used at two-hourly intervals while near the Gulf Stream. The GEK was streamed continuously, and alterations of course to get current vectors (jogs) were made every hour.

The Gulf Stream

As a result of the rapid accumulation of data by *New Liskeard* and the five United States vessels, a synoptic picture of the waters of the Gulf Stream, from Cape Hatteras to the tail of the Grand Banks, was made possible.(2) The stream, as shown in Fig. 6, was found to be a narrow current, only 30 to 40 miles wide, meandering through the ocean rather like a land river in flat country but, unlike a land river, the paths of the meanders moved.

It was possible to show for the first time that the meanders progressed downstream at about ten miles per day. It is interesting to note that these meanders start in the vicinity of the previously mentioned submerged mountains, which lie in the path of the stream. These mountains may play an important role in forming meanders and eddies, even though their tops are nearly a mile below the surface.

Before Operation Cabot only one vessel, the *Atlantis*, had carefully observed a large Gulf Stream eddy. During "Cabot" the formation and development of a large eddy was followed for about three weeks. This eddy first appeared about 300 miles south of Halifax as an exaggerated southward meander of the Stream, with a big loop connected to the main Stream by a neck 100 miles long and about ten miles wide. After a few days this neck disappeared, leaving the eddy to revolve by itself while the main stream continued its course.

Another feature of the Gulf Stream that appeared as a result of "Cabot" was the recognition of pockets of cold low salinity water at the northern, or inshore edge of the Gulf Stream.(3)This was based largely on data collected by H.M.C.S. *New Liskeard*. The data from the BT, the Sea Sampler, the STD and the GEK, made it possible to draw cross-sections of the Stream (Fig. 7). These showed that long narrow pockets of cold water exist at the point of maximum change of temperature, which is also the point of maximum velocity at the edge of the stream. These pockets of cold water extend to a depth of 600 feet, with a minimum temperature at 400 ft. A survey of the data from all six ships (Fig. 8) showed that this cold water appeared in patches all along the northern edge of the Stream.

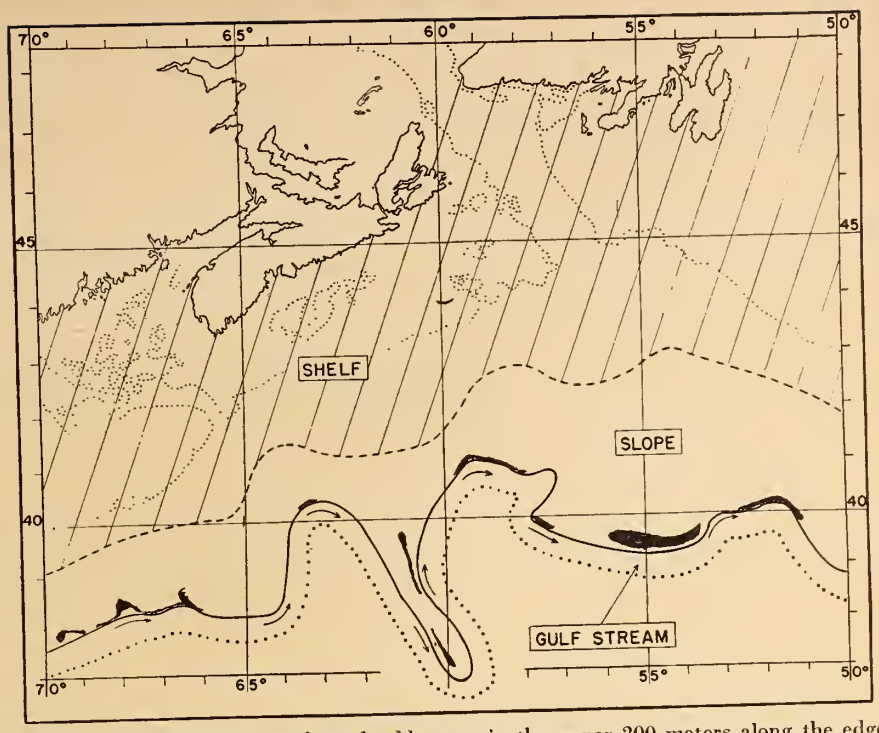

Fig. 8. Distribution of patches of cold water in the upper 200 meters along the edge of the Gulf Stream during the first eight days of Operation Cabot (heavy cross hatching) (courtesy *Journal of Marine Research*).

From its temperature and salinity it was shown that this water could not have come from the Gulf Stream or the slope water to the north of it, but must have originated in cold low salinity waters such as those of the Scotian Shelf. The mechanism for getting this water into the Gulf Stream is not known, although several suggestions have been made.

Conclusions

Thus as new features of the oceans are explored, new and puzzling questions arise to challenge the observer. The rapid collection of data, the quick exchange of information and the availability of ship facilities on a scale never before approached, today make oceanography a rapidly developing science. All these help to put the new tools of the trade to the greatest possible use.

The words of Dr. Redfield of the Woods Hole Institute of Oceanography, when addressing the Boston Society of Civil Engineers in 1950(4), make a fitting conclusion to this paper.

> "When combined with the exact and continuous method of determining position at sea by Loran, these devices reveal structure and motion of the water quite beyond the scope of the older methods, and with a speed which compensates somewhat for the great cost of collecting data at sea. These developments have opened a new era in hydrography, which is now in a position to deal with rapid changes in the behaviour of the sea".

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4. Redfield, A. C., 1950 — Some applications of oceanography to engineering problems. J. Boston Soc. Civil Engrs. July, 1950. √

Tests of a Furnace for a

The development of the gas turbine for aircraft propulsion during and after the recent war stimulated considerably the production of designs of industrial gas turbines. Various duties were proposed in these designs, such as electric power generation, gas line pumping, railroad applications, and marine propulsion, and presently a fair number of gas turbines are in service on these various duties. All of them, however, burn either oil or gas as their fuel.

It is rather ironic that the outcome of Dr. Diesel's attempts to burn coal in an internal combustion engine should have been the development of an engine which, more than any other, has diminished the use of coal for power purposes. The gas turbine, however, does offer a possibility of using coal as its fuel, and it looks as though the problems of so doing are considerably less than the problems encountered by Dr. Diesel in his earlier work. Indeed, there are good grounds for believing that in the fairly near future there will be serious commercial possibilities of using a coal-burning gas turbine.

In order to appreciate the various problems encountered and the possible methods of their solution, let us refer first to Figure 1. This shows the simplest possible gas turbine, containing a compressor for supplying compressed air to the combustion chamber, from which the hot compressed gas expands through the turbine. Under the right conditions the turbine produces more work than is required from the compressor, so that a net power output is available.

It will be noticed in this simple arrangement that any and all of the products of combustion pass straight through the turbine. If we simply replace the liquid or gaseous fuel by a solid fuel having a residual ash after combustion, it is quite clear that these ashes are going to be blown through the turbine at high speed and will act as a powerful erosive agent. Before one can consider burning coal directly like this, it is essential to separate out all the ash particles from the hot gas stream. This is by no means easy, because the gas is under a pressure of four to six atmospheres; it is at a high temperature of 700 or more degrees C, and the degree of separation required is very high indeed.

Work on separator development has been going on in the United States and the United Kingdom for some time, and the Locomotive Development Committee in the United States have recently run a full-sized gas turbine for more than 750 hours, using pulverized coal as fuel. However, at this stage it could not be said that the separator or combustors are completely satisfactory. There is still further development to be done, and it is actually quite a cumbersome component for which one might imagine maintenance difficulties.

A second method of utilizing coal fairly simply would be to gasify it in an external gas producer and then burn the gas in the gas turbine unit. However, this still means a separation problem, although the quantity of gas to be filtered is much less than the quantity of hot air to be filtered. The producer gas, if made at atmospheric pressure, must be compressed, or else a pressurized producer must be used. So far, a compact, efficient producer for these purposes has not been developed.

Another attack altogether is to use what is known as a closed cycle. Diagrammatically, it is shown in Figure 2. It will be noticed that, instead of heating the compressed air by internal combustion, it is heated by being passed through a heat exchanger. The exhaust from the turbine is not rejected to the stack, but is passed through a cooler and returned to the compressor intake. The heat is supplied to the other side of the heat exchanger by a

In view of the diminishing demand for Canadian coal due to competing fuels, and because of our vast coal resources, the search for new methods of coal utilization is of vital importance. McGill University, in co-operation with the Department of Mines and Technical Surveys, has been conducting research on the possible use of coal in the gas turbine. Results to date are encouraging.

In this paper the authors enumerate the various methods of utilization and discuss furnace design. A description of the equipment used for the tests is given, and the test data and preliminary test results are recorded.

A paper presented at the 67th Annual General and Professional Meeting of The Engineering Institute of Canada, at Halifax, May, 1953.

Coal Burning Turbine

by

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and

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Gas Dynamics Laboratory,
Department of Mechanical Engineering,
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quite separate combustion system.

It is evident that the products of combustion cannot get near the turbine in this system, although one must obviously have a large supply of cooling water for the cooler, and we must expect a fair expense in heat exchanger equipment. Units operating on this system up to 12,500 kw. have been installed, but so far have all used oil as fuel, although a considerable amount of experimental work on coal has been done. In very large power sizes it is probable that this type of system is the best method of using coal.

A fourth method, somewhat similar though simpler than the closed cycle, is to use what is known as the exhaust-heated cycle, which is shown in its simplest form diagrammatically in Figure 3. Here, it will be noticed that the compressed air is heated indirectly as in the closed cycle, but instead of returning the exhaust air from the turbine to the compressor, this hot exhaust air is used as combustion air. The hot products of combustion then pass through the other side of the heat exchanger. It will be evident that there is no possibility of coal products getting near the turbine, nor is there any need for large supplies of cooling water, and the exhaust-heated cycle looks quite attractive for medium powers.

The exhaust-heated cycle was proposed independently by the senior author and the British Ministry of Fuel and Power some years ago, and both in the U.K. and Canada, work is proceeding on its development. In the United Kingdom the decision has been taken to go straight to a locomotive engine, but in Canada we have felt it necessary to conduct some research to try and find out more concerning the basic principles of this type of engine, before embarking on the major project of designing and building an experimental locomotive.

The Canadian Department of Mines and Technical Surveys felt that research on this project would be a useful contribution, and awarded a contract to McGill University for its Gas Dynamics Laboratory, Department of Mechanical Engineering, to design, build and test an experimental machine operating on this cycle in order to prove out the principles of operation; to study the problems of control, of ash deposition, behaviour of different coals, etc. In this report, some of the tests on an experimental furnace for the experimental plant are described.

Furnace Design Considerations

Design requirements for the furnace for the exhaust heated cycle include:

a. Combustion at relatively low

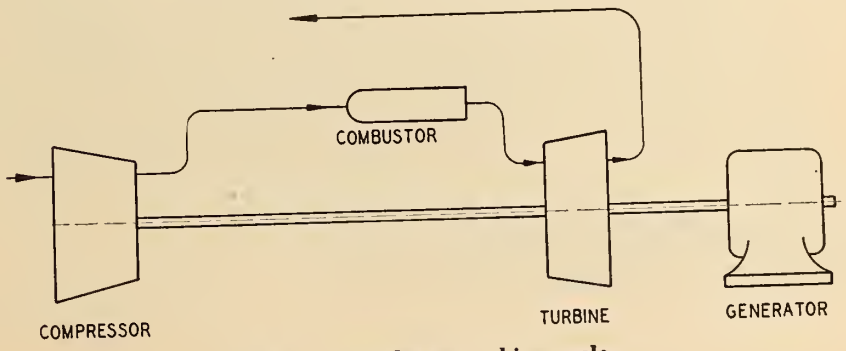

Fig. 1. Simple gas turbine cycle.

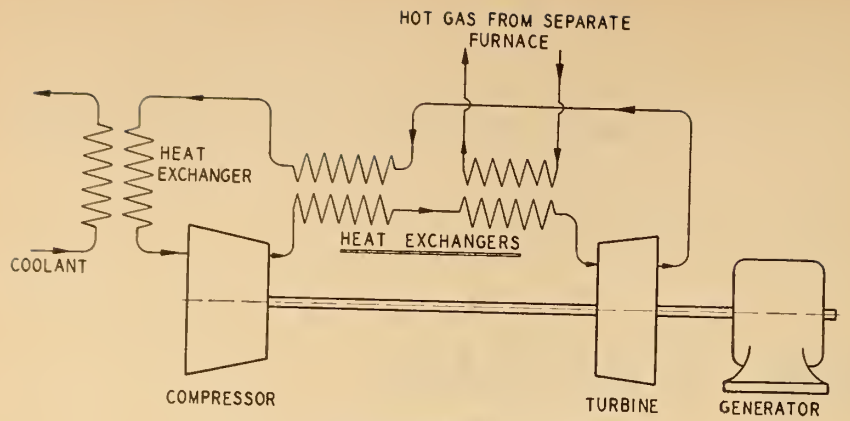

Fig. 2. Simple closed gas turbine cycle.

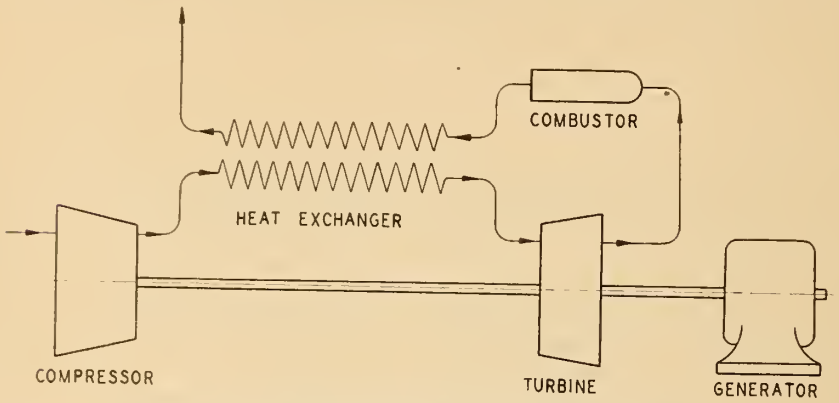

Fig. 3. Simple exhaust heated gas turbine cycle.

pressures, of the order of 20 in. of water above atmosphere.

b. High preheat temperatures, of the order of 500°C, should be used.
c. There should be little carry-over of ash.
d. It is desirable to avoid any moving parts or grates, due to the high temperatures expected.
e. It is desirable to have automatic ash removal.

Consideration of these factors led to the design of a small furnace, based on the well-known cyclone-type furnace developed for stationary plant application. As developed, it has the particular advantage of being able to make use of low-grade fuels; it is a slagging furnace, and therefore resolves to some extent the ash problems, and essentially it is a simple design without moving parts.

As the first step in a joint program, the Department of Mines and Technical Surveys designed and constructed a 6 in. diameter furnace for preliminary tests, in order to find out something about the operation of this particular type of furnace. This was not found to be too satisfactory from the combustion viewpoint, but it actually played a very useful part in the whole program, as it was later used

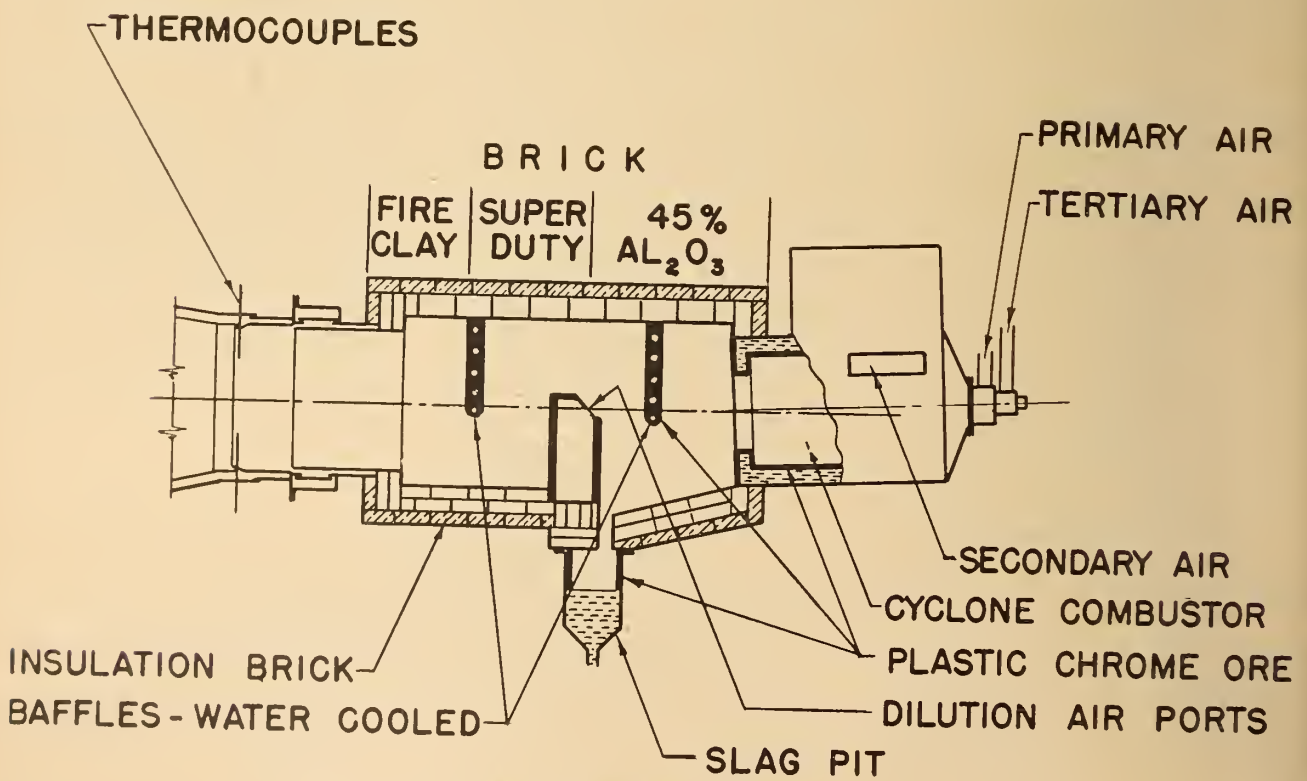

Fig. 4. Diagram of furnace.

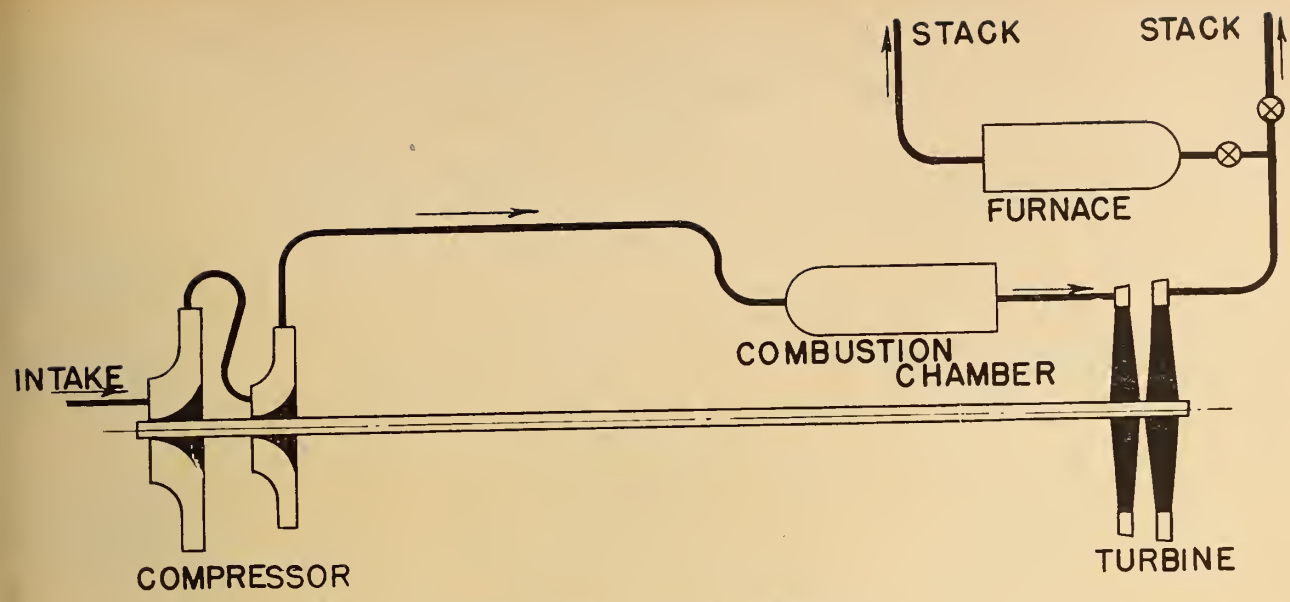

Fig. 5. Diagram of test arrangement.

supply ash-laden gases to a section of an experimental heat exchanger in order to make measurements of the expected rate of fouling or erosion.

At this stage, a furnace of 24 in. diameter, which was expected to be the right size to fit in with the complete experimental plant, was designed and built. Preliminary tests were carried out in Ottawa which showed that it appeared to have the possibilities of achieving the performance which was needed. However, the program in Ottawa was delayed due to structural reasons, and the furnace, tests on which are now reported, was designed in our laboratory using the results obtained from the preliminary Ottawa tests, and information supplied by Messrs. Babcock & Wilcox. This furnace is also of 24 in. diameter, and has a rating of about 1,400 lb. per hr. of coal.

The furnace is shown diagrammatically in Figure 4, and consisted of a 24 in. diameter cyclone combustor and a mixing section. The cyclone was lined with a chrome ore plastic, applied on studs $\frac{3}{8}$ in. diameter by $\frac{3}{4}$ in. long on a 1 in. square pitching. The mixing section was a 3 ft. square section approximately 6 ft. long and contained three baffles. The walls consisted of 5 ins. of refractory brick plus $2\frac{1}{2}$ in. of insulating brick.

The purpose of the mixing section was to remove the slag, which was carried over from the cyclone or combustion zone of the furnace, and to reduce the temperature of the gas by diluting it with a proportion of the turbine exhaust air. The first

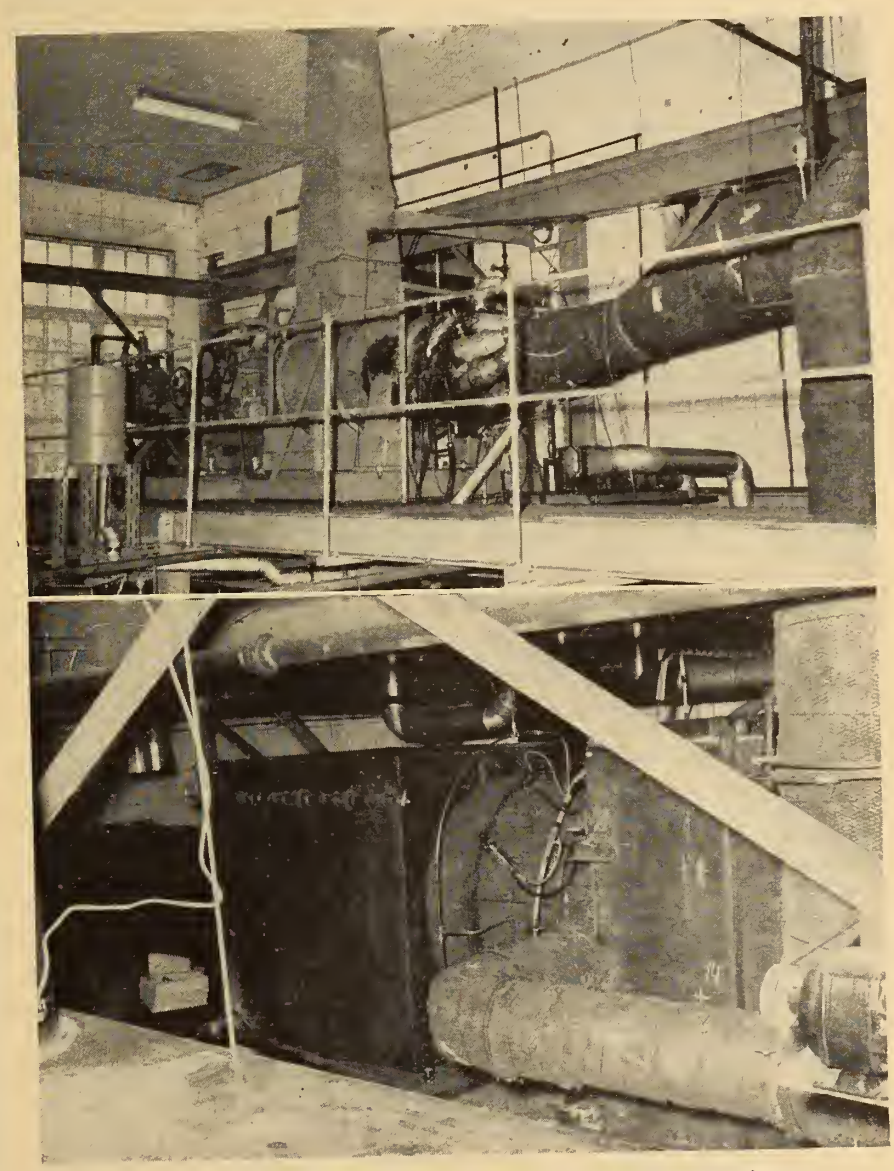

Fig. 6. a. Dart engine with exhaust ducting on mezzanine.
b. Mixing section and spray box on main floor.

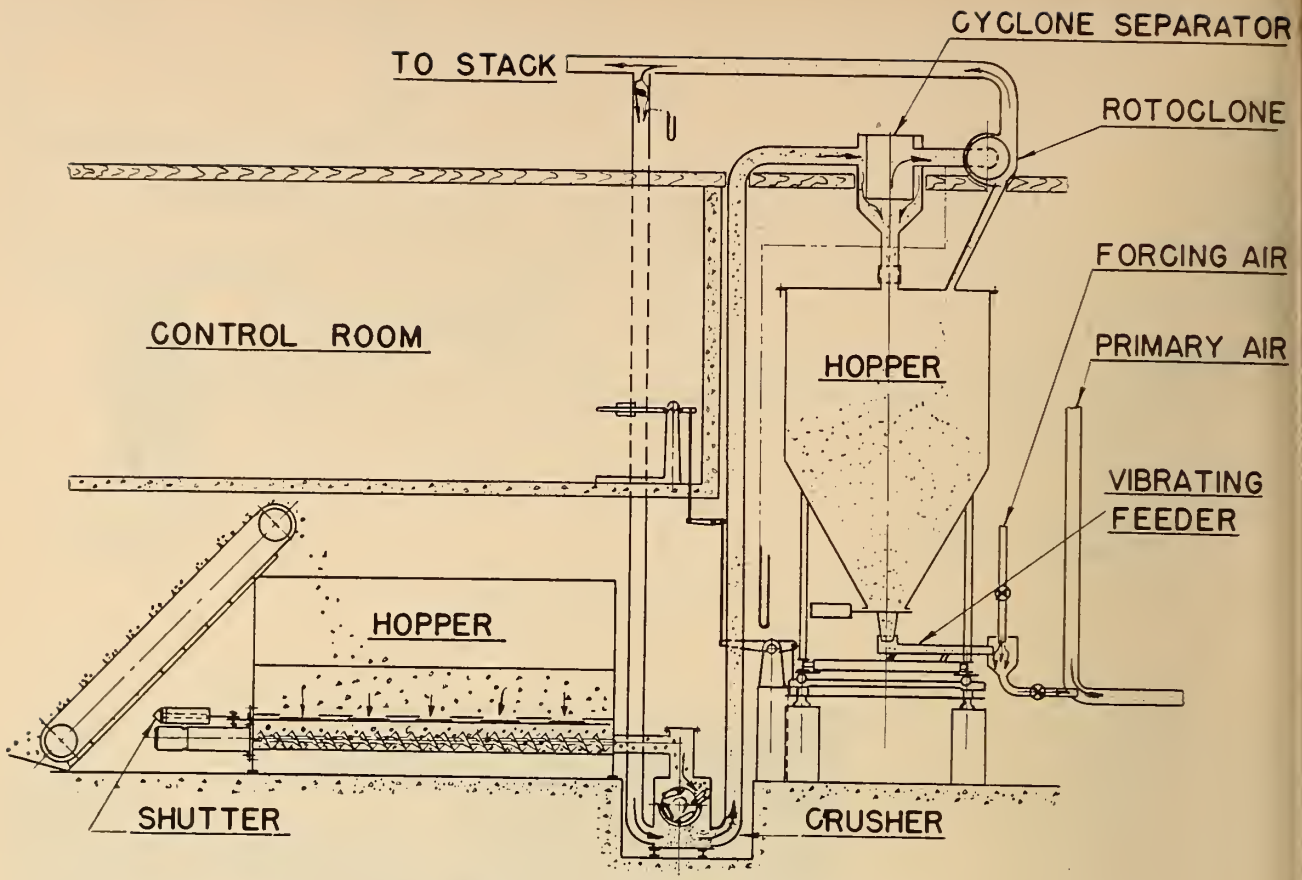

Fig. 7. Co l handling equipme. t.

baffle forced the hot gas and slag down, depositing the slag on the floor of the furnace. The gas then passed over the second baffle where the dilution air was injected. The third baffle afforded additional mixing, and reduced the radiation to the furnace outlet.

The slag pit was bolted to the bottom plate of the furnace with a four inch square hole at the top for the slag to enter. The slag entering the pit was kept molten by a breather, which maintained a flow of hot gas through the entry. The breather was a 2 in. pipe connecting the slag pit to the furnace, so that the pressure drop of the dilution baffle was used to induce a flow of hot gas. The pit was operated half full of water with continuous supply and an overflow system, and a rotating screw was attached to the bottom of the slag pit to extract the slag in a granular form, after being quenched in the water.

Test Arrangements

Cycle

Figure 5 is a diagram of the test arrangement for the furnace, and Figure 6 shows photographs of the installation. The furnace was supplied with the gas exhausted by a gas turbine, in an identical manner to the full coal burning turbine. The gas turbine obtained its heat from the combustion of kerosene in the conventional combustors.

The heat produced in the furnace was quenched by water sprays before discharging to the exhaust stack. In the final engine, the heat in the furnace exhaust will be used to heat the high pressure air of the gas turbine in the heat exchangers, which will replace the kerosene combustors.

Coal Handling Equipment

The layout of the coal handling equipment is shown in Figure 7. The crusher was a hammer mill pulverizer, fitted with a $\frac{1}{8}$ in. diameter mesh screen. The crushed coal was stored in the hopper mounted on a weigh-beam which had a capacity of about 5,000 lb. of coal.

The bottom of the hopper could be closed by a slide-valve operated by a pneumatic ram, and when the valve was opened the coal dropped into a tubular vibrating feeder which was regulated by a rheostat. This rheostat constituted the throttle control of the plant by regulating the rate of coal feed to the furnace.

The vibrating feeder conveyed the coal into an injector, which forced the coal into the pressurized primary air line to the furnace. The injector was partially sealed, a small clearance being left around the tubular feeder, and the forcing air induced a small depression in the injector.

Tests

The furnace was first run on December 10th, 1952, and after some preliminary adjustments to use the oil for pre-heating to the best advantage, coal was burnt for the first time on December 23rd. In the next 6 weeks many tests were made trying the effects of various modifications and improvements. By the middle of February, 1953, a reasonable combustion performance appeared to be attainable.

Some six weeks were then spent in detailed calibrations and checks, so that a complete record of the performance of the furnace could be available in order to appraise its suitability for operating the engine on its preliminary tests. The test program was terminated on March 27th, when a minor failure occurred in the turbine engine being used as a slave. As the test schedule was very nearly completed, the decision was taken to curtail the tests and to

arry on with the building of the complete plant at this point.

Test Data and Results

The analysis of the coal used for hese tests was made by the Fuels Research Laboratories, Department of Mines and Technical Surveys, and is presented in Table II. Also shown in Tables III and IV are the results of our screen analyses and the ash analyses made also by the Fuels Research Lab.

It will be seen that the coal was high in volatile and low in ash. There was about 3 per cent sulphur, and the ash was quite strongly acidic. As fired, between 10 and 13 per cent passed a 200 mesh screen, and between 23 and 30 per cent passed through a 100 mesh screen, so that it was by no means pulverized.

Analysis of the results was not too simple, because the combustion air had some of its oxygen burnt out previously by the kerosene used as the fuel in the slave turbine supplying the preheat air. Furthermore, the different streams of air for primary, secondary, tertiary and dilution purposes had different heat losses, and so arrived at the furnace at different temperatures.

The heat supplied from the coal was distributed among:—

a) increase of sensible heat, i.e., temperature of the gases. This represents what we would regard as the useful output of the furnace; b) carry-over of unburnt fuel; c) losses due to incomplete combustion; d) losses to the cooling water arour d the primary furnace and the baffles; e) losses to atmosphere from the mixing chamber, etc.

Items a), c) and d) can be measured more or less exactly by thermocouple traverse, analysis of a representative sample of exhaust gas, and heat balance on the cooling water. The heat losses to atmosphere, which were quite considerable in this installation, were found by operating the furnace on kerosene. Under these conditions, items b) and c) were assumed negligible, and Orsat analysis showed practically no CO, so that the heat losses under item e) could be determined from the heat balance.

It was found that, at the same furnace outlet temperatures, the heat losses to the water were slightly more (about 20 per cent) when running on coal than on oil. As the heat transfer coefficient to the water was high and there was relatively little protective insulation, it would appear that the higher radiation effects with the luminous coal flame increased the overall transfer coefficient slightly.

On the other hand, as far as the heat losses to the air were concerned, there is adequate insulation and then a relatively low final coefficient for radiation and convection to atmosphere. The increased radiation with coal would therefore have a very much smaller effect on the overall coefficient.

It was therefore assumed that losses to atmosphere from the mixing chamber were the same when burning coal as when burning oil. The validity of this assumption was to some extent confirmed by the final results obtained. Working back from this assumption the complete heat balance could be obtained, and shows at the best conditions, an account of practically all of the heat supplied in the fuel.

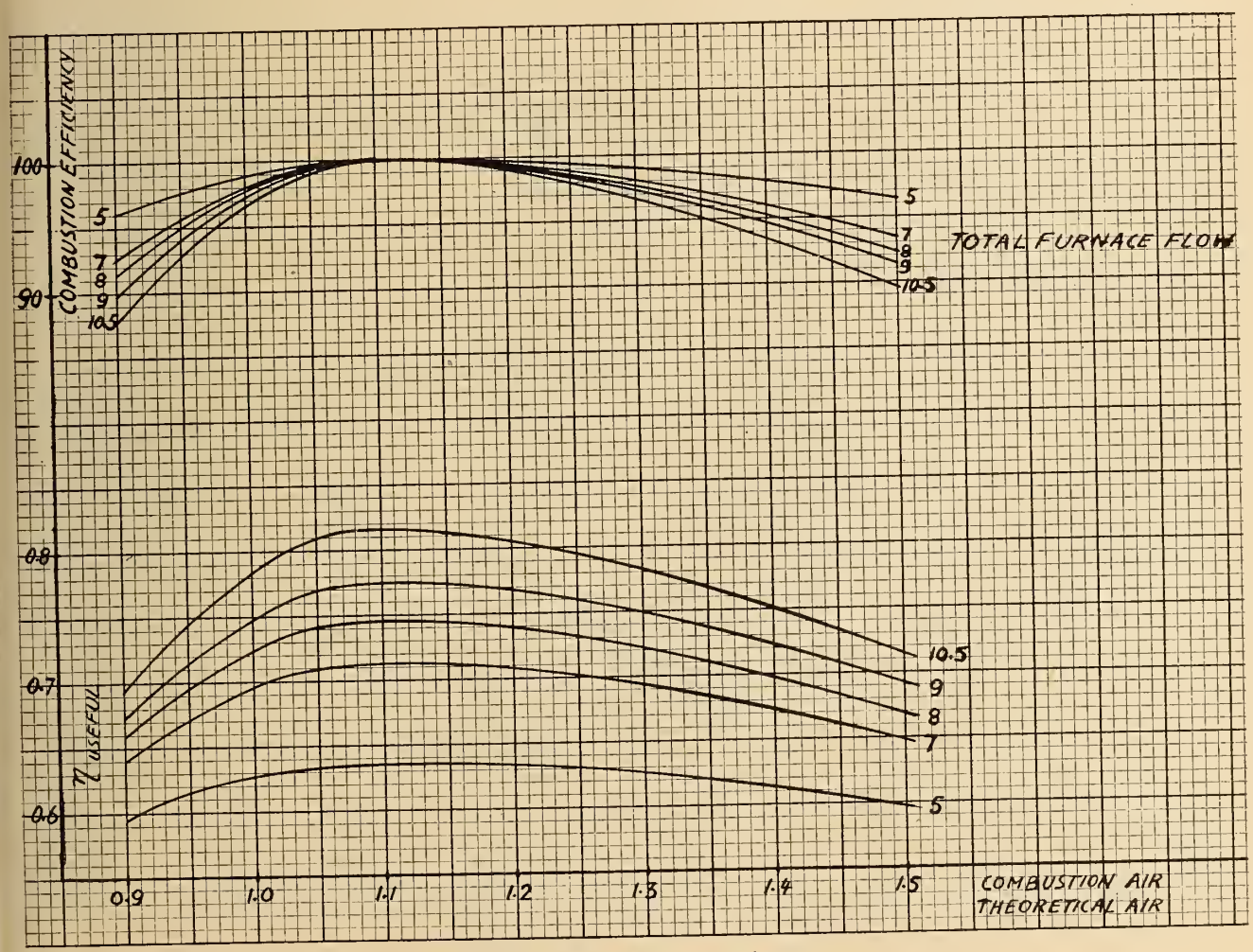

Fig. 8. Furnace efficiencies.

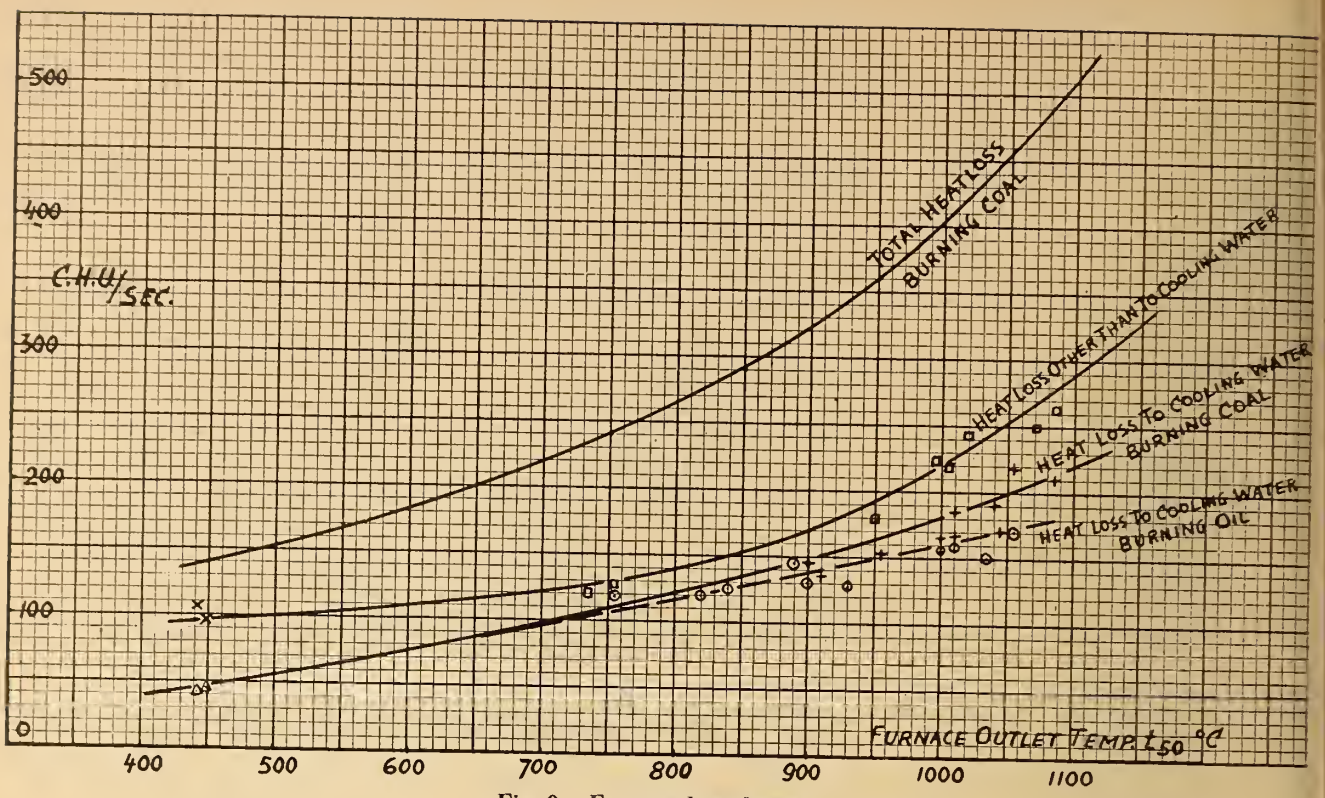

Fig. 9. Furnace heat losses.

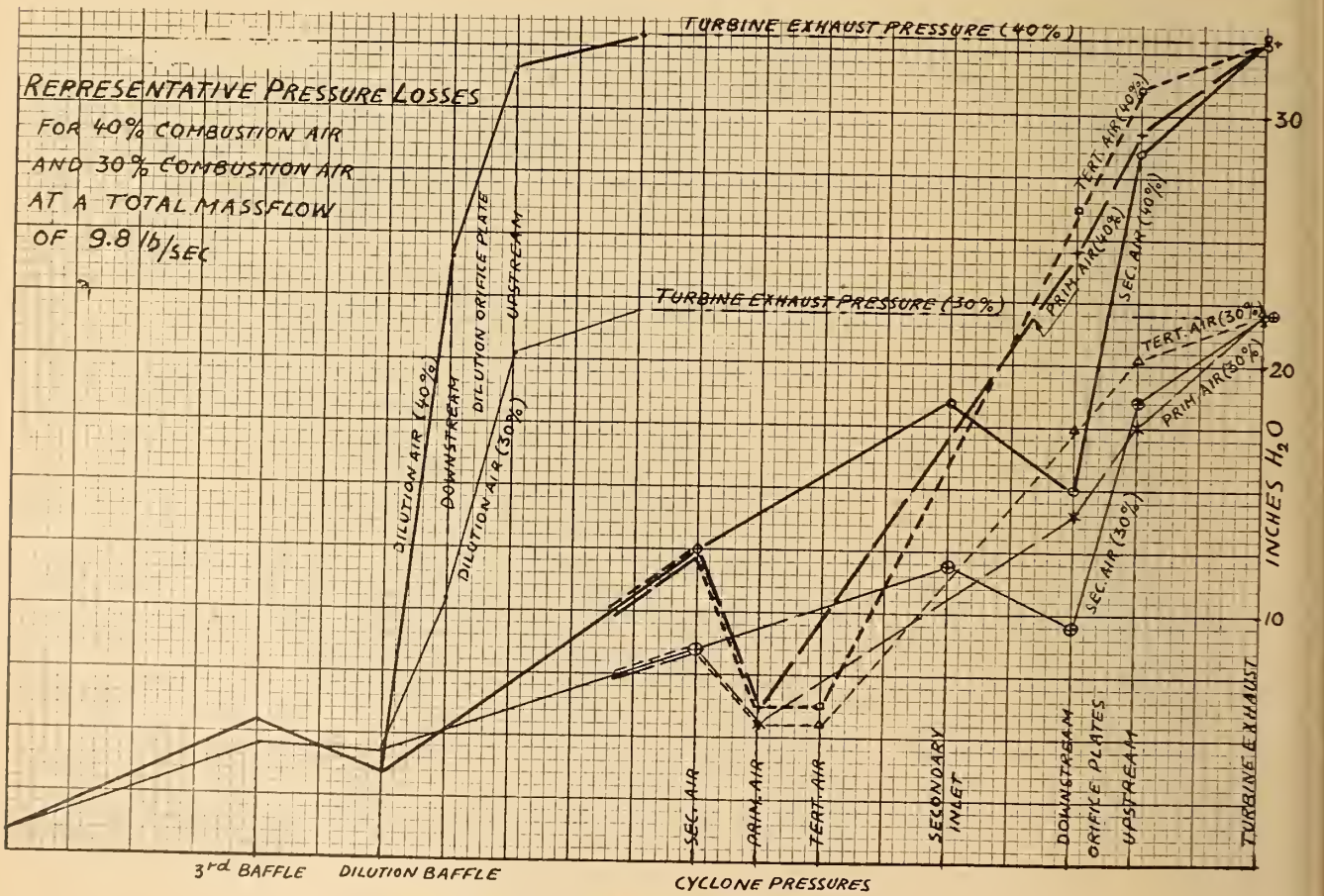

Fig. 10. Furnace pressure losses.

Table I — Representative Data on Pure Air

MF_{10}—Total air flow	10.5	8.0	5.0
MF_1—Primary air flow	0.332	0.253	0.157
MF_2—Secondary air flow	3.67	2.8	1.74
MF_3—Tertiary air flow	0.274	0.208	0.130
Combustion Air—lb./sec	4.276	3.261	2.027
Dilution Air—lb./sec	6.224	4.739	2.973
Combustion Air/theoretical air	1.1	1.1	1.1
Rate of Coal Feed—lb./sec	0.377	0.288	0.179
Air/Coal—Combustion Zone	11.35	11.35	11.35
Combustion Air Mean Inlet Temp.—°C	485	485	485
Mean Air Inlet Temperature—°C	500	500	500
Heat to Cooling Water/Added Heat	0.085	0.114	0.163
Heat Loss Other Than to Cooling Water/Added Heat	0.105	0.141	0.2015
Optimum Useful Heat/Added Heat	0.81	0.745	0.635
Loss by Incomplete Combustion/Added Heat	0.02	0.02	0.02
Useful Heat/Added Heat	0.79	0.725	0.615
Temp. in Combustion Zone. No loss considered—°C.	1990	1990	1990
Temp. in Combustion Zone. Loss considered—°C.	1870	1830	1770
Furnace Outlet Temp. Losses considered—°C.	1185	1130	1040
Heat Release in Comb. Zone CHU/cu. ft./sec.	235	180	112
Heat Release in Comb. Zone CHU/cu. ft./hr./atm.	8.5×10^5	6.5×10^5	4.05×10^5
Heat Release up to Outlet CHU/cu. ft.	1.825×10^5	1.4×10^5	0.875×10^5
Residence time in Cyclone—sec.	0.026	0.035	0.058
Total Residence time—sec.	0.1	0.14	0.035

Figure 8 shows the combustion and useful efficiencies as a function of the excess air coefficient for different total mass flows. The combustion efficiency is defined as the heat liberated compared to the heat available in the coal, and the useful efficiency is defined as the increase of sensible heat in the furnace gases compared to the heat available in the coal.

The excess air ratio is simply the actual air flow divided by the air flow, which would be chemically correct for combustion, making due allowance for the diminution in oxygen by the previous kerosene combustion. It will be seen that between the values of 1.05 and 1.20 for the excess air coefficient, the combustion efficiency is in the range 99 to 100 per cent. The statement that the combustion efficiency is 100 per cent really means that it is 100 per cent of the value obtainable burning oil, which was not directly measured, but assumed to be 100 per cent on the basis of the Orsat analysis.

The useful efficiency, which is what we are primarily concerned in, reaches a peak of about 81 per cent at the highest flow, but falls off rapidly as the total mass flow decreases. The reason for this, of course, is that the heat losses do not depend upon the actual rate of air flow but upon the outlet temperature, and therefore become a relatively greater fraction of the total heat release as the flow decreases.

Figure 9 shows the heat losses. The differences in the heat lost to cooling water on oil and coal is seen, and the heat loss other than to cooling water is the curve of losses derived from the calibration tests on oil, and assumed to remain the same on the coal. Table I shows a summary of the results obtained, interpolated to correspond to certain running conditions.

A typical set of results of pressure loss measurements are shown in Figure 10. These losses are raised unduly by the measuring orifices installed for experimental convenience When these are removed and the duct work simplified, we anticipate that with the present configuration, we shall be able to operate on not more than 20 in. of water when passing a mass flow of 10 lb./sec.

Ash

Over the whole series of tests, some 16,200 lb. of coat were burnt, and the ash content of the coal as fired was 7 per cent. Of the total ash that this produced, some 64 per cent was collected in the slag pit, 17.5 per cent was collected as fly ash in the outlet duct, and 8.75 per cent was found in the drain trench which was really an overflow from the outlet duct.

In all, therefore, 87 per cent of the ash was apparently collected. However, some of the slag pit content, which analysis showed to contain virtually no combustible, was undoubtedly due to fused bricks or lining which had run down into the slag pit. The fly ash samples showed, in some cases, only 24 to 40 per cent of ash, the remaining being combustible matter.

As it was only possible to get the ash balances over a long period of running, these results include not only the tests where the furnace was operating at its correct conditions, but also preliminary tests when it was under far from correct conditions. It was found that when operating with an excess air coefficient of 1.1, the carry-over was very small indeed, and consideration of the overall heat balance shows that it must have had a negligible amount of combustible content.

As soon, however, as the excess air coefficient was reduced, carry-over increased, due to insufficient oxygen. If the coefficient was increased to values much greater than 1.1, the time available for combustion and the temperature were lowered and there was again an increase in the carry-over of unburnt combustible.

Furnace Condition

A full inspection of the furnace conditions after the tests was carried out. Within the cyclone primary chamber, the lining was in good condition generally, with a slag coating varying in thickness between .25 in. and 1.6 in., depending apparently upon the temperature distribution actually within the furnace, and also circumferentially depending upon the air distribution.

Table II—Analysis of Coal

Date Received		28 July, 1952	
Laboratory No.		1500-52	
Sample Mark		Nil	
Moisture Condition		*As Received*	*Dry*
Proximate Analysis			
Moisture	%	2.03	0.00
Ash	%	6.94	7.03
Volatile Matter	%	37.46	38.24
Fixed Carbon (by difference)	%	53.57	54.68
Calorific Value			
B.t.u. per lb. gross	°F	13,819	14,105
Ash Fusibility			
Initial	°F		1900
Softening Temp.	°F		2030
Fluid Temp.	°F		2320
Caking Properties (Residue at 950°C)			Fair
Ultimate Analysis			
Carbon	%	75.33	76.89
Hydrogen	%	5.32	5.43
Sulphur	%	3.19	3.26
Nitrogen	%	1.45	1.48
Ash	%	6.94	7.08
Oxygen (by difference)	%	7.74	5.86

ables appeared to stand up better. There were many cracks in the brickwork, which are attributed to both thermal shock as the furnace was frequently heated up quickly (20 minutes), and also in some cases due to insufficient provision for thermal expansion.

Discussion

In general, the furnace behaved well. Complete remote control was easy, and the ignition and preheat systems, after due development, were satisfactory. The response of furnace exhaust temperature to changes in the rate of coal feeding was rapid, and a rate of 100°C per minute was often recorded. These rapid changes, however, undoubtedly cracked bricks, and the main purpose for experimenting in this direction was in order to make sure that we would have ample flexibility when the furnace was driving the gas turbine. It is expected that in normal operations such rapid changes would not be required.

No difficulty was experienced in picking up on coal from a temperature rise condition in the furnace of 200°C, and a good turndown was available. Combustion on coal was noticeably smoother than on oil. The oil burnt with a clear flame that was rough and noisy and led to a reverberation all through the ducting. The coal flame, on the other hand, was smoky in the primary furnace, but completely inaudible when operating with the correct amount of excess air.

The main criticism of the system as a whole is the excessive heat losses from the mixing chamber. In building the furnace for the engine tests a new design has been evolved, which uses dilution air to return most of the heat transmitted through the brickwork back into the system. This we consider will not only cut these heat losses considerably, but will also cool the brickwork and help in the final mixing.

The coal handling and feeding systems worked well, and permitted accurate measurement and rapid changes of coal rate. The actual feeding system was a vibrating feeder together with a compressed air injector. During the tests the vibrating feeder was used as the main control, and gave at various times different minor troubles. Rig tests of the injector suggest that it is capable of feeding and controlling at least as well, if not better, than the vibrating feeder, and would present fewer possibilities of trouble.

It was found that the automatic slag removal screw gave continual trouble, and this was finally dispensed with in favour of a box big enough to recover all the slag produced in one run. However, a lot of the troubles encountered with this system were due to the very cramped installation.

Table III—Screen Analysis of the Coal

Date	Mesh	16	32	60	100	150	200	—200
10–12–52	% retained	5.4	15.8	28	22.1	12.2	5.9	11.2
	% through	95.2	79.4	51.4	29.3	17.1	11.2	
10–12–52	% retained	6.16	21.0	30.42	18.42	9.48	3.78	10.24
	% through	93.34	72.34	41.92	23.50	14.02	10.24	
30– 3–53	% retained	8.5	23.2	26.4	15.8	7.35	4.23	13.69
	% through	90.67	67.47	41.07	25.27	17.92	13.69	

Table IV—Ash Analysis

F.L.R. No.	1500-52
Marked	Nil
Date Received	28 July, 1952
Date Reported	26 August, 1952

Constituent	*Per Cent*
SiO_2	35.87
Al_2O_3	16.85
Fe_2O_3	36.10
CaO	2.77
MgO	0.62
K_2O	2.00
Na_2O_2	0.81
Total	95.02

In the mixing zone there was considerable erosion (¾ in.) of the firebrick in the hottest zone. The bricks used here were 45 per cent Al_2O_3 firebrick, Cone No. 34.

In one corner, where the edge of the brick was exposed, the brick was eroded to its full depth. For test purposes, some 62 per cent Al_2O_3 and 90 per cent Al_2O_3 bricks were left in the hottest part of the furnace, and appeared to stand up well. The mortar eroded more than the bricks, but chrome mortars and cast-

Conclusions

These preliminary tests show that the furnace will be suitable for first trials of the complete exhaust-heated gas turbine. From the combustion point of view, performance was excellent, and a large fraction of the ash was recovered as slag. The heat losses in the mixing section were too high, giving a useful efficiency range of 60 to 80 per cent, and the refractories in the hottest part of the mixing section did not withstand the service. By using cooling air over the back of the refractory brick and better quality brick, it is believed that the efficiency over the working range will be raised to 82 to 90 per cent, and the brickwork will be satisfactory.

Control and turn down of the furnace was good and no difficulties are foreseen in using it to operate the gas turbine. At the same time, it is emphasized that the tests here described were only preliminary tests, and that a lot remains to be done to find out how the furnace will operate on different grades of coal, for long periods, and with a lower pressure loss.

Acknowledgements

Thanks are due to Messrs. L. E. Wilcockson and R. Hardgrove of the Babcock and Wilcox Co. for advice on design, to J. I. Yellott, Locomotive Development Committee for loan of coal handling equipment, to Dominion Steel and Coal Co. for supplying the fuel burnt, to Dr. T. E. Warren and H. P. Hudson of the Dept. of Mines and Technical Surveys, who have actively collaborated in this work, and to Mr. Montgomery of the Fuels Research Lab. who made the analyses. Special thanks are due to Dr. A. Schlader, who made painstaking analyses of the results. √

Some Marine Aspects of Cathodic Protection

by

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The principles of cathodic protection were first enunciated in connection with the marine corrosion of copper. By this method, metal structures are protected against corrosion, by being made the cathode of an electrochemical system. It was Sir Humphrey Davy who suggested that the copper sheathed wooden bottoms of the Royal Naval ships be so protected, by either zinc or iron anodes.

The copper sheathing was used to protect the wooden hulls against the ravages of marine borers, and it was found that the copper, in turn, required protection. Renewable zinc anodes were used to supply a protecting current to the copper sheath as a cathode, the sea water serving as the electrolyte in this particular electro-chemical system.

With the advent of wrought iron hulled vessels, the principles of cathodic protection in the marine field were more or less lost sight of, wrought iron having reasonably good corrosion resistant properties. But wrought iron was later replaced with mild or high quality steels.

These steels have a fairly high corrosion rate in sea water, particularly when coupled to nonferrous metals such as are used for propellers, etc. The corrosion prevention by means of cathodic protection was not tried on steels except in a very cursory manner, although for the past thirty years the same principles have been applied quite vigorously to pipeline protection, particularly in the United States.

During World War II, Canadian Shipyards commenced to build a greatly increased number of thin hulled escort vessels, under conditions of extreme urgency. The usual treatment of plates, which consists of the removal of millscale by pickling, or if time permits by weathering, was often not possible. This millscale forms a corrosive stimulant, and as a result the corrosion problem assumed serious proportions in the maintenance of such vessels. Large numbers of rivets (frequently in the thousands) had to be renewed shortly after the ships were commissioned, or plating had to be repaired or renewed.

Shortly after the end of World War II, Naval Research Establishment began trials to investigate the marine corrosion problems of ships. At the start it was obvious that paint alone did not give sufficient protection. Even if superior paints were available at a high cost, holidays or gaps in painted areas were bound to occur at keel and bilge block positions, — positions where the ship sits when drydocked. Other gaps would occur at other parts of the ship due to abrasion of the paint film by jetty fenders, etc.

Cathodic Protection

The most promising starting point to investigate ways of supplementing the protection given by paints was to reinvestigate cathodic protection, using methods applicable to modern vessels. The use of zinc anodes had been carried over to steel ships without any thorough investigation of their usefulness, or of the quality and quantity required for protection. The anodes were individually tailored to fit around nonferrous outlets and inlets and near the bronze propellers. These are the places where corrosion is likely to be most severe.

In principle, this method of application was reasonably sound, but in practice the principles were forgotten. Insufficient amounts of zinc were fitted. An inferior grade of zinc was often used because it was a ½ - 2c. cheaper per pound. No special precautions were taken to ensure that a waterproof metallic contact between hull and zinc was maintained.

The result was that severe corrosion frequently occurred where these anodes were fitted, often on the bolts or nuts securing the zinc in place. The zinc anodes themselves were used up within three months if they were effective sacrificial anodes. In other instances they sat inert

This paper summarizes the events leading to the application of cathodic protection techniques, for prevention of corrosion on R.C.N. ships. Application techniques are discussed, and it is shown that the wetted portions of a hull can be indefinitely protected against corrosion.

Current requirements of such protection, and possible benefits accruing therefrom are indicated. The same protective techniques can be applied advantageously to interior structures, such as condenser doors, etc.

until the next dry-docking, at which time they would be referred to as being "good zincs" because they were not consumed and hence did not need replacing!

These latter were usually the inferior grade zincs, containing a certain amount of impurities. On corroding they form a tight adherent film of corrosion products over their surface, thereby preventing further consumption of the anodes. In cathodic protection using sacrificial anodes, such as of zinc, protecting current can only be supplied by the sacrifice or consumption of the anode.

Again, if water is allowed to seep between the zinc and, say, the steel retaining nut or washer, electrochemical reactions are set up in the seepage space. The result is that the zinc surface is attacked. Thus metallic, and hence electrical contact no longer occurs, and the zinc sits on the hull as a useless appendage.

In a few instances, to prevent the rusting of the retaining nuts or bolts, brass ones were used. In this case the foregoing action would take place much more quickly, since the potential difference between zinc and freely corroding steel is about 0.4 volts, whereas between zinc and brass it is about 0.6 volts. The foregoing does not apply solely to R.C.N. ships, but can be generally applied to all marine shipping.

The greater potential difference between zinc and brass or copper explain in part the successful use of zinc on copper sheathed hulls. It is known that the harder zinc works, or the faster it corrodes, the less the stifling effect of the corrosion products, as they form a less compact surface at the higher current densities.

Hull Potential Readings

Experiments were begun with a reserve fleet ship in 1947. It was shown that the magnesium alloy anodes developed for pipeline protection gave a reasonably good performance when used as anodes in sea water. No stifling film was formed on such anodes, and they gave good current output until consumed. It was also shown to be quite practical and economical to use this type of anode for the protection of such ships.

Moreover, it was determined that provided the "hull potential", or the potential difference between the steel hull and a silver-silver chloride reference electrode, was kept above a certain definite value, no corrosion would occur on the underwater hull. This conclusion was arrived at by many readings and concurrent drydockings made over a two-year period.

It was a forward step, since it furnished a definite criterion by which it was possible at any time to tell whether or not a ship was rusting by simply taking a voltage reading. This is an important consideration if protection is dependent on the amount of current supplied to the hull at that particular instance. Hence, by taking advantage of this criterion, — that is, by taking hull potential readings daily and controlling the protecting current accordingly, it is quite practical to prevent the underwater corrosion of a ship indefinitely.

Since 1948, this has been shown to hold for both active and inactive ships, from small tugs with about 500 square feet underwater hull to hulls having over 60,000 square feet underwater. The power requirements to prevent corrosion are almost negligible, being less than that required to operate two "Trilite" lamps for the case of the largest ship in the Royal Canadian Navy.

Tests on Naval Vessels

The R.C.N. gave full co-operation to the program of investigation permitting trials to be carried out on both reserve and operational ships. This was brought about through the interest of Commodore R. Baker, O.B.E., Naval Constructor-in-Chief, who is in charge of ship construction, of Officers of the Halifax Dockyard, and others who quickly appreciated the economies to be gained by the use of controlled cathodic protection. This co-operation allowed rapid strides in determining the most suitable methods of applying the protecting current, and in the writing of suitable specifications covering such methods. The result was that satisfactory, even though not final, systems have been worked out.

Magnesium, steel or graphite anode systems are used. The first of these is self-energising, the second and third require impressed currents to operate, the last one having the advantage of being almost non-consumable, though somewhat fragile. The use of platinum anodes will be tried shortly. The Navy has officially adopted the principles of *controlled* cathodic protection for all ships based in sea water.

The benefits of such a program are becoming increasingly noticeable, as ships are now being drydocked without requiring repairs to plates, or renewal of rivets due to the effects of corrosion. Moreover, in several instances the period between drydockings has been extended, and if only corrosion need be considered the period could be safely extended to two years or to the lifetime of the anode system. Cathodically protected active ships have been left without drydocking for two years without any corrosion occurring anywhere on the underwater hull.

Better Valves and Better Lasting Paints

It is now up to engineers and designers to produce trouble-free outlet valves, etc., and shaft bearings, that will enable the ships to remain out of drydock for a minimum period of two years. It is also up to the paint manufacturers to produce paints that will have anti-fouling properties for a minimum two year period.

Paints at present are the best known deterrents to the growth of animal and vegetable life on ships' hulls, and since clean hulls are important from speed and fuel consumption viewpoints, paints are required for such purposes, as well as for reducing the current requirement for complete cathodic protection. For these reasons it is stressed that the systems used should be controlled cathodic protection systems.

The use of uncontrolled cathodic protection is not considered satisfactory for active ships, since the application of a too high electrical current density will strip paint from a hull, and paints are necessary for their anti-fouling properties. On the other hand, application of insufficient current will allow a ship to corrode.

It is not possible to set a predetermined value to the current and to maintain this current throughout the period between drydockings and expect to obtain optimum protection, since the current requirement will vary with the paint condition, the speed of the ship and other factors which do not remain constant.

Before concluding, mention should be made of the fact that cathodic protection has moved inside the ship into the engineroom bilges and the sea water cooled condensers. In the latter case, it has been demonstrated that steel doors fitting against non-ferrous tube plates and tubes can be given adequate protection against corrosion. The indications are that in many cases galvanic couples, such as are normally not recommended to be used together in sea water, can be used if given adequate cathodic protection.

(Continued on page 1138)

Fig. 1. Main physiographic divisions of North America

A paper presented to the Montreal Branch of The Engineering Institute on December 18, 1952.

by

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Oil in Western Canada

Before discussing oil in Western Canada, its position should be established in relation to oil in the rest of the world. Speaking broadly, the oil world is divided into five major geographical provinces. The Middle East rates first because of individual fields and wells many times greater than anywhere else in the world. North America and Russian-controlled areas follow in second and third place, while Latin America and Indonesia are fourth and fifth. Those comparative ratings are based on long-term prospects. If current production is the measuring stick, then, North America rates first.

Total world production has reached 12,360,000 barrels daily. The United States is the leading area, with 6,370,000 barrels daily. During and after the war, Middle East production expanded rapidly to the current figure of 2,025,000 barrels daily. Latin America produces 2,340,000 barrels daily, of which Venezuela accounts for a major portion, 1,830,000 barrels daily. The rest of the world, including some 925,000 barrels daily for Russia, accounts for the balance. In comparison to these figures, Canadian production, estimated to average 170,000 barrels daily this year, may seem small. However, the Canadian oil era is still young, so Canada's percentage of total world production is not a fair measure of its potentialities.

Western Canada is a major part of the great oil province of North America. The interior plains area of both Canada and the United States has been the source of major production to date and holds the greatest promise for the future. Figure 1 shows the relationship of the physiographic provinces in Canada and the United States. The Canadian portion favourable for oil prospecting represents about one-fourth of the total for North America.

It is in this area that there exists a great thickness of sedimentary rocks favourable for oil accumulation. To the east, it is bounded by the Precambrian Shield where the sedimentary rocks are not present, while, to the west, the rocks are highly folded and faulted in the mountainous area. Speaking in broad generalities, oil may be found anywhere in this great plains area from the Gulf of Mexico to the Arctic ocean.

Sediments occur in Canada outside the Prairie Provinces, but,

Oil is getting to be big business in Canada and there is every prospect that it will get bigger. It already provides a living for many of our members, directly or indirectly, and more and more of them are going to be associated with it as time goes on. It is therefore quite appropriate that we should publish this paper, giving a broad summary of present conditions in the industry and some predictions of what we may reasonably look forward to.

generally speaking, these areas are not considered as favourable for large oil fields as the Western Canadian plains, as the result of either a lack of sufficient thickness of marine sediments or unfavourable characteristics of folding and faulting. However, some oil and gas have been produced in southwestern Ontario and in New Brunswick, near Moncton.

Canada's oil history may be conveniently divided between the pre-Leduc and post-Leduc eras. The pre-Leduc era dates from 1858 through 1946, and the post-Leduc era from 1947 onward. The first oil in Canada was produced in 1858 in Ontario and this area is still producing. Test wells have been drilled in other areas of eastern Canada, but without encouraging results. Western Canada oil dates from 1919-1920, when Norman Wells was discovered. Later, came Turner Valley, Lloydminster, and others. But the real birth of the present-day era was touched off by Leduc in 1947.

History in this new era can best be described by charts and maps illustrating the rate of growth.

Acreage acquisition is the first step in the exploration program of any company. Before undertaking the huge expenditures required for finding oil, a company must have assurance of the right to produce and reap a profit from any oil that may be found. The area under lease in Western Canada has grown from less than 20 million acres at the end of 1946 to more than 200 million acres at present.

Figure 2 shows the acreage under lease in 1946 and in 1952: it now covers an area 800 miles east and west by 1,000 miles north and south.

After acquiring acreage, the next step in exploration is geological and geophysical work. The seismograph is one of the major exploration tools prior to drilling. This type of work has expanded from fewer than 10 crews in 1946 to 167 crews now. Each party includes a drill for making shotholes, several trucks with equipment, scientific instruments and 15 to 20 men. It costs $20,000 to $25,000 per month to operate each party.

In 1946, the seismographic work was confined to Alberta, working principally between Edmonton and the Turner Valley. Today it blankets the southern half of Alberta, covers the southern third of Saskatchewan less densely and spills over into adjacent areas in British Columbia, the North West Territories and Manitoba.

Exploration drilling is the next major step in exploratory work. Only 87 wildcat wells were drilled in 1947, but 840 test wells are expected

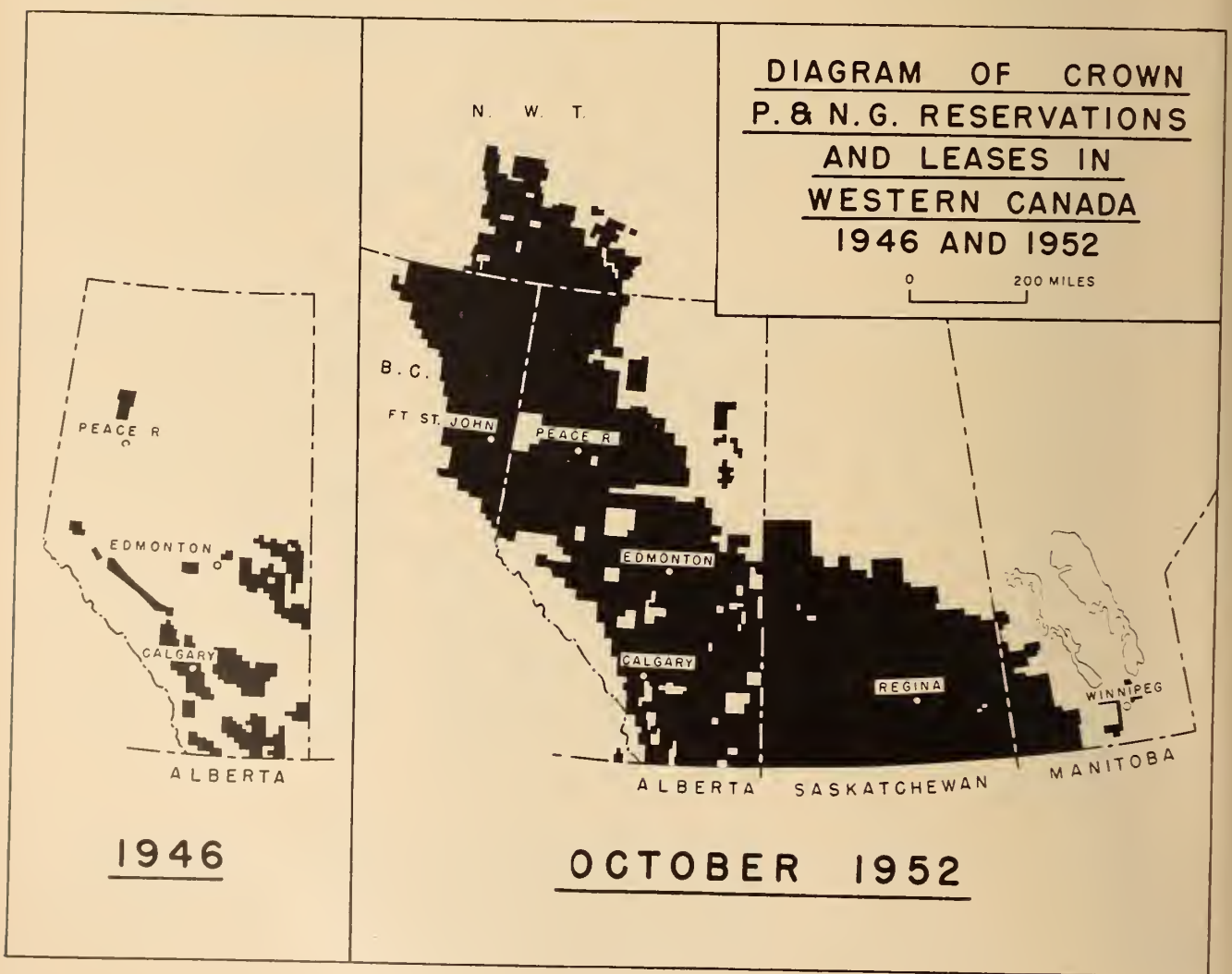

Figure 2.

to be drilled this year. This drilling has resulted in many oil and gas discoveries.

While 840 wildcats seems like a large figure in comparison to what has been done previously here it is only about one-tenth as much as is done in the United States. It is reasonable to expect further increase in wildcat drilling.

Let us now consider reserves and production. Crude oil reserves have expanded with the continued discovery of new fields. Reserves of less than 100 million barrels were reported at the beginning of 1947, while today they are on the order of 1¾ billion barrels. (See Figure 3.)

What does "crude oil reserves" mean ? The 1¾ billion barrels represents the inventory of oil that can be produced from oil fields so far found. Every year, new fields are found which add to the inventory, and every year oil is produced which subtracts from the inventory. It is probable that many oil fields remain to be found in Western Canada; so long as exploration remains at a high level, an upward trend of reserves may be expected.

Over the six-year period covered by Figure 3, an annual average of 300 million barrels per year of new oil has been added. Today's level of exploration activity is greater than the six-year average, so it is reasonable to expect more oil than this to be added each year in the future.

Actual production and potential productive capacity (Figure 4) have risen with the increase in reserves and with the number of development wells drilled. Productive capacity represents the maximum rate at which existing wells and oil fields can be developed under good oilfield practice. The producer needs to know productive capacity for two reasons: first, to be sure that oil will be available to meet demand; and, second, to plan future expansion of markets if productive capacity exceeds present demand. In 1946, actual production was slightly less than 20,000 barrels daily, which also represented total productive capacity. At that time, the producer was not concerned about expanding his area of crude oil supply, because imports were required to meet demand even in the Prairie Provinces. With the advent of Leduc and Redwater, the first need was to build refineries on the Prairies to utilize local crude to meet the local demand. Producing is highly competitive, with the result that each operator drilled his property in proved oil fields as rapidly as possible. In 1949 this increased productive capacity

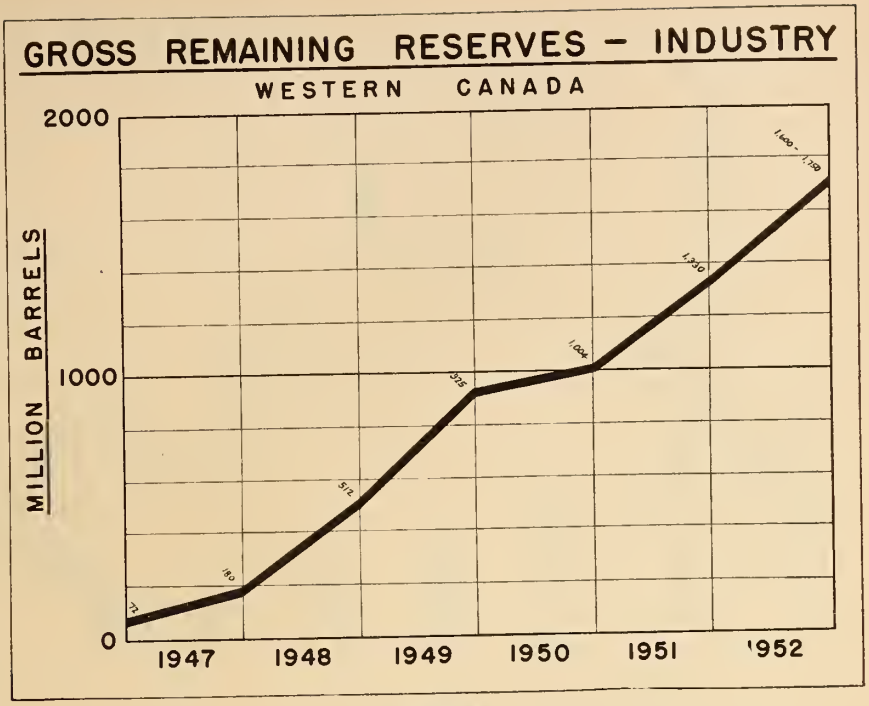

Figure 3

to a level greater than the needs of the Prairie Provinces alone.

The first major step toward expansion of markets beyond the Prairies was the construction of the Interprovincial pipeline. Completion of this line resulted in a large increase in production during 1951. Construction of the Trans Mountain pipeline to Vancouver and the northwestern United States due for next fall, will further expand the area served by Canadian crude.

Average production for 1952 is approximately eight times the 1946 figure, while potential productive capacity has expanded to a much greater degree, now approaching 300,000 barrels daily. The difference between "actual production" and

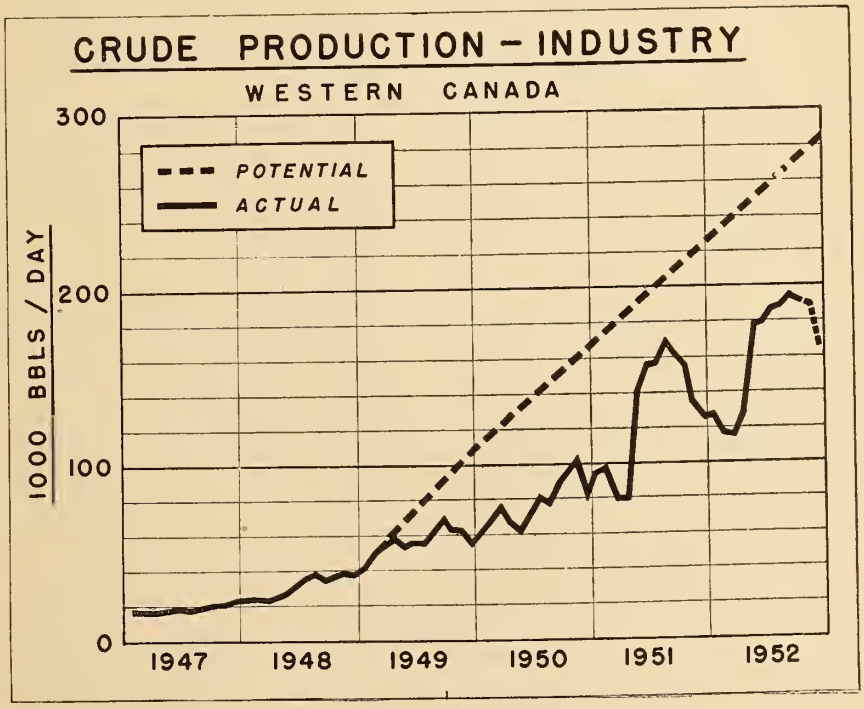

Figure 4

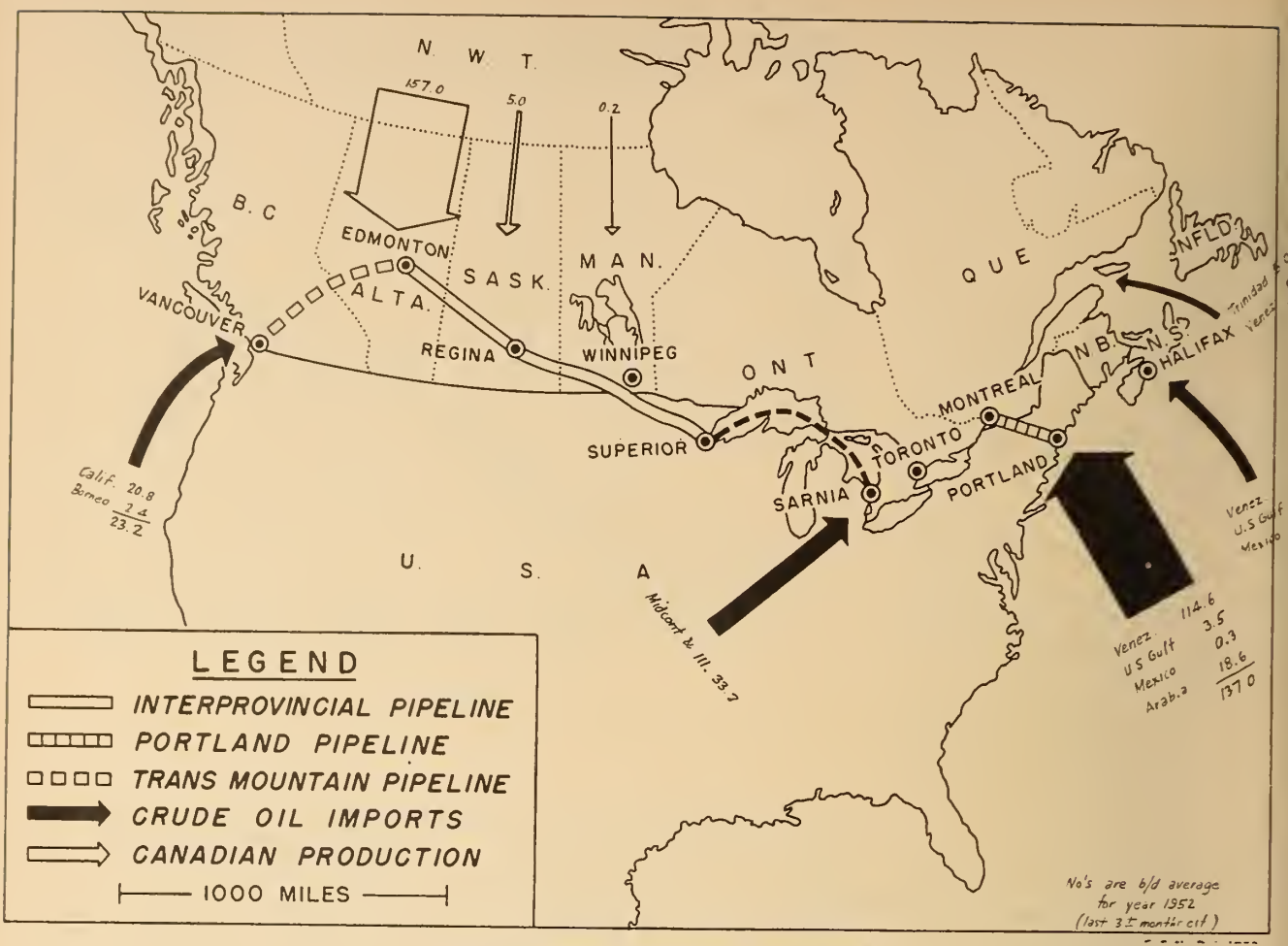

Fig. 5. Crude oil supply—Canada 1952

"productive capacity" is spare capacity. Part of this spare capacity is used to take care of seasonal variations in shipment by tankers through the Lakes. However, there exists today additional spare capacity, which provides the incentive to further expansion via Trans Mountain pipeline into new markets. The potential productive capacity will continue to grow as new reserves are added. The oil producer is always conservative in estimating his own ability, but there is no reason why potential productive capacity should not continue its steady climb.

Canada's total crude and product requirements for 1952 averaged 455,000 barrels daily. Of this total, 55,000 barrels daily represent imported products, and 400,000 barrels daily represent crude oil refined in Canadian refineries. Western Canada supplies 42 per cent of this crude requirement. The various sources of total crude supplies for 1952 are shown in Figure 5, with arrows sized proportionately to volumes. First, there was 170,000 barrels per day (b/d) production in Western Canada, divided among the provinces as shown, Alberta being the major contributor. There is also a small production in Ontario not shown. Foreign sources include 23,200 b/d for the Vancouver area from Borneo and California, 33,200 b/d for Ontario from the Mid-Continent field, and 170,000 b/d, represented by the three arrows, for Montreal and eastward from the United States Gulf, South American and Arabian fields.

Canada's production is used first for requirements totalling 109,000 b/d in the Prairie Provinces. Interprovincial pipeline distributes crude within the Prairies and moves the balance of 60,000 b/d to Superior. Of this balance, 4,000 b/d is used in local refineries at Superior, and 56,000 b/d moves eastward. The next step in the expansion of the Western crude market will follow the completion of the Trans Mountain pipeline. Present guesses place the initial volume at 75,000 to 100,000 b/d; the total initial capacity of the line will be 120,000 b/d, which can be expanded to 200,000 b/d, leaving room for future expansion.

Following completion of the Trans Mountain pipeline, the next logical step will be the expansion of the Interprovincial pipeline and its extension across the Straits of Mackinac to the Sarnia area. Such an expansion would permit year-round deliveries of Western crude to refineries in Ontario and would provide capacity to meet the growing demands in that area. The combined capacity of the Trans Mountain and Interprovincial lines, together with local requirements in the Prairie Provinces, is expected to total about 450,000 b/d by 1955. If history in other major producing areas is any indication of the future, it would not be surprising to hear of plans for further expansion before the goals mentioned become reality; even now, we are speculating on the possibility of three-quarters of a million barrels daily production by 1960.

Completion of the Trans Mountain pipeline will eliminate the need for crude imports in the Vancouver area and open up the possi-

bility of export to the northwestern United States. Likewise, when the Interprovincial line is enlarged and extended, it will reduce the need for import of Mid-Continent crude and may provide supplies for export in the Detroit area.

Toronto is about the economic dividing line between products from waterborne imports to Montreal and the interior crudes refined in the Sarnia-Toronto area. Two products pipelines now terminate at Toronto, one moving products west from Montreal, the other moving products east from Sarnia. Toronto occupies a unique position in the oil world inasmuch as products from all the major supply sources of the world, except the Far East, are competitive there.

Any new and expanding industry must pour in a lot of hard cash over a long period before its cash income equals its cash outgo. Western Canadian oil is no exception. The industry is converting cash in the bank

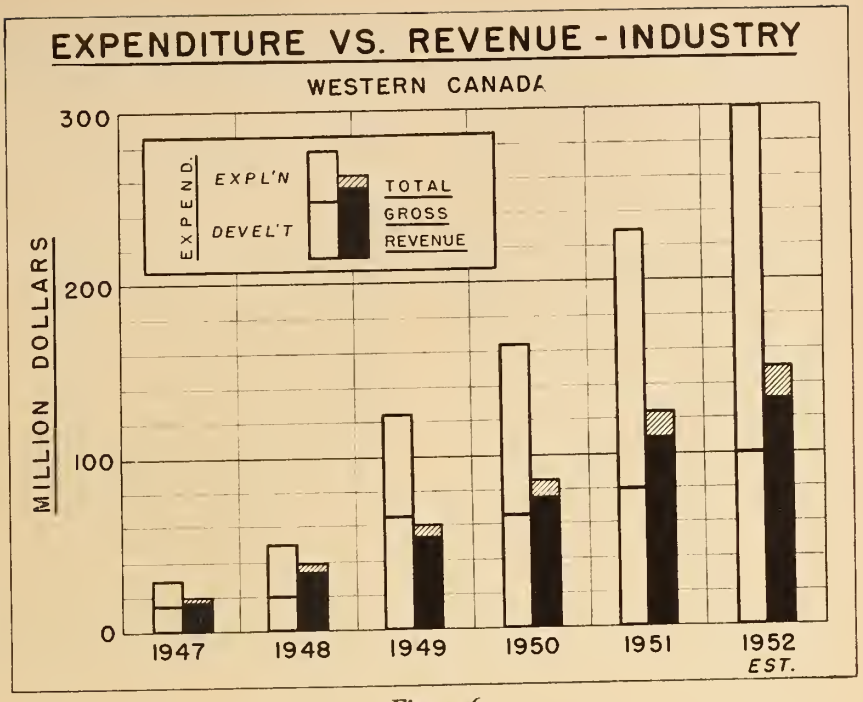

Figure 6

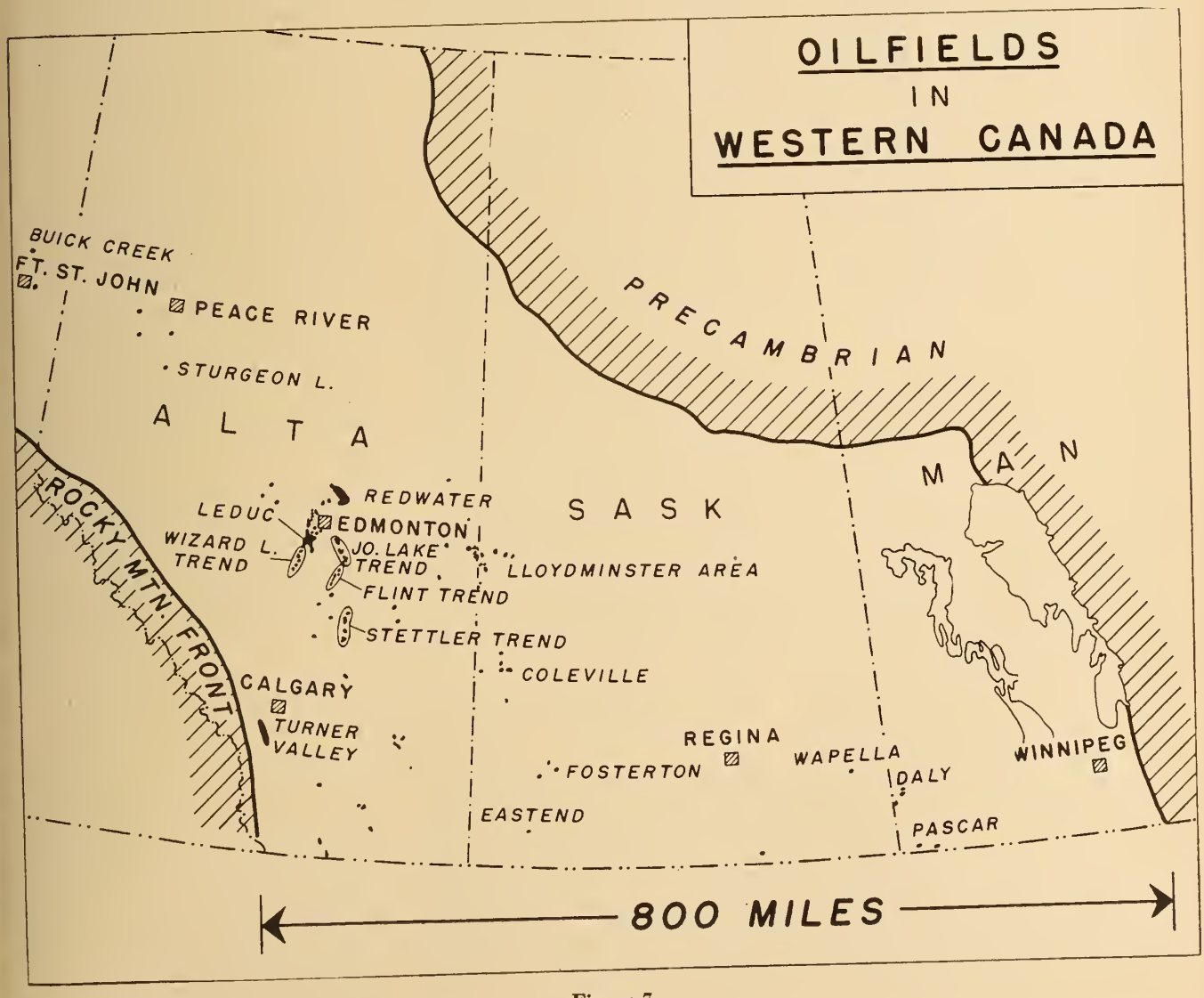

Figure 7

into physical assets in the ground. This is shown by the comparison in Figure 6 of gross income with cash outlay before income taxes. From 1947 through 1952, the industry put about $900 million into exploration and production, while the gross value of all production amounted to only $480 million. In other words, the total outlay has been approximately double the gross income. This means that, on the average, for every dollar of gross income, the industry has ploughed back that dollar plus an additional dollar of new cash, possible only because of the faith of both the industry and the public in the future of Western Canadian oil. Average results to date justify that faith. The costs of finding and developing oil in Canada are high, but are believed to compare very favourably with similar costs in the United States. However, this advantage is offset to some degree by the length of time it will be necessary to wait for recovery of initial cash outlays. The rate of cash input continues to increase annually, and there are large areas favourable for further expansion. An increase in tempo of activity is therefore probable, an increase justified by the belief that markets can be expanded to levels which will support it.

Oil and gas discoveries continue to stimulate the search for oil. These discoveries have occurred over a very broad front from Fort St. John and Buick Creek in British Columbia to Daly and Pascar in Manitoba.

The general location of the Western oil fields is shown in Figure 7. Looking first at the Manitoba-Southeastern Saskatchewan area, production has been found in Mississippian and Basal Cretaceous formations. Mississippian formations are productive at six localities in the general Daly-Pascar area. Daly is the only field where active development has been undertaken, the other discoveries being recent. Basal Cretaceous production has recently been found at Wapella, and the first Jurassic production is now being tested at that locality.

In southwestern Saskatchewan, medium-gravity crude has been found at five localities in the general area of Fosterton and Eastend. This production is from Jurassic and Basal Cretaceous sands. The largest oil accumulation in Saskatchewan is in the Coleville area, including recent discoveries at Buffalo Coulee and Onward. This is a heavy crude; reserves found to date are ample to meet all requirements for heavy fuel oil in the Prairie Provinces. Coleville crude is similar to that from the large heavy-oil deposit at Lloydminster, which has been known for many years. The economic results to be achieved from production in Saskatchewan and Manitoba are still an unknown quantity because of the lack of actual production history. So far, except for Coleville heavy oil, the fields appear to be comparatively small, but there will undoubtedly be a large number discovered as exploration continues.

In the northwest, at Peace River and Fort St. John, moderate success is being achieved. The principal discoveries have been gas, notably at Fort St. John, where a very large gas reserve is being proved. While there is some oil at Fort St. John, the most important oil discovery of the year appears to be at Sturgeon Lake, south of Peace River town. As more is known of the area and competitive activity increases, there will undoubtedly be many fields found in northwestern Alberta and in British Columbia.

The chief area of interest is still in the general Edmonton area. Commercial production is found in Cretaceous sands and in Devonian limestone, of which Leduc and Redwater were the two early outstanding discoveries. Of the more recent discoveries, four production trends are now outstanding. These are outlined by the ovals in Figure 7.

The Joseph Lake trend includes several fields, such as Armena and Camrose. Production is obtained from the Viking sand of Cretaceous age. This trend represents a major field which is very active at the present time. The wells are shallow, only 3,300 feet, and can be drilled in about ten days. The industry is completing one well per day in the area and each well contributes about 55 barrels of daily productive capacity. While Joseph Lake was discovered in March, 1949, the full significance of the area was not recognized until oil was found at Camrose in February, 1951, and later, at Armena in October, 1951. Development work this year suggests that this will be one continuous productive area and proves it to be of major importance.

The Flint trend includes Flint, Duhamel, New Norway and Malmo, while the Stettler trend includes Stettler, Caprona and Big Valley. These two groups of fields produce from Devonian reefs, each having important discoveries this year at Malmo and North Big Valley (MacAlister), respectively.

Now, we come to the "hottest" area of all in Western Canada, the Wizard Lake trend, which is a chain of Devonian reefs extending southward from Leduc. So far, six pinnacle-type reefs have been found at South Calmar, Glen Park, Wizard Lake, Bonnie Glen, Pigeon Lake and Fivelands.

The last three of these were found this year. These pinnacle-type reefs are small in area, but usually contain an unusually large thickness of oil saturation. The result — each one is a rich oil field, even though it is comparatively small in area. Three wildcat tests are now drilling to the south of the known producing fields, and three additional locations have been made. There is an excellent chance that several of these six wells will result in new discoveries, so next year should get off to a good start.

In summary, it may be said that 1952 was a successful year from the standpoints of both number of new oil and gas discoveries and of volume of new reserves added. A total of 138 new oil and gas finds have been reported. While many of these will not "pan out" to be important, there is no doubt that several are major finds. While it is too soon to evaluate 1952's finds fully, they will likely total 300 to 450 million barrels, probably nearer the latter figure.

The oil industry in Western Canada still continues to expand in all phases of exploration and production. It will continue to grow so long as you and I and all our friends like to use automobiles and oil furnaces. √

SOME MARINE ASPECTS OF CATHODIC PROTECTION

(*Continued from page 1132*)

The problem of reliable valve seatings and of shaft bearings, particularly the lubrication of the latter, and the anti-fouling paint problem still remain to be solved by the engineers and the paint manufacturers. Only then will two-year, or longer, periods between drydockings be acceptable to ships' officers on all counts.

The work here reported was carried out in the laboratories of the Naval Research Establishment, Dartmouth, N.S. The author expresses his appreciation to the Defence Research Board of Canada, and to the Royal Canadian Navy, for the support given to the investigation and for their permission to publish the results. √

Mining Development in the Province of Quebec

by

Bertrand T. Denis,

Chief, Mineral Deposits Branch,
Department of Mines,
Quebec.

An address given to the Montreal Rotary Club, Tuesday, March 31, 1953. Presented with the permission of the deputy minister, Department of Mines of the Province of Quebec.

During the past fifty years our Province's mineral industry, measured by the annual value of its products, has expanded a hundredfold, from two and a half million dollars to a quarter of a billion. It is true that our yardstick, the dollar, has decreased, but the real progress of the industry, measured for instance by man-days of employment or by the volume and variety of the products, constitutes an achievement of which we may be proud. Furthermore we now have assurance that the immediate future is brighter than it has appeared at any previous time.

The list of our mineral products, valued at a quarter of a billion dollars per year, comprises approximately forty items. All of them are important to those who are directly interested in producing or consuming them. A glance at the table of production quickly shows, however, that only a few of the products account for more than nine-tenths of the total value. Unfortunately, these few do not include fuels. The importance of fuels may be gauged from the fact that the value of the mineral production of the State of Texas is equal to that of the whole of Canada.

The big items that constitute the backbone of our mineral production are asbestos from the Eastern Townships area; gold, copper and zinc mostly from the Western Quebec Mining Belt, and building materials, such as cement, limestone, bricks and clay products, sand and gravel, which, generally speaking, are won from quarries in the St. Lawrence Lowlands, reasonably near the large centres of population. The value of our asbestos production is nearly one-third of the total. If you add gold, copper and zinc you have accounted for three-quarters of our production; building products will bring you up to nine-tenths, leaving only one-tenth for all of the others put together.

Asbestos and Metallics

Our asbestos mining industry is centred about the Thetford-Black Lake and Asbestos districts. Probably most of you have, at one time or another, seen the vast open pits that now mark the locations of the principal deposits. These remarkable deposits have been in production now for more than seventy years, and asbestos is still the largest single item in the table of our mineral production. Moreover, new records have been established regularly in recent successive years.

Our asbestos operators treat large quantities of rock with amazing efficiency. Some of the operators mine, transport and treat 8,000 to 10,000 tons per day. Although open pit mining is still practiced on some of the properties, on others the economic limit of depth for this type of mining has been reached. The operators have gone underground, using an ingenious low cost method known as block caving. It is not the time to go into details on this technique, but the changeover to its application without interrupting the flow of production, is an engineering achievement of the highest order.

The metals, gold, copper and zinc, are extracted from twenty-nine mines in the Province. Twenty-four of these are situated in the Western Quebec Mining Belt, which extends from the Ontario boundary eastward through Rouyn and Val d'Or. Of these, sixteen are straight gold mines and the other eight produce base metals as well as gold from the complex ores that they mine. The oldest of the Western Quebec mines, Noranda, which started production in 1927, is still the biggest producer, handling over 4,000 tons per day.

There are, however, five others that hoist more than half a million tons per year. Our five other metal

The annual value of production from Quebec's mineral industry now totals some $250 millions. Asbestos accounts for nearly a third of the total; gold, copper and zinc account for some forty per cent and building materials fifteen per cent. Gold, while still holding the lead in metal production, is being overtaken by copper and zinc.

Current developments of iron ore from Ungava, zinc in Northern Quebec, copper in Gaspé, Chibougamau and the Eastern Townships, titanium on the North shore of the St. Lawrence, together with the expansion in asbestos production, hold promise of a bright future for Quebec's mineral industry.

producers are widely scattered. One is in Portneuf County, about forty miles from Quebec; two others are near Sherbrooke; the fourth at New Calumet about thirty miles west of Ottawa, and finally, a small operation is being successfully conducted at Marsoui on the north shore of Gaspé Peninsula.

Building Materials

The quarries from which we extract our building materials are, generally speaking, situated reasonably close to the large centres of population. Deposits of these building materials are abundant and practically unlimited, consequently competition is very keen, selling prices are so low that the cost of transportation is a critical factor. Because of these considerations, success of any such enterprise requires most careful study in the choice of the deposit to be mined, its location and the available markets.

Large operations include the cement plants at Montreal and at Hull, numerous limestone quarries in the Montreal area, the brick plants at Laprairie and Quebec. There are a few steady, large sand and gravel producing operations in the Montreal and Quebec areas, but there are also dozens of smaller operators; these materials, as well as crushed stone, are also produced temporarily on a large scale in whatever part of the Province construction happens to be particularly active.

The granite quarries of the Eastern Townships, la Rivière à Pierre, the Lake St. John area and the Laurentians north of Montreal provide a steady production and a pleasing variety of stones for construction, building and ornamental purposes. It is pertinent to point out in passing that the Province of Quebec produces more than three quarters of the granite used for building and ornamental purposes in Canada.

Titanium

A comparatively recent development of considerable interest is the discovery and development of the titaniferous iron ore deposit at Allard Lake, a few miles north of Havre St. Pierre on the north shore of the St. Lawrence River opposite Anticosti Island. This is the largest known deposit of ilmenite in the world. The ore is shipped to Sorel for treatment in electric furnaces. From it are extracted metallic iron and a titanium oxide rich slag, which is exported to the United States for further treatment for the manufacture of white paint.

During the past year or so, numerous articles have appeared stressing the theme that titanium is the metal of the future. This may quite possibly be so, but it is still for the future. We have reasons to believe that intensive research is being put in to the extraction of metallic titanium and its industrial use, but so far at least, it would seem that we are still in the research stage. Those who are engaged in this work have given out little new information that might be of use to their competitors, so that it is difficult to form a clear idea of progress. I should not care to predict when or even if, large-scale industrial use of metallic titanium will be realized. If it is, however, Quebec is particularly well favoured with deposits and occurrences of titanium-bearing minerals.

Gold Mining not Expanding

There is ground for considerable satisfaction in current developments in the mining industry of our Province. Important favourable developments are now well under way and most encouraging of all is the fact that these are taking place in widely separated areas. We are not in the position of having all our eggs in the same basket.

Before outlining the favourable developments, I must draw attention to a flaw in the overall picture. This is the situation of our gold mines. In 1951, gold still headed the list of the metals produced, although copper and zinc followed closely. If, however, we keep in mind that the production for 1951 is about the same as that for 1941 and that the overall mineral production has expanded by two and a half times, the conclusion is inescapable that, for practical purposes, we must consider that our gold mining industry is in a state of regression.

This is not our fault nor is it peculiar to Quebec. In Canada, the number of gold-producing mines has fallen from 144 in 1941 to only 60 in 1952. In Quebec, eighteen out of thirty-four gold producers have closed down since 1942. It must be kept in mind, too, that an important proportion, approximately one-third of our gold, is produced as a by-product from base metal mines whose operations are less affected by the adverse factors that have led to the deterioration of our gold mining industry.

It should be clear then, that something is wrong and that the measures that are being taken are inadequate to correct the situation. This is not solely a provincial matter, but is tied in to national and international policy. Some new measures were introduced in the Federal budget speech, but how far these will go to correct the situation must be left for the future to show.

Iron Ore

The most important mining development in the Province is the project for bringing to the production stage the iron ore deposits of New Quebec. During the last two years, an average of 3,500 men have been employed by the Iron Ore Company of Canada, and last fall the number of men on the payroll was over 6,000. These are the men engaged in construction, and when the enterprise is on a regular producing base the payroll will of course be considerably less. A permanent mining townsite has been located close to Knob Lake, which is 350 miles north of Sept-Iles. It is expected that 500 families of miners and railway workers will be accommodated there, while almost as many railway employees will be stationed at Sept-Iles. The work is progressing according to schedule, which calls for the first shipments of ore by the end of 1954.

The deposits that it is proposed to work have ore reserves of the order of 400,000,000 tons. Production is planned at the rate of 10 million tons per year, which will give the camp a life of forty years even if no other ore is found. The possibility that no other ore will be found is so remote that it does not merit consideration at this point. Our experience has always been that mining enterprises far outlast the initial estimates of their lives.

There is a good reason for this, namely that mining exploration is so expensive a proposition that in the normal course of events, as soon as there is enough ore proven to assure its profitable extraction (that is, to pay for the installation) mining operations commence. When these are underway, exploration is then resumed and paid for from the revenues of the operation, with the object of keeping ore reserves up to the point that will assure maintenance of the enterprise for a reasonable future.

The iron-bearing formations now being developed by the Iron Ore Company of Canada extend northwestward right up to the west shore of Ungava Bay, a distance of over 400 miles. Along this belt, several other organizations are actively engaged in mineral exploration. They have been favoured with encouraging results, but it is still far too soon to say exactly what developments we may expect.

The progress achieved by the Iron Ore Company of Canada was reached through intensive effort over a period of several years. None of the others have reached the same stage, nor can be expected to do so for some time to come. It is reasonable to anticipate also that access to the heart of New Quebec will stimulate activity in exploration, and that in the area thus opened up new discoveries of other minerals will be made.

New Copper and Zinc Properties

Turning from New Quebec to quite a different part of the Province, Gaspé Peninsula, another important large-scale development is underway in the north central part of the peninsula. Here Gaspé Copper Mine, a subsidiary of Noranda, is actively pushing the development to the production stage of a low grade copper deposit having an estimated reserve of about 70,000,000 tons. Construction of the buildings and the installation of equipment are well advanced, and a mining village is being set up at a distance of about half a mile to the east of the site of operation.

Concurrently with this project, the Quebec Hydro-Electric Commission has acquired a million potential horsepower on the Bersimis River on the north shore of the St. Lawrence River. It is expected that between 150,000 and 200,000 horsepower will be developed initially, and half of this amount is reserved to supply mining and industrial developments in Gaspé. Submarine power cables will be laid across the St. Lawrence River, which is forty miles wide at this point.

In Western Quebec the Barvue Mine completed last November the installation of a plant designed to treat 4,000 tons of zinc ore daily. The plant was tuned up at an initial rate of 1,000 tons per day and is now treating 3,600. At present, all these concentrates are being exported for the extraction of the metal. Recent reports of exploration in Gaspé and in New Brunswick have indicated the existence of important zinc deposits in both of these areas. There is therefore every reason to expect that one or more zinc smelters will eventually be put into operation in Eastern Canada.

Sulphur

Other announcements of interest to the mining industry of Western Quebec have recently been made. Noranda is planning to erect a sulphur plant at Hamilton, Ontario, to treat pyrite extracted from their own mine, and from the nearby Macdonald mine which they propose to open. Sulphuric acid is also being extracted from the Western Quebec ores at Arvida, where the Aluminum Company roast zinc ores for the production of the acid. The Nichols Chemical Company are doubling the capacity of their acid producing plant at Valleyfield, Quebec. This plant treats by-product pyrite from Canadian mines.

New Developments

In the past two or three years, exploration has been very active in the Chibougamau Region which, broadly speaking, is to be considered as an extension of the Western Quebec Mining field. The results of this exploration have been most promising and, according to estimates by eleven interested companies, ore reserves of over eight and a half million tons, valued at over a hundred million dollars, have been established by diamond drilling and underground exploration. The Department of Mines has built a road to reach this area from Lake St. John.

During the past year, three shafts have been put down on the properties of Campbell Chibougamau, Merrill Island and Chibougamau Explorers. A mining plant is being installed at Opemisca Copper in Levy township. Recently the Federal Minister of Transport has announced that a railway will be built to Chibougamau, and the Quebec Hydro Commission has under consideration a plan for bringing power into the area. These two developments are still in the project stage.

Important new developments are taking place in the heart of the asbestos mining fields, which are among the oldest in the Province. Last February, the Provincial Asbestos in the Black Lake-Thetford region started a new operation. The Johnson's Company, one of the oldest operators, is building a new mill of 4,000 tons per day capacity, which should be ready for operation at the end of the year. Another of the largest operators, the Asbestos Corporation, is undertaking the opening up of a new deposit with a 5,000 ton per day mill. Underground exploration is being actively pursued on the property of United Asbestos. On the property of the Dominion Asbestos Limited, twelve miles east of the town of Asbestos, a mill with a daily capacity of 2,000 tons should be in operation within a very short time.

Another development in the field of non-metallic industrial minerals in the Province is the construction by Dominion Magnesium of a million dollar plant at Beauharnois. This is for the manufacture of ferro-silicon which, in turn, is used for the production of metallic magnesium. The silica comes from a deposit at Lac Bouchette, south of Lake St. John. Another new plant put into operation during the last year is that of the Dominion Silica Corporation at Lachine for the treatment of silica to be used in the manufacture of glass and also foundry sands. The capacity of the plant is 850 tons per day. The silica is mined at Blanche Lake near Nominingue, and also in Loranger township near Labelle.

A most interesting renewal of activities has been taking place in the Sherbrooke area, where copper was mined as far back as the time of the American Civil War. Two mines are now in production at Moulton Hill and Suffield, both operated by Ascot Metals Corporation. The Weedon Mine, a copper producer, has recently reopened after more than twenty years of idleness, and is currently handling nearly 300 tons per day of ore. Metal-mining operations in the Eastern Townships in the past and still today are on a small scale if compared to the asbestos industry or to the mines of Western Quebec, but future developments will be watched closely. Copper mineralization in the area is widespread and anything can happen.

A considerable flurry resulted from a discovery in Montmagny county of nickel, copper, zinc mineralization during 1951. Following diamond drilling, exploratory shaft sinking and underground exploration were undertaken. It is still too soon to assess the importance of this field or to predict the eventual results, but recent reports of progress are satisfactory. The interest in this area has already resulted in a discovery of gold mineralization of unexpected richness in the neighbouring county of Bellechasse. Here again, exploration has not advanced to the stage where predictions of consequences are justified.

Future Bright

All this evidence leads us to the conclusion that we are at present assured that the immediate future is brighter than at any previous time. There are so many and such important developments under way right now that we seem to be at a turning point which will be reflected as a step in the curve showing the progress of the industry.

When it comes to discussing de-

(*Continued on page 1147*)

Two Hundred Ton Testing Machine at McGill

by

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McGill University now has the most up-to-date facilities for testing large specimens such as full size castings and fabricated parts for working load capacity and to failure in compression or tension under loads up to two hundred tons. This paper describes the testing machine in detail and its method of operation.

The installation of the 400,000-lb. Baldwin-Lima-Hamilton testing machine in the materials testing laboratory of McGill University, Montreal, is the result of many years of planning on the part of the members of the department of civil engineering.

The old machines of our laboratories, although adequate for teaching students the fundamentals of strength of materials, have limitations in size and capacity that are a distinct handicap in modern research work. It is also desirable that students should see and know a modern type of testing machine.

This new device has been installed in the room at the north end of our existing laboratory, vacated by the department of mechanical engineering. Its acquisition was made possible by an anonymous gift to the University, earmarked specially for this project.

The experience of the war years, as well as the rapid advance of non-destructive testing, indicated the kind of machine that should be installed. It should be physically large enough so that full size castings, weldments and fabricated parts could be placed in the machine. The loading capacity should be such that at least a proof working load could be applied to these pieces, and such that most of them could be loaded to failure.

A survey of past experience with testing machines indicated that requests for loadings of over 200 tons were few and far between. Consequently it was decided to specify a standard universal testing machine with as large a clearance as possible between side standards, and a capacity of approximately 400,000 lbs.

This specification was sent to all the well-known testing equipment manufacturers. After a careful examination of the tenders, it was de-

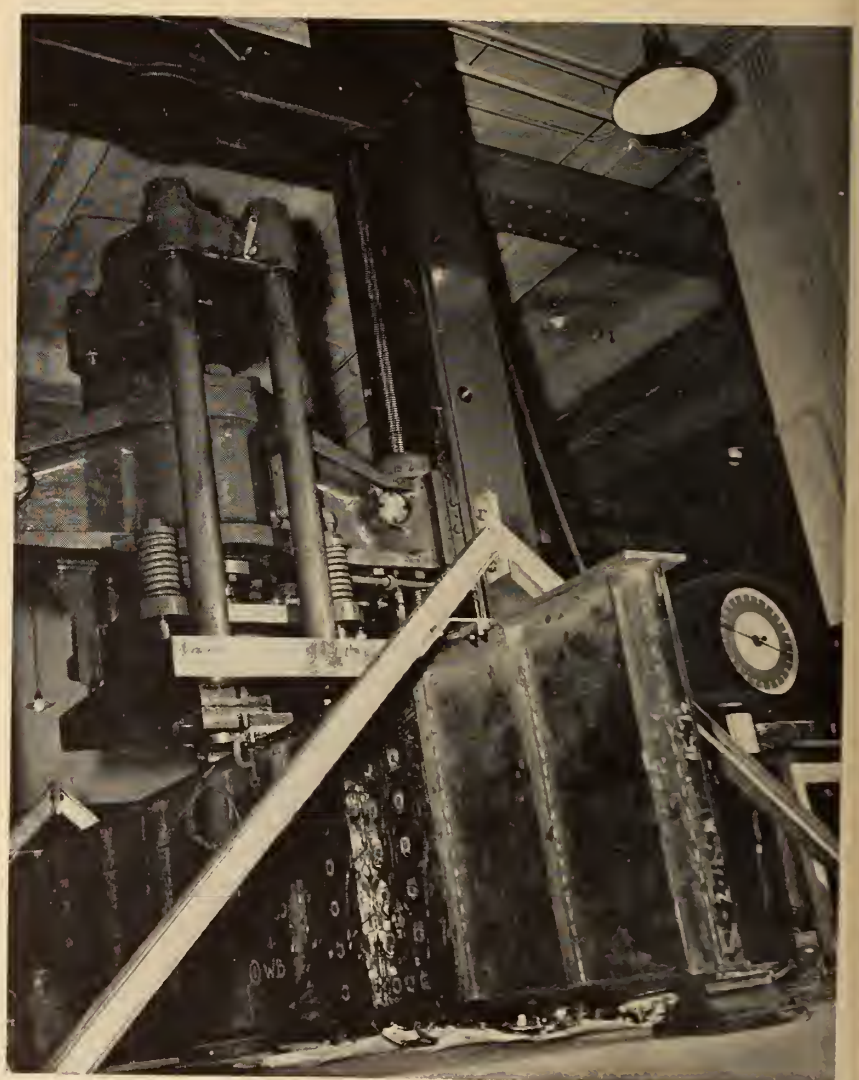

Fig. 1. Testing of welded beam in the 400,000-lb. Baldwin-Lima-Hamilton universal testing machine.

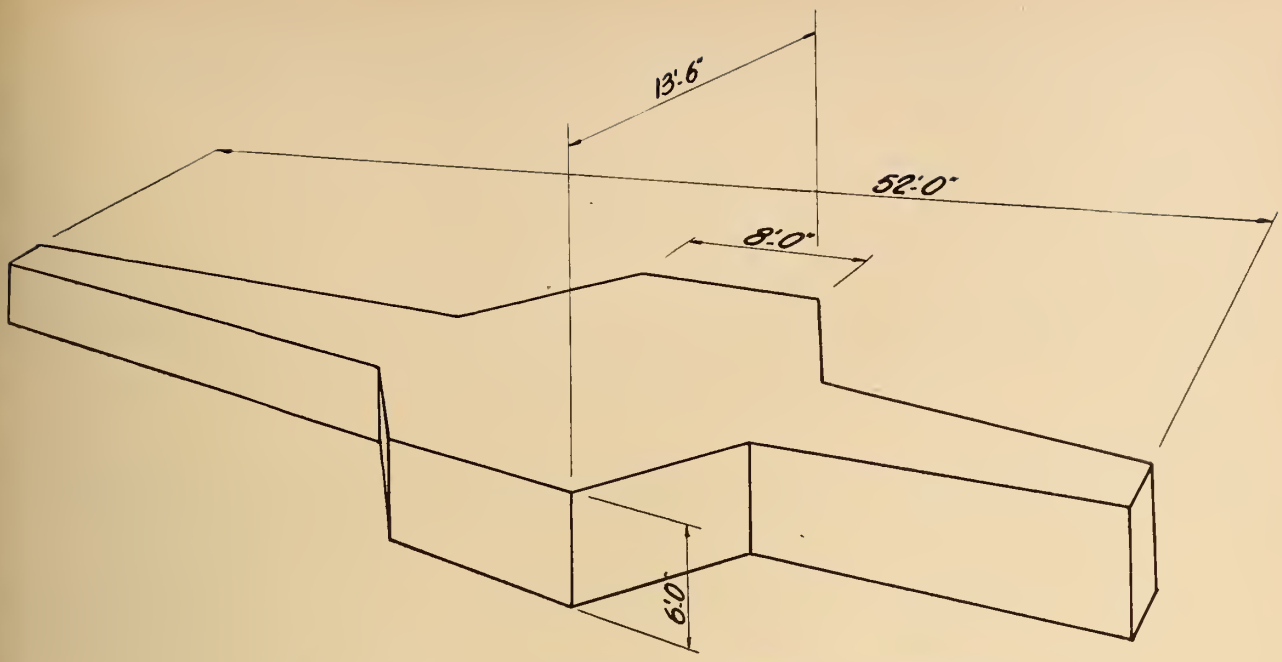

Fig. 2. Base and transverse beam for 400,000-lb. testing machine.

cided to install a 400,000 lb. Baldwin-Lima-Hamilton floor-type universal testing machine. This piece of equipment gives the capacity specified, 400,000 lbs. It has a clearance between screws of 6 ft. 6 in., and is able to take a tension or a compression specimen 10 ft. long.

The loading and measuring devices are all installed in the moving head, so that there are no moving parts below the base plate or above the ceiling. The side columns and screwed standards are of such a design that they could be ordered to dimensions so as to fit the space available to maximum advantage.

Transverse testing has one bad feature on most standard testing machines, in that an auxiliary beam must be provided to transfer the beam reactions back to the base of the testing machine. This machine, since it has no working parts below its base plate, could be mounted on the auxiliary beam. This means that the beam is below the floor level and is permanently in place. All that needs to be done to place the specimen under test is to move it into place.

Loading Ranges

The machine is equipped with three loading ranges, namely, 20,000-lb., 100,000-lb. and 400,000-lb. It is possible to change from one scale to another while the test is in progress. It has a movable head (Fig. 1) in the centre of which is the hydraulic ram which supplies the loading pressure. Between the bottom of the ram and compression loading platen, is the Tate-Emery load-indicating capsule. The lower tension head is placed on the upper side of the movable head, and below this is a small ram used to return the platen to the top of its stroke.

Nuts running on the threaded side columns are incorporated in the moving head. These are driven by an electric motor through a gear reducer and a bevel gear drive. By push button control the head can be raised or lowered as required. The moving head is guided by ways, fitted to the sides of the head and bearing on the side columns.

The screwed columns pass through the base plate. They are pinned to prevent them rotating, and are held in place by large nuts below the base. The side columns stand on the base plate and are bolted in place. On the upper end of the side columns an angle iron frame spaces them, and provides loose housings for the upper ends of the screwed columns.

Loading Always Downward

Above the moving head is a heavy cast beam, which carries the upper tension head. This beam is attached to the side columns by pins. Four pin holes are provided in each side column, so that the upper tension head can be placed as close to the floor as the tension specimen will allow.

This beam is raised and lowered by resting it on the moving head. Then, raising the head so that supporting pins are free to be withdrawn, the whole assembly, tension head and moving head, is then moved to the new position where the retaining pins are run home.

It will be noted that tension is provided between the moving head and the upper tension head; compression is provided between the moving head and the base plate; and transverse loading between the moving head and foundation beam. In all cases the loading piston moves downwards, and puts the Tate-Emery capsule in compression and the screwed columns in tension. The side columns only come into the loading system in tension testing, when they support the upper end of the tension specimen and are themselves in compression. On other tests they act only as guides.

The console of the machine is placed on the right hand side of the machine, and carries the load indicating dial. All the hydraulic and air valves are in the console, together with the electric switches for moving the head and operating the oil pump. The oil pump with its apparatus is housed under the skirt of the console. The dial is provided with a pacing disc by means of which definite loading speeds may be maintained.

High pressure oil is delivered to the loading cylinder through two valves with micrometer adjustment. One of these valves controls the quantity of oil delivered to the cylinder, while the other is for by-passing the oil back to the sump.

Indicating Mechanism

The load indicating mechanism consists of the Tate-Emery capsule, connected to a servo mechanism which operates the pointer on the

(Continued on page 1145)

An Undeveloped National Asset

by

D. F. Kidd,

Past President,
Canadian Institute of Mining and Metallurgy.

Presidential address to the annual general meeting of the Canadian Institute of Mining and Metallurgy in Edmonton, Alberta, in April, 1953. It is reprinted from the Canadian Mining and Metallurgical Bulletin, June, 1953.

My twelve months in the Presidential office are now at an end. April 24th, 1952, seems a long time ago. I have had, in the last year, unparalleled opportunity to see the Mineral Industry of Canada from coast to coast and from the Arctic to the border. In Nova Scotia, I have been out under the sea in coal mines and have seen an automatic mining-loading machine loading out a ton of coal every seven seconds — a Canadian machine — engineered, designed, and built in Canada. I have seen the cradle of Canadian mining in the Eastern Townships of Quebec, a country where we mine 70 per cent of the free world's asbestos. I have seen Noranda, which has produced well on towards a billion dollars for all of us in new Canadian wealth. I have seen the great gold mines of Kirkland Lake and Porcupine. I have seen Granby, which, since 1901, has mined copper ore in three great B.C., mines and still is doing so. I have spent two days at Sudbury where the smallest unit of production measurement seems to be 1,000 tons daily — the Frood pit, the Creighton mill, and so on. I have seen again the Sullivan Mine in B.C. its new open pit where they have stripped 2,000,000 yards of rock only to reach an orebody. I have seen 100 feet of massive chalcopyrite at Flin Flon, and 322 feet-ounces of gold ore at the Giant mine at Yellowknife. I have been to the bottom of the Eldorado mine at Great Bear Lake, our first uranium producer, and have seen there, on the Arctic circle, their new million dollar leaching plant. To my everlasting regret I have not seen our newest, biggest mining enterprise, the iron ore developments in northern Quebec: at the peak with seven thousand men preparing to mine 75,000 tons of iron ore a day, and docks at Sept Isles to load 8,000 tons an hour.

I have just returned from my last trip — to Mayo, in the Yukon — our newest and northwesternmost big mining camp. I have seen and am seeing something of our oil and gas industry. I have seen many more mines, plants, and men. I can't mention them all here.

Among our Institute branches I have preached — and I am afraid 'preached' is the right word — that we have in our mineral industry resources and power the full extent of which we ourselves hardly appreciate.

But I have seen more than that. While the evidence of great natural-resources wealth and of hundreds of millions of dollars anteed-up to make these resources yield up the wealth they must, first strikes one, the most lasting impression is of that catalyst, everywhere evident, that has brought dead money and inert resources into active reaction to make new wealth for Canada, better living for all of us. That catalyst is the men of the mineral industry — and their women too. Men with brains and nerve and guts to tackle and carry through the big jobs I have recited and about which we all know. Over the long pull, they are perhaps our greatest resource of all. The jobs they have first imagined and then engineered and done, I can say without boasting have never been excelled anywhere in the world in our time or our industry.

We have been listening now for three days to an exposition of the theme *The Role of Minerals in the Industrialization of the West.* I would suggest to you the absolutely critical role of men — engineers, managers, and dreamers too — in the Industrialization of the West. Ultimately, the men are our most important resource of all, because they bring to life — to fruition — all our other resources.

I find myself wondering these days how, or even if, this premier natural resource — our resource of Canadian brains — is being developed adequately. Let us for a moment look at this human brains resource like any other natural resource, from the standpoint first of appraisal and inventory, and second, from that of exploitation.

We obviously have no unit of measurement of undeveloped human brain power. We can but go on past performances and project them into the future.

We are 14,000,000 people, made up mainly of North European stocks. These stocks and their United States derivative stocks have today originated and developed almost all the great scientific and engineering achievement of both this century and the last, and our records stand there without me reminding you of the detail. Is it not only reasonable to suppose the trend will continue? We have the machines — universities and technical colleges — to develop the partly processed brain material we feed into them.

The point that has concerned me for some time is, how good is our exploitation of that raw material — undeveloped human brains? I know, and you must too, of many adult men with wonderfully well screwed-on heads, men whom you are certain could have gone through University with top honours, who never got there, never finished High School — had to quit at Grade 8 or 9 to work. I could name you several. Sure, an odd one of them by superhuman effort, or a reached-out financial hand, made it, but what of those who don't quite do it?

I doubt if we lose too many top-notch men by dropping out from University for money reasons. Ability there gets recognized scholarships, bursaries, and loan funds are available. There may be some wastage here, but it is the situation in the High Schools across Canada that concerns — I might go as far as to say appals — me.

I have recently asked our ten provincial Ministers of Education what direct financial aid is available in their province to high school students to help them complete matric-

ulation. I have heard from all of them except Prince Edward Island and Newfoundland. The total aid, outside of free tuition available to High School students, probably does not exceed $30,000 annually, mostly split between Ontario and Manitoba. Probably my use, a moment ago, of the word 'appal' is not out of line. The expenditure of a pitiful $30,000 annually by the citizens of Canada to ensure full development at the High School level of their greatest natural resource — brain power — justifies the word.

Since the close of the war and up to the end of 1951 the Federal government invested something like $160,000,000 through the Department of Veterans' Affairs in giving vocational or University training to 134,000 veterans. Eighty thousand took vocational training at a cost of 52 millions, and 54,000 took University training at a cost of 134 millions. While military service was the prime standard and academic standing was only a secondary qualification, so that the scheme was not strictly an investment in the development of the resource of latent brains, nevertheless who cares to say that they may not have been some of the best millions ever spent by our Government? I don't. The rapid absorption of these trained men into our expanding industrial economy is proof of the wisdom of the investment.

We in the Mineral industry are accustomed to spending millions of dollars — many millions in the aggregate — annually on prospecting in unknown ground for new mineral deposits. I wonder if Canada should not go prospecting in her High Schools for high-grade human brains and, when they are found, processing them through High School and University. I, as a prospector, think it would be an excellent gamble.

Ten million dollars annually would see three or four thousand students annually through High School. Even one million would see several hundred through annually. If selection were based strictly on scholarship and need, I think it might be as good a prospecting venture as any ever made in Canada.

I am no politician and I won't presume to say whether the project should be provincial or federal or both. There is precedent in federal grants in aid to education at the University level and for servicemen.

I grant you there will be some 'milling losses', to extend the mining metaphor. The assaying of human brains and energy at the Grade VIII or IX level is not easy or accurate, and there will be those who do not measure up in the later University training or, by analogy, the milling. There will be some later lost to the United States. Nevertheless, I think we will develop top grade engineers and scientists who, under today's almost complete lack of aid, might never have been found.

You should hear Dr. Mackenzie, former head of the National Research Council and now head of Atomic Energy of Canada, Limited, speak of the young Canadian engineers and scientists working at Chalk River and Ottawa on atomic energy. There are no better anywhere in the world. For our own mineral industry, and here I speak from direct personal experience over the past year, we have a group of engineers and managers second to none anywhere. We are proud of them. We, Canada, needs all of them. We can't afford High School wastage of undeveloped material.

So, Ladies and Gentlemen, I urge upon you, and, through you, upon our provincial and federal governments, the need of direct financial assistance toward living expenses, assistance based on both scholarship and need, at the High School level, where I believe today serious wastage of a great — perhaps the greatest — Canadian national asset may be taking place. √

TWO HUNDRED TON TESTING MACHINE AT McGILL

(*Continued from page 1143*)

dial. The Tate-Emery capsule is a floating sealed chamber filled with mineral oil. This is connected to a Bourdon tube, attached by means of iso-elastic springs to the rack which moves the pointer. The bottom end of the rack bar is attached to copper bellows.

Attached to the movable end of the Bourdon tube is a flat piece of metal, which covers the end of an air jet. This air jet is connected to the copper bellows. Any change in the position of the flat metal on the end of the Bourdon tube causes a change in the flow of air from the jet. This causes the copper bellows to exert a pull on the springs and Bourdon tube, in such a direction that air flow returns to its original setting.

By this means there is practically no movement of the Bourdon tube and the rack, and through it the pointer measures only the change in length of the iso-elastic springs. These springs are very constant and not subject to temperature changes, so that calibration is constant for long periods of time. The Tate-Emery capsule will maintain calibration provided the system is free from air, and provided that the correct spacing is maintained between the top and bottom parts.

Three Bourdon tubes are provided, all equipped with the correct iso-elastic springs. Changing from one indicating scale to another merely entails changing the air supply from one Bourdon tube to another. At the same time the numbers visible on the dial are changed. The console is also equipped with a load maintainer which is operated by air pressure, and attachments are provided so that recording stress-strain equipment may be used.

Foundations

The reinforced concrete beam which forms the foundation for this machine and supplies the means for transferring beam reactions in bending tests back to the base of the machine, is shown in Fig. 2. It is designed for loads of 100 tons each 25 ft. from the centre line of the machine, to give a maximum deflection of ½ in. The beam is 52 ft. long, 6 ft. deep and 13 ft. 6 in. wide in the centre.

Eight anchor bolts are provided, attached to heavy channel sections buried deep in the concrete. The contractor is to be congratulated on the placing of these bolts, because it took only ten minutes to sling the base plate and drop it into position on the bolts, and the clearance is not very large. The base plate is 18 in. thick, so the top of the beam was placed 18 in. below floor level.

As a result 18 in. of concrete padding had to be provided on the top of the beam. This was made in the form of concrete blocks, separated from each other by heavy building paper, so that when bending takes place the blocks separate at the paper line and do not crack in the body of the blocks.

The sides of the concrete base beam are kept independent of the surrounding soil by a loose crushed stone fill. In all, between five and six tons of steel bars were used and approximately 15 cu. yds. of concrete.

As a result of this installation, facilities are now available in Montreal for testing large pieces of equipment, and to evaluate the results in terms of working loads. √

Are We Ready to Consider a Major Change in Policy?

by

W. S. Evans,

Professor of Civil Engineering,
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Engineering—An Art or a Science?

The one piece of legislation most often mentioned in educational circles is probably the Morrill Act. Since this Act was signed in 1862, I am going to start off by saying that ninety years ago, our fathers made possible for future generations a new kind of education. Although it is not necessary for me to tell you that the part of this plan in which we are most interested was labeled, "Mechanic Arts", I remind you of it to emphasize that the forerunner of Engineering Education was thought of as an art. Of course, engineering was in those days, and still is, a mixture of art and science; but just as we can all agree on this, so I think, we can all agree that the mixture, the ratio of the part attributable to art to the part attributable to science has changed.

As evidence of this it is found that from the structural standpoint, present day writers credit the discovery or creation of the various styles of ancient architecture, the Greek Doric and Ionic, the Roman Arch, the Gothic Vaulting, to their creators as artists not as scientists or engineers. While the results were engineering accomplishments, they were arrived at by intellectual and physical processes which characterize an art rather than a science. Of course, the originators of these ancient styles of architecture were great architects and engineers but their accomplishments seem to have been derived from art, not science. Great strides had been made prior to the middle of the nineteenth century, but when the Morrill Act was signed, there was still a close linkage between the craftsman and engineering accomplishments. As examples of what I mean, study the old covered bridges of New England and the type of building construction which required four-feet thick walls. I once had a well-known bridge engineer explain to me how he could determine accurately the bearing power of a soil by the kind of imprint his heel made upon it. I have no doubt that he could, but it was through ability developed as an art and not through scientific deductions that he was able to make such decisions.

When Frank Lloyd Wright built the first modern home, the exterior of which was not determined by conventional appearance but by the interior demands based on a utilitarian use of space, he began to take the art out of architecture. It is worthy of note that while the types of architecture developed in the remote past are attributed to the great artists of the time, the modern skyscraper in all its many styles, in fact most of the modern developments in architecture, are attributed to the engineer. The point I wish to make is that while 2,000 years ago a structure had to be created by a master much as painting was created or a statue was modeled, today design is based on fundamental principles and concepts which may be acquired by anyone who possesses the will to do so and the necessary mathematical background.

Service is the Yardstick of Engineering Accomplishment

You may be wondering just what this has to do with our subject. We have been asked to investigate and evaluate our present engineering curricula. To investigate is difficult unless we know the purpose of our investigation and to evaluate is impossible without a standard of measure. Then we should first determine what we are to measure, second, establish a standard by which to measure it, and third, make such investigations as are necessary to apply the standard.

Rather than measure the success of our educational program as it affects the individual and the employer, let us consider its effectiveness as a service to the public. Let us consider such questions as "Is Civil Engineering as a science progressing satisfactorily?"; "Are the structures we build the safest and most economical possible with the men and materials available?"

As answers I would like to present a few observations. Three years ago there was built on the University of Maine Campus two fairly large buildings with reinforced concrete frames. Today, in the third year of their use, bad cracks are opening up under the spandrel beams at the roof level. Why? Two years ago at Seattle, a representative of the Portland Cement Association, told this group that we were 20 years behind the times in what we were teaching in our Concrete Courses. That, gentlemen, is why those buildings are cracking. We don't understand Reinforced Concrete Design as we should. At Seattle, when that statement was made, we, not all of us, but you and I, rose up and said we couldn't do any different as we had to teach design according to the present specifications, and now I remind you of the title of this paper, "Are We Ready for a Change?"

Last summer, while travelling from Pittsburgh to Harrisburg over the Pennsylvania Turnpike, the most extensive superhighway in the country, I counted ten repair crews working on the roads in each direction, 20 in all, replacing broken down slabs and I am told it has

become worse since then. From one coast to the other we find roadways pumping mud, pavements beaten up and broken down. And why ? There aren't enough engineers who understand the necessity for sufficient foundation under our highways and who possess the will to obtain such understanding. The men who will be in the key positions in our highway departments 20 years from now are in our institutions this year. Will they be the right men for the positions, unless we are willing to make a change ?

Theoretical Analysis and Technical Development

I'd like to give more examples in more fields, but time doesn't permit. I am going to take time to ask a few more questions.

Is it accident that many of the leading mathematicians and scientists in this country were foreign born ? Of course you can answer that, in many cases, circumstances forced them to this country and we have educated some great scientists too, all of which is true. Then I would ask "Is it accident that most of the original work on prestressed concrete was done in Belgium and France ?" But, you can say, shortage of materials forced its development and I would remind you that, having been shown its use, we don't seem to find it such a bad economy either.

No, these things have not occurred by accident. The pattern is too clear cut. The Europeans have excelled in originating those things which can be derived from a background of fundamental theory. The reason is clear. The philosophy of Engineering Education in Europe is based on theoretical treatment of problems in hand. Ours is based on a practical treatment. Again I ask "Are we ready for a change ?"

Requirements Change

Through the wisdom of our legislators in 1862, our engineering schools were founded as "Colleges of Mechanic Arts". This was just and proper but times have changed. Civil Engineering in 1862 consisted largely of surveying and bridge building, with the building of canals and dams next. The field was narrow, the students few, and the instructor would pass on his skills with ease and effectiveness, but we are working under a different set of rules in 1952.

The American Society of Civil Engineers lists 14 Technical Divisions. If we consider 12 functional divisions for each one of these technical divisions, then we get 168 different classifications. Actually there are many more. So we see that since 1862 Civil Engineering has broadened to fields unheard of at that time. In the meantime it has become much less of an art and much more of a science. I cannot feel that our curricula, our methods or our philosophy have changed in proportion.

Our Objectives Should Change

You may well ask what I mean by a change in Policy. I'm not sure I can explain it in a few moments, but I can try.

Let's start with Soil Mechanics. It was my fortune some thirty-four years ago to be subjected to a course in Foundations. As I remember the study consisted of a very rough classification of soils and a prolonged study of existing structures and their behavior. This was a common procedure, but Soil Mechanics as a science could never have developed from this kind of a foundation. When a scientist, properly trained, undertook to find out what happens to a particle of soil subjected to stress, Soil Mechanics, as a science, began to develop and it couldn't have developed in any other way.

If we ever hope to design concrete structures on anything approaching a scientific basis, we must study the particles of concrete and their behavior from the time the mass is placed until it has been subjected to service for a period of years. In much of our structures work, the student gets the idea that he is studying specific structures rather than fundamental principles of stress analysis. It seems that in many cases we actually teach a few isolated applications instead of fundamental theory applicable to a broad field.

The change I am talking about requires no radical changes in our methods or curricula but it would require a change in our objectives and attitudes toward what is expected of a man with the B.S. degree. The young graduate should not expect $5,000 for his first year's work and his employer should expect to offer a longer period of training and less immediate returns. In brief, we should hold the four-year curriculum for those things which can best be taught in the atmosphere of an institution of higher learning. We might adopt some such motto as "The Sciences for the student, the Arts for the practitioner." We must ever strive to increase the ratio of science to art in our engineering work and thereby continually whittle down on the factor of ignorance. This will require a change in our philosophy.

Are we ready to face that change ? √

MINING DEVELOPMENT IN THE PROVINCE OF QUEBEC

(*Continued from page 1141*)

velopments beyond the immediate future, we are on the spot, for the simple reason that we have no estimates of undeveloped mineral resources. About 80 percent of the Province is as yet virgin territory in so far as the geologist or the prospector are concerned. It is tempting to speculate on the resources of this vast region, but the truth is that they are unknown. However, only the most unjustifiable pessimism could inspire doubt that the unexplored area contains its share of major mineral deposits as yet undiscovered.

Despite the adverse conditions our prospectors have to meet, we have so far achieved remarkable success. At the same time, even slight acquaintance with these conditions leads to the conviction that many more mines remain to be discovered, even in areas that have been most intensively explored. So far at least we have been able to locate progressively new mineral resources, and this calls for confidence that on the whole, for a long time to come, the progress of our mining industry will remain proportional to the efforts we put into it. √

Directory

See page 1163, for particulars re.

our new 1953 Membership Directory.

Management's Debt to the Engineer*

by

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Urwick, Orr & Partners, Ltd.,
London, England.

Reprinted with kind permission of the American Society of Mechanical Engineers, from "Mechanical Engineering", May, 1953.

Calvin Rice was Secretary of the Society from 1906 to 1934. The Management Division was founded in 1920, or precisely at the midpoint of his stewardship. This development of the Society's activities had his full support and approval. He was largely responsible for the publishers' decision to issue Taylor's "Shop Management" in book form. This is, however, the first occasion on which this memorial lecture founded in his honor and to further his ideals of increased understanding between engineers of different countries and the stimulation of the programs of meetings outside New York, has been assigned to a visitor from overseas primarily interested in management questions. It seemed appropriate, therefore, when your President did me the honor of asking me to select my own subject, that I should devote my talk to trying to survey, however inadequately and superficially, the inescapable debt which students of business management throughout the world owe to the engineering profession in the United States.

There must be those among the membership of the Society — and I believe there are many such among the younger men in all countries — who feel with me that in advancing the frontiers of this new body of knowledge which we term "management," in applying the objective spirit of scientific investigation fearlessly to social and human as well as to technical problems, lies our civilization's best hope of an escape from the dilemma which beats upon "our proud and angry dust" in these middle decades of the twentieth century. For that dilemma, however complex its outward manifestations, is in its essence simple.

*The Calvin W. Rice Lecture, presented at the Fall Meeting, Chicago, Ill., September 8-11, 1952, of The American Society of Mechanical Engineers.

The Cultural Revolution

In little more than two hundred and fifty years the scientific curiosity released by the Renaissance has resulted in a major cultural revolution. Man has acquired a control over his material environment quite unprecedented in the long history of the human race. It is but a century and a half since the wooden three-deckers, which broke the line at Trafalgar, the day that Nelson died in the *Victory's* cockpit, were utterly dependent on the skillful use of the wind and tide for propulsion and maneuver. Yet, within less than a hundred years, a British poet was writing of

"The strength of twice three thousand horse that seeks the single goal
The line that holds the rending course, the hate that swings the whole:
The stripped hulls, slinking through the gloom, at gaze and gone again—
The Brides of Death that wait the groom — the Choosers of the Slain."[1]

And all that has happened in the half-century since those lines were written is merely an enlargement and a commentary on this tremendous access of power over material things. The "Spitfires" and the "Hurricanes" shooting the Luftwaffe to pieces over the smiling shires of Southern England, the American carrier forces that set a new pattern of sea warfare at Midway and the Coral Sea, the sudden blast of a yet more terrible force that reduced Hiroshima to pulverized dust almost in the twinkling of an eye — these things are of one piece.

[1]Rudyard Kipling "The Destroyers."

Nor is the record all a tale of destruction. Even as I speak, there are construction gangs out in the wilderness in British Columbia harnessing water power to man's service on a scale undreamed of even twenty-five years ago. Then the job could not have been contemplated. This is only one of the tremendous projects to which engineers and businessmen in alliance are setting their hands in the land of great opportunity which marches with the Northern frontier of the United States.

Why then, with this tremendous power to our hands, with so much that is hopeful just over the horizon, should we be rent with faction; afraid, as many are afraid, of the very future of humanity as a species?

For a very simple reason. This new-found power over material things, these gifts which engineering above every other profession has placed within our reach, are not unconditional. The price of power is understanding, the insight to use it aright. And, as every engineer knows, a culture dependent on power-driven machinery has its own postulates. Above all, the proper, the effective use of modern machinery demands of men an intricacy of co-operation, a refinement of social discipline, such as they never before have contemplated. All around us lies the evidence of this truth.

Less than a century ago the farmer's wife went into town to do her shopping by the local carrier's cart. If she were a trifle late it would wait patiently at the cross-roads while she panted up the lane. It could

make up the time on the road and, if it didn't, it was unimportant. Today she may use a railway. And the social inconvenience of even slight delay with a train carrying two or three hundred people from A to B cannot be tolerated. She must be at the depot in time to catch her train or it will go without her. A railway schedule is a set of rules for imposing social discipline, rules supported by immediate sanctions. As the toll of death on the highways bears witness we have scarcely begun to solve the problems of social discipline set by the automobile.

A factory is still legally a workshop — a shelter to which workers repair to exercise their individual skills. Law always tends to lag somewhat conspicuously behind the facts. As every production engineer knows, a modern factory is nothing of the kind. It is a single integrated machine in which individual effort counts for very little save in so far as it is built into the whole. It is a very intricate machine planned in great detail, in which any deviation from plan, however trivial, causes losses and excess costs out of all proportion greater than the incident which gives rise to them. If men are to work successfully with these highly geared machines there must be an intricacy and precision of social discipline which are something quite new in human experience.

But our ability to meet this challenge, to develop the social skills which a mechanized economy so imperatively demands, appears not only to be failing to increase; as far as the evidence goes, it is decreasing. Much the most objective and fundamental piece of research which has been directed to such problems in the lifetime of the reader is the series of inquiries known as the Hawthorne experiments. To be sure they have issued in a vast superstructure of statistical analysis and theoretical exposition on an extremely narrow experimental basis. But the man who directed the whole inquiry, the late Prof. Elton Mayo, was no brash speculator. He had the skepticism of the true scientist to an exceptional degree and stated his generalizations in the most careful phrases. Nevertheless as to his broad conclusions there is no room for doubt:

"The typical industrial community of today is an adaptive society composed of individuals of varied origins . . . Difficulties of relating themselves to others and consequent solitariness and unhappiness characterize many of these people. . . . Groupings frequently form in an attitude of wariness or hostility to other groups . . . (Digest) If our social skills (that is our ability to secure co-operation between people) had advanced step by step with our technical skills, there would not have been another European war."[2]

Society Needs Reorganization

Yet to meet this critical, this urgent situation which faces us all — how to organize our societies so that the inescapable demands of power-driven machinery shall not overwhelm us and issue in an orgy of mutual destruction, a Gotterdammerung of our civilization — we have, seemingly, only the political concepts of an outmoded yesterday, ideas of organization which are little more than the obsolescent mental equipment of a handicraft age. Yet, as Herbert Spencer observed over a century ago:

"Socially as well as individually organization is indispensable to growth; beyond a certain point there cannot be further growth without further organization."

An American economist put the issue quite clearly before the first world war:

"So far is the machine process from having yet recast the principles of industrial management, as distinct from technological procedure, that the efforts inspired in responsible public officials and public-spirited citizens by this patent discrepancy have hitherto been directed wholly to regulating industry into consonance with the antiquated scheme of business principles, rather than to take thought how best to conduct industrial affairs and the distribution of livelihood in consonance with the technical requirements of the machine industry."[3]

The way of escape from this dilemma is not easy. Research into material things, in the physical sciences, yields immediate and obvious dividends; so that the new wealth which power-driven machinery made possible has been poured back unstintingly into metallurgy, engineering, electricity, and so on. The results of discoveries in these fields are applied readily, if not indeed greedily, immediately they are available. By contrast, research in the social sciences is a far more remote and less favorable prospect. We have only to reflect that psychology, the science of human behavior, on which all exact knowledge in this field ultimately must depend, has only begun to emerge from a branch of speculative philosophy into a modern inductive and experimental study within the past three quarters of a century. The problems of social or group behavior are, of course, far more complex and resistant to measurement, than are those of individual behavior.

Moreover, the results of developments in the social sciences are only applied slowly and with great difficulty. Custom, tradition, determine our expectations of how others will behave and our own norms of conduct. They are not only the cement which holds our societies together, but also which makes human co-operation possible. The social patterns which derive from them are the basis of that satisfactory social living which is one of the deepest needs of the human spirit. Man is a gregarious animal. It is not surprising that we regard originality in social thinking with the gravest suspicion, that epithets such as "heterodox" and "radical" are terms of abuse, that social invention only makes any impress on established thinking at the speed of water dropping on a stone.

For these reasons there is not only a vast and dangerous unbalance in our knowledge about our human problems, there is a great and perilous delay in applying exact knowledge to social organization, even where it is available.

Nor must we overlook the effect of these tendencies on the minds of those best qualified to help us to meet our current difficulties, those in positions of leadership. They face a double temptation. An increasing proportion of the individuals in such positions are scientifically trained. On the one hand this inclines them to push their own particular methodology beyond the point where it has validity. But, on the other, it makes them aware of the rigorous character of scientific criteria, of the limitations of ordinary human judgment, and of how frequently they are compelled to discharge practical responsibilities for which they have little qualification save the valor of ignorance.

Opportunities of evading such responsibilities by laying the burden on the shoulders of some "expert" or other are extremely seductive — the modern equivalent of the sirens against whose charms earlier mariners took such elaborate precautions. And, unlike those ladies (the evidence as to their sex is inconclusive, but I am far too human to say neuters) the "expert" is not

[2] "The Social Problems of an Industrial Civilization," by Elton Mayo, Harvard University Press, Boston, Mass., 1945, p. 33.

[3] "The Instinct of Workmanship," by Thorstein Veblen, The Macmillan Company, New York, N.Y., 1914, p. 342.

always a passive factor in the situation. He is often too willing, for ordinary human reasons to which he fails to apply his rigorous analysis of the behavior of others, to wear the cloak of a little brief authority; it conceals his nakedness of exact information on the subject in question.

There is no more pathetic spectacle than the specialist turned executive who uses the skepticism, so proper in one of the physical sciences, his awareness of the limitations of exact knowledge, as an excuse for evading the responsibilities which life has laid upon him. The point has been charmingly expressed by the Spanish philosopher, Ortega y Gasset:

"Life cannot wait until the sciences may have explained the universe scientifically. We cannot put off living until we are ready. The most salient characteristic of life is its coerciveness: It is always urgent 'here and now,' without any possible postponement . . . If the physicist had to live by the ideas of his science, you may rest assured that he would not be so finicky as to wait for some other investigator to complete his research a century or so later. He would renounce the hope of a complete scientific solution, and fill in, with approximate or probable anticipations, what the rigorous corpus of physical doctrine lacks at present, and in part always will lack."[4]

Research in the Social Sciences

If my analysis is correct, we face a dual problem. We must restore the balance of our knowledge. We must learn to push forward research in the social sciences with the same enthusiasm, the same outpouring of resources, which we have hitherto devoted almost exclusively to the physical sciences. At the same time we must recognize that exact knowledge is a plant of slow growth. While it is developing we have to preserve social order, both nationally and internationally; we have to devise methods of introducing social change where it is proved desirable, despite custom and tradition, without disturbances which render organized life impossible. That is primarily a question of personal leadership, of discovering and developing individuals with the knowledge, the character, the sense of service to their fellow men, which will convince those they administer to of the wisdom of allowing them to lead. We have to redesign our political and social thinking to accord with the postulates of a culture based on power-driven machinery; at the same time we have to keep the ship of organized society afloat.

To quote Ortega y Gasset once more:

"Society needs good professional men — judges, doctors, engineers . . . But Society needs before this, and more than this, to be assured that the capacity is developed for another kind of profession, the profession of governing."[5]

The group of engineers who, with the support of this Society, first attempted to apply the intellectual methods of science — the tools of definition, analysis, measurement, experiment, and proof — to questions of business management, were the first men in the world to approach this wider problem which I have outlined. They were in fact attempting to take thought "how best to conduct industrial affairs and the distribution of livelihood in consonance with the technical requirements of the machine industry." And they were facing up to both aspects of the problem. They were carving out of ignorance and uncertainty a new branch of human knowledge; they were equally clear that it was a part of their responsibility to hold at arm's length while they did so the chaos that is apt to follow too sudden change.

They were aware of the need for dealing with the problem of cooperation. Toward the end of his life, before the Congressional Committee of Inquiry in 1912, Frederick Winslow Taylor laid down two basic conditions "without which scientific management cannot be said to exist in any establishment." *First* of these two conditions he placed the development of a common purpose — "both sides take their eyes off the division of the surplus as the all-important matter, and *together* turn their attention toward increasing the size of the surplus."[6] They were equally well aware of the need for more research in the social sciences; "There is another type of investigation," wrote Taylor, "which should receive special attention; namely, the accurate study of the motives which influence men."[7]

If they had not been—and Taylor either failed to encounter, or to recognize the significance of, the early work in industrial psychology contributed by Walter Dill Scott, Hugo Munsterberg, and others — there was the amazing fact that one of them, Frank Bunker Gilbreth, happened to fall in love with a girl who was a psychologist by education, a teacher by profession, and a mother by vocation. I know of no occurrence in the whole history of human thought more worthy of the epithet "providential" than that fact. Here were three engineers — Taylor, Gantt, and Gilbreth — struggling to realize the wider implications of their technique, in travail with a "mental revolution," their great danger that they might not appreciate the difference between applying scientific thinking to material things and to human beings, and one of them married Lillian Moller, a woman who by training, by instinct, and by experience was deeply aware of human beings, the perfect mental complement in the work to which they had set their hands.

Long since she has taken her place in her own right among the pioneers of management. This Society again showed its sympathy with the subject by making her one of its first woman members, and more recently, its first woman Honorary Member. Also recently, two of her children by their wit and their good writing have made her name famous in all quarters of the globe, and Mrs. Myrna Loy Gilbreth has presented the movie public with a dual personality which taxes its powers of discrimination. But I do not think she will blame me for the suggestion that the greatest thing she has ever done, and she has done many great things, was to marry Frank and through that marriage to contribute the influence of the young science of psychology to the nascent management picture.

This triumvirate, or rather quadrumvirate, was too fully alive to the importance of leadership. One of Henry Lawrence Gantt's three books carries the title "Industrial Leadership." He chose this phrase as the caption of his first lecture in the Page Lecture Series at Yale in 1915, because he wished to emphasize leadership "over all other elements that make for industrial progress."[8] Business has taken its time in taking that lesson to heart. It was not till approximately 1945 — thirty years later — that interest in what is called executive development, treating the supply of future leadership as a problem of major importance and organizing for it deliberately, attracted general attention even among the more progressive corporations.

[4] "Mission of the University," by Paul Kegnan, London, 1946, p. 146.

[5] Reference 4, p. 45.

[6] "Scientific Management," by F. W. Taylor, Harper & Bros., New York, N.Y., 1947; "Testimony," pp. 29, 30.

[7] Ibid., "The Principles of Scientific Management," p. 119.

[8] "Industrial Leadership," by H. L. Gantt, Yale University Press, 1916, p. 1.

This would not have surprised Frederick Winslow Taylor, though it might have irritated him. He also was deeply sensitive to the difficulties of introducing changes in social thinking. Time after time in his later years, when he had become the first professional management consultant, he returned to the point. For instance, "time, and a great deal of time, is involved in a radical change in management, and . . . in the case of a large works if they (the Directors) are incapable of looking ahead and patiently waiting for from two to four years, they had better leave things just as they are, since a change in system involves a change in the ideas, point of view and habits of many men with strong convictions and prejudices, and . . . this can only be brought about slowly and chiefly through a series of object lessons, each of which takes time."[9] Despite the storm of criticism which his ideas provoked among the leaders of organized labor, it remains a fact of record, which should not be forgotten, that there never was a strike in any plant where he himself was operating.

It may, and has been urged however, that to claim that the small group was in fact precipitating a revolution in our ideas about government is going too far. Business management is not government; it moves in a different realm of discourse. It is true, however, that Taylor himself and other distinguished authorities who have followed him, notably Henri Fayol and Mary Parker Follett, have been convinced that if valid principles are established bearing on business organization they must be equally applicable to conducting the affairs of a municipality, a state or an empire. In Great Britain, for instance, business management and public administration are often spoken of as contrasted callings involving different techniques. However, this may well be an example of what the French call *déformation professionnelle* — a phrase which it is difficult to translate, but which may be rendered freely as occupational paralysis of the cerebellum.

In the words of Henry Laurence Gantt, "administration means administration of human affairs, and the one common element in all enterprises is the human element."[10] It is possible that the claim by other vocations that management knowledge is not applicable in their special circumstances is only a variant on the old alibi "my business is different," which was so serious an obstacle to the diffusion of an understanding of management in industry in its early stages. If we turn to the only other art, with a scientific foundation, which, as in management, is primarily concerned with human beings, namely the art of medicine, it is difficult to imagine how it could have made satisfactory progress on a basis of vocational distinctions. To be sure it recognizes certain occupational diseases, but their cure is derived from a general knowledge of medical practice and not from the exclusive study of particular callings. Artists' amnesia, professors' paranoia or the psychopathology of politicians do not suggest fruitful lines of inquiry.

[9]Reference 6, "Shop Management," p. 130.

Business is Based on Co-operation

Certainly a business enterprise is a form of human co-operation for economic purposes, a society with a special object within the larger society of the nation. To manage it is to govern it just as surely as conducting the business of a municipality or a state or an empire is to govern it. Indeed if, following Mr. Peter Drucker, we agree that the business corporation is the typical institution in our modern society, the problem of governing it well may not only be analogous to but more important to the community than the problem of governing states or empires. I can see no major distinction, and I have had some experience of both, between the problems arising in the government of business and in the business of government.

During the course of the Congressional inquiry already mentioned, Taylor was asked, "You do not claim a monopoly on scientific management ?" His reply should be hung framed in every office where men are concerned with the subject. "I should say not. My gracious, I do not believe there is any man connected with scientific management who has the slightest pride of authorship in connection with it. Every one of us realizes that this has been the work of 100 men or more, and that the work which any one of us may have done is but a small fraction of the whole. This is a movement of large proportions, and no man counts for much of anything in it. It is a matter of evolution, of many men, each doing his proper share in the development, and I think any man would be disgusted to have it said that he had invented scientific management, or that he was even very much of a factor in scientific management. Such a statement would be an insult to the whole movement."[11]

[10]Reference 8, p. 9.

Pioneers in Management

I have mentioned so far four people — Taylor, Gantt and the Gilbreths, all members of this Society, whose names were conspicuous in the early days of the movement. But, I think it accords with the spirit of Taylor's observation which I have just quoted and with our general knowledge of the way in which new categories of knowledge develop, to suggest that the contribution of these individuals as inventors and initiators was less important than the fact that they focused and organized tendencies in human thought which were already in the atmosphere, when they started on the work of their lives. The Society placed all of us in its debt when it provided a ready platform for management concepts. F. W. Taylor presented four papers to the Society on such subjects and was its President; H. L. Gantt eleven such papers; F. B. Gilbreth four; and Lillian Gilbreth eight up to 1949. But I believe that the American engineering profession rendered the world and its future an even greater service by providing a climate of professional opinion in which what I may perhaps describe as extra-curricular ideas could take root and germinate. It is this breadth of vision, this determination not to confine their interest within too narrow technical bounds, for which the world owes that profession its undying gratitude.

We are celebrating the centenary of the American Society of Civil Engineers, founded in November, 1852. Its first circular issued at that time reveals this spirit. It welcomes as members not only all categories of engineers, but architects and "other persons who, by profession, are interested in the advancement of science." It expresses the hope that "the bond of union established by membership in the same society, seeking the same end, and by the same means, will do much to quiet the unworthy jealousies which have tended to diminish the usefulness of distinct societies formed heretofore by the different professions for their individual benefit."

After March, 1855, the ASCE was in abeyance until October, 1867, partly because of the Civil War. But at the first annual convention of the reconstituted society held in 1869, John B. Jervis, an honorary member of the society, struck a similar broad note:

[11]Reference 6, "Testimony," p. 282.

"No skill," he said, "in forming lines and levels and in devising structures, will complete the education of an engineer without an intelligent capacity for conducting business. This is an important item in his education and indispensable to a successful practice . . . Some people suppose an engineer, as a matter of course, knows nothing about business management. An absurd mistake. No profession more needs a thorough business qualification . . . I think I am fully warranted in the opinion, that the training and practice of an engineer should make him peculiarly eminent as a businessman, not less than skilled in erecting and designing works in his profession."

Similarly, when The American Society of Mechanical Engineers came to be formed, A. L. Holley, CE, one of the founders and an Honorary Member in Perpetuity took the chair at the preliminary meeting held in New York in February, 1880. On this occasion he said:

"In the American Institute of Mining Engineers and in the Iron and Steel Institute of Great Britain, anyone is qualified who is engaged in mining and metallurgy. The advantages of the association of businessmen with engineers in these societies are notorious; these advantages are not only large membership, and hence large incomes to devote to publications and illustrations, but they lie chiefly in the direct business results of bringing professional knowledge, capital, and business talent together under the most favorable circumstances."

From the very beginning that spirit of accommodation was manifest in the proceedings of the Society. F. W. Taylor's first paper on a management subject, "A Piece-Rate System," was read in 1895. But this was merely regarded as a contribution to the prevailing interest in methods of wage payment, somewhat to Taylor's disgust. It was only in 1903, with his "Shop Management," which owed much to the encouragement of Calvin Rice, that he really focused the attention of his fellow engineers on his management thinking. At the conclusion of that paper he acknowledged the contributions of eight men "among the many improvements for which the originators will probably never receive the credit which they deserve."

Among these eight were Oberlin Smith whose "Mnemonic System of Order Numbers" was presented at the Society's third meeting at Altoona, Pa., in 1881. He was one of the original members and a frequent contributor in the eighties. Most of his papers had a management angle, for instance "Experimental Mechanics," a plea for more research, at the second meeting in 1881. "The Systematic Preservation of Drawings," in 1882, and the "Graphical Analysis of Reciprocating Motions," in 1890, "Inventory Valuation of Plant," in 1886, and "Intrinsic Value of Special Tools," in 1887. He was elected the Society's ninth President in 1889. His paper on "Order Numbers," established one of the earliest international links in management.

In 1889, Messrs. Emile Garoke and J. M. Fells published their "Factory Accounts," one of the earliest management books to appear in Great Britain; they reprinted Oberlin Smith's paper in full. It may be noted that the two authors were respectively an engineer and an accountant. In the Britain of that date when the commercial and engineering departments of most factories usually lived on opposite sides of a heavily defended frontier, for members of these two professions to collaborate in a book was for Montagu and Capulet not only to marry but to have a baby.

Contemporary with Oberlin Smith was Henry Robinson Towne who was president of the Yale and Towne Manufacturing Company and preceded Smith by one year as the Society's eighth President in 1889. He was elected an Honorary Member in 1921. In 1884, he presented a paper on "A Drawing Office System," at the Society's ninth meeting. On this subject he had been preceded by C. T. Porter who presented "A New Method of Keeping Mechanical Drawings," at the third meeting in 1881.

In 1886, Towne followed up with his famous paper on "The Engineer as an Economist." This was a direct challenge to those engineers who felt that the Society should confine itself strictly to technical subjects and that management problems lay outside its proper field of interest. "The true function of the engineer," said Towne, "is, or should be, not only to determine how physical problems may be solved, but also how they may be solved most economically." Between 1887 and 1912, he presented five further papers on management subjects.

One of the eight, Taylor selected for special recognition. He wrote:

"The card system of shop returns invented and introduced as a complete system by Captain Henry Metcalfe, U.S. Army, in the Government shops of the Frankford Arsenal, represents another such distinct advance in the art of management. The writer appreciates the difficulty of this undertaking as he was at the time engaged in the slow evolution of a similar system in the Midvale Steel Works, which, however, was the result of a gradual development instead of a complete well thought out invention as was that of Captain Metcalfe."[12]

Captain Henry Metcalfe, an officer in the Ordnance Corps, was the inventor of the magazine system of loading rifles; his clip, being of wood, was rapidly superseded. While in charge of the Frankford Arsenal he initiated a system of production control which was, as far as I am aware, the first example of the thorough application of the unit document or card principle to the paper work of industry. He presented a paper to the Society in 1886, entitled "A Shop Order System of Accounts." His book on the subject appeared in 1885, and is an early management classic.[13]

I hope you will regard as proved my conviction that the attitude and outlook of the American engineering profession, when Taylor was still quite a young man, were already concerned with problems of management, had laid the foundations of certain lines of inquiry, and were predisposed to welcome further developments. To say this is not to detract one iota from the genius and the achievement of the four persons whom I have described as the great quadrumvirate. Indeed it seems to me to raise their contribution to a higher power, as expressing and focusing a widely felt, but dimly appreciated, need of their time. What they did was to seize the opportunity thus presented to them. They supplied, in their turn, a whole series of new and stimulating ideas, above all a unifying concept, a philosophy which gave the study of management definition a tremendous impetus. But, if the opportunity had not been there, their ideas might well have been dissipated and frustrated in vain struggles for a hearing of any kind, their energy wasted in clambering onto any sort of platform rather than in taking thought as to what they should say when they got there. That has been, too often, the fate of original minds in a world not markedly sympathetic to originality.

It was the general attitude of the

[12]Reference 6, "Shop Management," p. 202.

[13]"The Cost of Manufactures and the Administration of Workshops, Public and Private," by Henry Metcalfe, 1885.

American engineering profession which made possible the generation of that profound interest and confidence in a small but vital group. And to those who believe as I do, that in the development of scientific thinking about government lies the only hope of humanity today, the significance of that attitude *at the beginning of a new order of thinking*, was incalculable. In words used in another context, "Some altars are safe; some debts will never be dishonoured . . . There remains the stark simplicity of Terence — 'In truth they have deserved to be remembered of us.' "[14]

Second Generation of Management

Of course there was a reaction. In every profession there are men who believe with all sincerity that the only way to keep the milk of the world pure is to sterilize the cow. The most scientific training is no guarantee against vocational provincialism; there are always would-be martyrs looking for a parish pump to die with their backs to it. Taylor's paper on the "Principles of Scientific Management," was not welcomed, despite the fact that he was a past President of the Society.

But this opposition was well handled by a new generation of engineers who appreciated the importance of the management movement. Ever since, the Society's records have been starred with the names of engineers who also have made outstanding contributions to the theory and/or the practice of management. Among its living Honorary Members, in addition to Lillian Gilbreth, are William L. Batt, Harold V. Coes, Ralph E. Flanders, and Dexter S. Kimball,[15] all of whom have held Office as President, and Herbert Hoover. Among former officers appear Morris L. Cooke, Horace P. Liversidge, and Robert B. Wolf.

Papers on management subjects appear under eighteen headings in the most recent index of the Transactions. In the 1940-1949 period the caption "Management" by itself included 46 papers, an average of just over five a year. The Management Division attracts the interest of a greater number of members than any other.

While this happy result is a product of the enthusiasm and interest of the membership as a whole, there is one more name which must be mentioned before I close — that of the late Leon Pratt Alford. He was Secretary of the Subcommittee on Administration which in 1912, prepared the report on "The Present State of the Art of Industrial Management," already mentioned; at that time he was editor of the *American Machinist*. On the formation of the Management Division of the Society in 1920, he became its first chairman. In 1922, he conceived the idea of following up the original report with a second report to the Annual Meeting of the Society on "Ten Years' Progress in Management." He presented a third report in 1932, and was already well advanced in his preparations for a fourth report in 1942, when he died suddenly in January of that year. The work was picked up immediately by the Executive Committee of the Management Division which nominated a Report Committee under the Chairmanship of Dr. Lillian Gilbreth. The report was completed along the lines of Mr. Alford's original plan. A fifth report will be published shortly.

These first four reports, covering a period of more than thirty years, and all of them prepared in some degree under the unifying influence of a single mind deeply versed in management literature and practice, form a unique contribution to our knowledge of the subject. Many of us in other countries have viewed with great admiration the tremendous vigor with which the study and practice of management has been developed in the United States over this period. But the task of trying to keep ourselves informed has sometimes been intimidating. As the provision of educational facilities in management has expanded, it has sometimes seemed to us that the publication of a comprehensive textbook at fairly frequent intervals has become almost an occupational disease with American professors of business administration. And, putting aside the fact that there is as yet little common agreement as to the pattern into which management knowledge should be organized, these textbooks often appear to be aiming at the principle of "bigger and better elements." I know few of them which do not contain a large proportion of redundant matter, redundant because it already has been stated effectively elsewhere. I know none of them light enough to be carried conveniently in an ordinary brief-case.

Amid this welter of ponderous volumes, these decennial reports, brief, authoritative and yet omitting nothing of real importance, have been the most valuable of guides. They are of a piece with what I have always regarded as Alford's other major contribution to management knowledge — the most distinguished series of handbooks, beginning with "Management's Handbook," continuing as "The Cost and Production Handbook," which in its turn, developed into "The Costing Handbook," and "The Production Handbook," most of which he designed and edited for The Ronald Press. He was made an Honorary Member of the Society in 1941. With Lillian Gilbreth he was a bridge between the early pioneering days and the stupendous development of the subject we see around us today.

America's Place in the Management Movement

On behalf of my fellow students of management in all other countries I know I can say with absolute truth how deep is their gratitude to the United States for fostering and fathering this great movement in human thought. As I have tried to show, it owed almost everything in the beginning to the support and vision of the American engineering profession. They would view with the deepest regret and dismay any signs that that profession was less interested in the subject or was abating one jot of its enthusiasm and leadership.

So, to those members of the Society who believe in expanding and strengthening the work of the Management Division, I would say "stick to your guns" — not only for the sake of its splendid past, for which we are all in your debt, but still more for the sake of your own future. For without better management and a wider appreciation of management principles in the Western democracies, the outlook for our civilization is bleak.

Management is an Art

Management, government, is not a science: It is difficult to contemplate that it will ever become a pure science. It is an art. But it is an art which can be practiced in one of two tempers. There is the temper of the old-time craftsman who was merely apprenticed to a master, who learned his craft unsystematically by trial and error and practiced it in the half-light of custom and tradition. Or there is the temper of the modern medical man, who knows that his skill is based on a score of underlying sciences and can only develop by developments in those sciences and their application, who realizes that "clinical experience" does not mean his personal history but scores and

[14] "The Wandering Scholars," by Helen Waddell, Constable & Company, London, seventh edition, 1934, pp. 220, 221.

[15] Dean Kimball died on Nov. 1, 1952.— Editor.

hundreds of "cases" which provide an adequate statistical answer to some problem, who recognizes that in the interests of his patients he often must use imperfectly informed judgment, but tries his utmost to insure that when he does so his mind is controlled by the objectivity, the respect for facts and the care in amassing and assessing all available data which are the hallmarks of a true scientific training.

Practical management responsibilities can be met in one of those two tempers. You will find often that it is your duty, your inescapable duty, to make decisions where the facts are obscure and inadequate, the issues confused and the outcome highly speculative. The first syllable of management is man. Man is idiosyncratic, eccentric, often unreliable. In many directions we as yet know very little that is exact about his behavior and its causes. Go ahead we must. We can proceed "by guess or by God." Or, we can make the best use of the organized knowledge about the subject that is available, and, at the point where knowledge fails, fall back on a well-tested intellectual technique to eliminate the biases and the errors to which as human beings we are inevitably prone. Time after time you will feel that you are blind and groping, that science has failed you. It will not matter, unless your courage also fails you. The valor of ignorance is merely stupid; the courage that makes the best use of available knowledge and then consciously takes a calculated risk is one of the highest qualities of the human spirit.

Draw strength and comfort from the memory of the great men whose task is done, but whose story remains with us. Be valiant for Truth in your turn, a soldier of sincerity, and do not worry too much about the consequences. Keep untrammeled the breadth of vision, the generosity of outlook of your great profession which helped them, and which will help you and your sons and your sons' sons. Stick to the fifth stone of objective truth, and you will add a little piece in your turn to the great edifice we are all trying to build.

"Bless your blindness, glory in your groping,
Mock at your betters with an upward chin,
And when the moment has gone by for hoping,
Sling that fifth stone, O son of mine, and win.

Grief do I give you, grief and dreadful laughter,
Sackcloth for banner, ashes in your wine,
Go forth! Go forth! Nor ask me what comes after,
The fifth stone shall not fail you, son of mine.
Go forth! Go forth! And slay the Philistine!"[16]

[16] "The Young David," from "Twenty," by Stella Benson. ✓

"Petal" Construction

Aviation Traders' new "Accountant", a DC-3 replacement, will have a perfectly symmetrical streamlined shape, chosen because of its aerodynamic and structural advantages.

Although this shape is generally considered expensive to build, Aviation Traders feel they can solve the constructional difficulties by using what might be called the "petal" method of construction, and work is well in hand on a fuselage to this design. Instead of using expensive stretcher presses to induce double-curvature in skin sheets, the skins, which run almost the whole length of the aircraft, are cut to their final shape in the flat, and the double-curvature is induced during actual assembly.

Because the fuselage is symmetrical, all skin sections are identical in shape, much as each petal of a tulip is the same shape as the next. A large number of skins, or "petals", can therefore be cut out and drilled one on top of the other.

The formers and stringers are riveted to the petals, which are then placed on a jig which is the final shape of the fuselage. The petal sections are fastened to a frame at one end so that they radiate round the jig like petals round a flower.

All that remains is for the tips of the petals to be closed in manually to complete the cigar-shaped fuselage. The metal skin is thus stretched to its final shape without wrinkling, and when all the adjoining skins have been riveted to one another, a very strong light structure results.

After the fuselage has been completed, the windows, doors and apertures for wing attachments are cut out of the metal skin.

From Weekly News Letter, Soc. British Aircraft Constrs.; July 15, 1953. No. A1723

Research Demands Extreme Accuracy

Measuring for high accuracy at Britain's National Physical Laboratory at Teddington, England. A technician uses a hand gauge to measure angular pitch between the teeth of a gear wheel. The Metrology Division of this great government laboratory is only one of the many departments whose work is "accuracy plus".

Fictions in the Story of Radar

by

Sir Robert Watson-Watt, M.E.I.C.,

President, Adalia Limited,
Montreal.

Address to the annual banquet of The Engineering Institute of Canada, at Halifax, May, 1953.

Mr. President, honoured guests, fellow members of The Engineering Institute of Canada, I ask your leave, Sir, to step out one moment for private conference with the member of our Institute who has been honoured by his selection to succeed you in the responsibilities which you are about (theoretically at least) to lay down. I feel that I ought to tell him, in this private conference, that the success of all great institutions like this one is largely dependent upon the skilled engineering of one benevolent despot, a despot who rules the institute with the classical iron hand in a velvet glove. In this particular instance, our Institute is, of course, ruled by a hand not of iron but of austenite steel, which as you so well remember has the two special properties of being corrosion resistant, and, of carrying a brilliant lustre which does not dull on exposure—even to the climate of Halifax, N.S., and the glove is, of course, worn on the Wright hand.

Well, the benevolent despot got me into a corner a little while ago and said this—much more politely, but I had no doubt at all what he meant. He meant "Let's have no nonsense about giving these unfortunate people more information. They're being stuffed with three days of information at this annual meeting of ours and we are offering you the privilege of coming to our banquet on the sole condition that you refrain from attempting to inform them. All you're there for is to try to amuse them." He also said, "Let's have no nonsense about your talking for thirty-one minutes. If Dr. Gilbreth can say all that she wants to say in thirty minutes, with a tolerance of minus ten and two-fifths seconds and a tolerance of plus no seconds and two-fifths, then you can do it in a net thirty."

Now his instructions put me in a position which I must confess was just a little embarrassing. He had suggested to me that I ought to talk about myself. The truth is that I love talking about myself. But I am usually able, at least I usually attempt, to convey the impression that I am overcoming a natural modesty and merely talking about myself in the interests of teaching a lesson, of pointing a moral, or if you like, doing what the Scot invariably does, preaching a sermon for the good of his fellows. This time I am robbed of any excuse. Nevertheless, I am going to talk about myself, unless the despot intervenes at the controls of these electronic devices which have very few merits, except that they do have an "off" switch. I had thought of talking to you about "The Intrusive Fictions in the Story of Radar". Perhaps I can even persuade you that the President's lack of discretion, in disclosing my utter inability to hold down any job for more than a year or so at a time, puts his work into this class of fiction in the story of radar. But perhaps not.

Research and the Library

When I meet my newspaper friends, I find that they have an addiction for illuminating engineering; they offer me only two possibilities about the origins of my claim to have been responsible for what one of your learned colleagues, my Lord Chief Justice, pin-pointed as "the inception of radar". They offer me the choice of confessing that it came in a dazzling flash of inspiration or alternatively claiming that

Sir Robert Watson-Watt, M.E.I.C.

it came as the result of the burning of gallons of midnight oil in deep mental concentration. And they count me a very dull human indeed when I say, with a little regret, that it's not as picturesque as either of these things. When I go on to say, primly, perhaps even pompously, that it was an unlaborious triumph of pure reason and simple arithmetic, the shadow of the journalist's nightmare "no story" falls on them. But always helpful, always hopeful, they feel around for some other excuses for me. And they make matters a great deal worse. They say that, of course, I must have heard the fluttering in intensity of received short wave signals when an aircraft (itself sending no radio messages) passed near a radio receiving station. Well, I suppose if I had been a really good observer, I should have heard that. I might even have seen the flutterings of television pictures in similar circumstances. You will forgive a

little U.K. propaganda in my reminding you that the U.K. already had a public television service in those distant days—but the honest truth is that I missed seeing or hearing either of these things. Driven to an almost last resort, they suggest that I had perhaps made deep studies of "The Prior Art" as the legal people say. I ought to be equally ashamed to admit that incipient illiteracy was already descending on me in those days of 1935 and I hadn't studied the prior art! I had, in fact, a feeling (and I pass on a piece of advice to this Institute) that a library, a technical and scientific library, is perhaps a necessary evil, but it is a partial evil. I sometimes fear that more good inventions are spoilt by people reading in books about how difficult it is to do the job, than are helped by people being encouraged towards the undertaking of a new enterprise by their studies in a library. I have suggested elsewhere that nobody should be admitted to a scientific library unless he first produces a full account of the work that he is already determined to do — whatever he discovers in the books that have been written about his subject. That's my only excuse for not having studied the prior art.

It came, then as a slight shock to me a few weeks ago, when I had the privilege of going to a radar conference in Frankfurt am Main, to be introduced to a gentleman who was described as "Der Vater des Radars". This was on the strength of a patent specification dated 1904, a very creditable specification drafted on the result of quite interesting and absolutely pioneering experimentation in 1903. Now among the many hard things that have been said about radar are the recurrent doubts about its paternity. They even found their way into the morning newspapers of Halifax beneath what I reserve the right to call a libellous photograph of myself, a caption hesitantly identifying me as "sometimes described as the father of radar". My own conclusion about the legitimacy of radar is this. Grandfatherhood is something which goes in geometric progression. It is customary to have only one father, but reasonable to have two grandfathers, four great-grandfathers and eight great-great-grandfathers and so on. There is a very long line of (great)^{N}grandfathers without whom there would have been no radar. The confusion about actual paternity arises from looseness in the definition, or absence of definition, of what we are talking about when we say "radar". Radar was not merely the utilization (or the proposed utilization) of that reflected radio energy which was predicted by Clark Maxwell, demonstrated by Heinrich Hertz, talked about by Nikola Tesla 'round 1900, by Marconi in 1922.

What Radar Isn't

Radar wasn't merely direction-finding on this reflected radio energy, as was tried on the ill-fated French liner *Normandie*. It wasn't merely approximate measurement of distance by reflected radio energy as was done in 1924 and 1925 in the United Kingdom and in the United States. Radar, as I understand it, wasn't just the utilization of reflected energy, it wasn't just a single kind of measurement; it wasn't a "merely" scientific device. It was pre-eminently a military device. It was at once a process, an equipment and a system meticulously devised to do, for the military user, a job much more difficult, much more valuable to him in its result, than merely discovering, for example, the approximate position in space of a supposedly single and isolated aircraft, freed from the troubles due to the presence of other aircraft in the sky and of the earth itself. I claim, unreservedly and unashamedly, the unique paternity of this real radar, which performs in a, perhaps regrettable, real world, in which Air Forces have more than one aircraft and the world globe itself is complicating this job by being a good, but not a very good, conductor of electricity.

Radar was, indeed, concerned with the forces of nature, but it was concerned above all with the directing of some of these forces for the use and convenience of man, in the hour of his greatest need.

Recorded History

Looking through some old papers just a week ago, I stumbled quite accidently on what I suppose I may fairly call a historic document. It begins this way: "The problems of delivering, by radio beam, energy in amounts adequate for disabling man or craft may be separated into two classes, for quasi-fixed and rapidly moving targets respectively. The most favourable case of the simpler class will be examined first in a roughly quantitive way.

"A man at a distance may be treated as composed simply of 75 kilograms of water. It is necessary to deliver, over his projected area of one sq. meter (two meters high by half a meter wide), etc., etc." This was an attempt to do the elementary arithmetic of a death ray. I had never thought a death ray project was much good, and I now concluded that it was no good at all. But not wishing to disappoint my old friends in the Air Ministry, I ended up with a slightly pompous epilogue which read thus. "Meanwhile, attention is being turned to the still difficult but less unpromising problem of radio detection as opposed to radio destruction and numerical considerations on the method of detection by reflected radio waves will be submitted when required." Well, of course, the Air Ministry said: "They sure are required, and quick!" and I submitted my proposals for radar.

Tours of Discovery

I repeat that radar was the product not of an inspiration, not of a good observation followed by a sound inference, not, in fact, by anything more than a combination of pure reason, elementary algebra, first-chapter physics and a good deal of daring in the spending of other people's money. It led me into the chequered career which has been recited to you. It led me into a number of interesting places about which fact and fiction have been interlaced into the radar legend. I would like to take you briefly on a quick tour of some of the places to which my radar missions took me. The memorandum which I have quoted to you was written in February, 1935. Early in 1936 began my brief and inglorious career as a professional spy. In that year I was invited by official colleagues in British government circles to proceed to Berlin to discover what was happening and what was new in very short-wave radio telegraphy. Of course, we were then already sure that it was desirable to use very short waves in radar whenever such very, very high-frequency generators and receivers became engineeringly usable. I need hardly say that I was delighted to carry out this mission. Berlin was a place where I had repaired on holiday at my own expense on a number of previous years, on the much sounder grounds that it was the only place that had three good opera houses and several good picture houses, where I could find some of the non-engineering education which ought to be administered (as we decided at the Panel this afternoon) to every promising engineer. I had a very happy time talking to my colleagues in radio in Berlin, but I did observe that

they were a good deal less talkative in 1936 than they had been in 1934 and much less than in 1926.

That particular outing belongs to the non-fictional part of the legend of radar. So does my next mission, again at His Majesty's expense, this time to the wilds of East Prussia in the succeeding year. It is true that I carried my mild espionage into a walking tour in that very delectable and, at that time, very peaceful country, in a search for tall towers and a large building. These had been described in great detail by an agent who had, I now conclude, turned a not very honest five pound note by having a look at our research station at Bawdsey in Suffolk, thinking that nobody in his senses would go to the depths of East Prussia to check his story, and giving a plausible description of a Bawdsey transplanted to East Prussia. That allowed me a very happy walking tour; I looked very closely into the ecclesiastical and industrial architecture, as well as into the depths of the woodlands, of East Prussia, and found absolutely nothing that bore any resemblance to what I expected a radar station to be. I did incidentally, meet one of Field-Marshal Goering's gamekeepers, who told me how much he had enjoyed being a prisoner of war in England in the 1914-18 war.

The following year, 1938, His Majesty sent me on a more peaceful and less clandestine mission. I went to Venice and to Rome to attend a scientific radio congress. I had previously formed an affection for a particular hostelry in Venice which will be known to some of you as the Royal Danielli. I decided that although my colleagues in the British delegation were to be at the Hotel d'Angleterre, I would return to my favourite Danielli. The German delegation, not unnaturally, booked into the Hotel Bauer, but oddly enough one member, one only, and he the most charming, the most lovable, member of the German delegation, appeared as a guest in the Royal Danielli! We had met earlier in Berlin; now he and I became bosom pals. We discussed the basis of Nazism (I had then the first indication, which I confirmed in a leading later official expedition to Germany in 1945, that there were no Germans at all who were Nazis, except a mere handful of men in Berlin, and in Munich, called "they" and "them"); we talked about a great many radio subjects; but curiously enough we never said a word about the detection of aircraft by radio. I don't know yet whether it was an accident that my very dear friend of those days found himself the only German in that hotel in Venice which contained only one member of the British delegation.

These were the prewar outings beyond the confines of what became the Allied Nations, but our radar didn't have its enemies only in the district beyond the Rhine. I had amongst my odd jobs the task of suggesting desirable sites for the big radar stations, a task which made me public enemy number one to the Council for the preservation of the beauty spots of England. One of my choice sites lay on the moors of Yorkshire. It was all very fine to choose a site on a map, and then to go and look at it and decide that it would be able to carry 350-ft. towers, could be given good road access, water and electricity supplies, could support a young village of R.A.F. and W.A.A.F. types, police, cooks, butchers and the rest. It was quite a different thing to persuade the owner that he should make this particular kind of contribution to the safety of his native land. In this Yorkshire case, I had to interview a most indignant member of the Upper House who explained to me that the site of my choice was right in the middle of the absolute best grouse shoot in the whole of England; it was with no little difficulty that the Air Council persuaded him that there might be shooting of another kind going on soon and that we wanted to make preparations during our own and probably brief close season.

Fiction is Stranger than Truth

I now come to some of the fictional part. It has been incredibly reported that a Scotsman, I was going to say a young Scotsman, but it was a not-so-young Scotsman, was observed by a talented U.S. newspaper correspondent to pass through the West African airport of Takoradi, clad in a heavy tweed suit and an aura of great secrecy. I don't know why he took the inverted precaution of disguising himself in a tweed suit; it must have been a little conspicuous in the climate of Takoradi. This was alleged to be the innocent and longhaired Watson-Watt, making his way in great haste to a super-secret conference in Cairo. Well, I wish it had been; I don't know Cairo very intimately, but previously I had spent some happy times there in pursuit of my favorite hobby, the collecting of lightning flashes and thunderstorms. I've since been back in days which were a little happier than the present day in Egypt, but I give assurance not merely that I did not wear a tweed suit in Takoradi but that I have never seen the place and I'm not a bit sorry. Any resemblance between the tweedy displaced Scot and myself is, if not coincidental, certainly fictional.

I turn to a real disappointment on my way to visit this continent for the very first time. On the 9th of December, 1941, I flew from Bristol to Lisbon to come over to the predecessor of the Pentagon for some little discussion about the future of radar. It was one of the interesting anomalies of life in Europe in those days that when one passed through Lisbon on air expeditions, one was likely to have the doubtful privilege of dining in a Lisbon hotel at the next table to the German air attaché, and one had the exciting prospect of being accosted, if that is the *mot juste*, by a blonde spy of the Nazi regime. Well, it's one of my big grievances against the Nazis in this whole radar business that there wasn't a blonde spy in sight! I made my way to this continent by easy stages including Portuguese West Africa, Belem de Para, Port of Spain, etc., and after a mere 10,000 miles more or less, I succeeded in finding my way into New York. But that's a different and dullish story.

Now I come to the superman stuff. Quentin Reynolds must be known to many of you as a vivid and enthralling war correspondent. He is known to me as a very dear personal friend, but I am bound to say that he is also a highly imaginative person. He has put in one of his books an account, to which I listen with breathless fascination, of how I sat in a landing craft on the beach at Dieppe most uncomfortably propped by British machine guns with their business ends tucked in between my ribs. I have to admit to a constitutional objection to being at the receiving end of a machine gun, and I admit with no shame whatever that I was not at Dieppe. I might have had to reveal my odd antipathy to machine guns if it hadn't been that somebody else saved my face, after a fashion, by making the other unflattering suggestion that I might, under the influence of machine guns or if other methods of persuasion were used on me, be persuaded to talk about myself—as I have admitted I so readily do and that I'd better be kept at home so that I mightn't be exposed to persuasion. Well,

that spoils a story which is interesting in every respect except that it was tied on to an ersatz and involuntary hero. There was a real radar hero at Bruneval, but his name wasn't Watson-Watt!

Just Resentment

I don't know anything about the origin, not even about the locale, of the next story, but on descending from another of these fictional aircraft in which I seem to have been doomed to spend an even larger fraction of my career than my quarter million miles of wartime passenger flight, I am supposed to have been snatched by an armed guard of United Nations persuasion from an ingeniously arranged reception committee of Germans who had hoped to receive me with open arms (doubtless including small arms), at one of these same neutral ports at which in the earlier days of the war we found ourselves touching down. I'm sorry that I'm such a careless observer; this is just one more of the things I failed to notice. It may only be that I just wasn't a good physicist and didn't keep a sufficiently sharp eye on the experimental data that was available, or it may be that it just didn't happen. But I have resentments which I nurse to this day. I've told you that I resent the inefficiency of the German Intelligence Service in relation to the hotels in Lisbon. I resent the absence of any evidence that any German ever thought me worth intercepting at any airport. I resent the complete neglect of that same Intelligence Service on the occasion of my visit to East Prussia. But I resent most of all, the arrogant way in which Field-Marshal Goering refused to take any notice at all of the radar research establishment at Swanage, which ought to have been the target of some of his closest attentions after Bruneval, if not before. I just can't understand it; but then the Nazis were stupid in lots of ways. If they didn't see how important I was, that was their loss and I suppose also mine—or was it?

I hope I have lulled the despot into a sense of security and since I believe I have a few minutes left, I would like to tell you a little about an engineer's encounters with top brass on some other occasions. I had written my prospectus for radar in what I believed to be irresistibly convincing salesman form. I thought nobody could doubt that this was going to be "A Good Thing". I ventured to mention detection ranges of sixty miles as "a dead cert", and two hundred miles as something much better than an outsider. One of the topmost of the top brass in the Royal Air Force, however said: "These scientific guys can sell you anything on paper; I want to see something actually happen." I didn't think much of this demand and I went to interview the Top Brass. I said to him "I'm perfectly willing to arrange for you a demonstration that there is enough energy reflected from an aircraft to allow us to get from it the information that we need about the aircraft's position." Perhaps I can interject that this is where the classical extravagance of the Scot came into full play. What I was promising was that I would go the expenditures of an amount of energy which was a billion, billion times (I'm talking in North American billions) the energy that I proposed actually to utilize in finding the position of the aircraft from which energy was reflected. That was to say, I should be basing a fifty million dollar project (as a start) on a basis of what we engineers might loosely call an engineering efficiency of one in ten to the minus eighteenth.

The Enemy Within

Well, these were long odds indeed, and I quoted them to the Air Marshal. But I went further and I said, "This demonstration I will give on short notice, but only if I'm allowed to write my own rules. The rules are quite simple. If the demonstration is a success, if we get a positive result, then everything's all right. It's meaningful. If we get a negative result, if we don't get anything showing on the screen, then it doesn't mean a thing. It will just show that we've hurried too much, used the wrong lash-up equipment and so on. What I've promised I'll perform later, with faith unshaken by the failure of a premature trial." I don't think that particular ornament of top brass yet believes that I played fair about the rules of that game. However, he reluctantly consented, we gave the demonstration, it showed that there were "lashings" of energy available, and we were able to proceed with our proposal, but not quite unimpeded. Top brass intervened again and said this: "I am reluctant to see the expenditure of ten thousand pounds sterling (and I admit that that was real money in those days of 1935) on a purely defensive device when at any moment a promising offensive device, as yet completely unknown to us, unsuspected by us, may present itself as a better object for the expenditure of ten thousand."

I am glad to say that salesmanship (and it may be that I ought to belong to the Salesmen's Institute instead of the Engineers' Institute), salesmanship prevailed. We spent our ten thousand, and again another bit of top brass threatened to come in the way.

In this rummaging through my archives, I find a recommendation by a distinguished air force officer who said: "If I am correct in the above, it would be obviously unwise to start the engineering development of the apparatus until the possibility of jamming by the enemy has been completely eliminated." Well, he might have got away with that, but he was foolish enough to go further. He said that "the vital importance of this aspect of the RDF system might be in danger of being lost in the atmosphere of pure scientific achievement." That really got me mad! I wasn't in the least interested, at that moment, in pure scientific achievement. With all the enthusiasm of the newly converted, I was more military than the military. I was out for a major weapon, and I was out for it quick. I said: "Don't let's waste time in guessing what the other fellow may sometime be able to do, let's get on with our work and make the best job we can of it. It's got so much engineering in it that it is going to take us some years anyway. By the time these years have gone by, I promise you that we shall have found some way of preventing the enemy from effectively jamming us." And we did.

I must add just one other fiction to the radar legend. I used to live and work in a charming little village called Datchet, under the shadow of Windsor Castle, about 19 miles from London. My duties as a comparatively obedient, comparatively civil servant, often took me up on the Southern Railway in an electric train for that 19 miles. No one was more astonished than I, ten years after the radar story had "broken", to be told that it was now part of the established history of Datchet that I used to go up to town in the corner of a railway carriage, working on *The Times* crossword puzzle, which I invariably solved completely without the aid of pen or pencil, before we reached Waterloo Station! Did I ever do the crossword? Did I never meet my Waterloo? Alas, the crossword legend also must have come from Takoradi. √

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

New By-laws, New Horizons

All seven proposals to amend the by-laws have been approved by the membership, and with substantial majorities. The ballots were counted by the scrutineers on August 26. Their report gives the following figures:

Ballot No. 1 making all Juniors Corporate Members.

For	2567
Against	208
Percentage of favourable ballots	92.5

Ballot No. 2—Relates to resident and non-resident members.

For	2585
Against	181
Percentage "for"	94

Ballot No. 3—Increasing *Journal* subscriptions and Institute fees.

For	2145
Against	601
Percentage "for"	78

Ballot No. 4—Relates to the Finance Committee and the countersigning of cheques.

For	2682
Against	83
Percentage "for"	97

Ballot No. 5—Relates to the ballot for officers.

For	2682
Against	82
Percentage "for"	98

Ballot No. 6—Relates to the date for the Annual Meeting.

For	2682
Against	83
Percentage "for"	98

Ballot No. 7—Relates to the number of meetings of Council.

For	2644
Against	91
Percentage "for"	98

All by-law amendments except those relating to the term of office of any officer are effective "forthwith" upon the approval of the membership. Therefore all these changes are now in effect as of August 27, 1953.

It is a splendid tribute from the membership to the Council of the Institute, that they should have approved so emphatically all the proposals submitted by Council. Such a ballot is an indication that Council is close to the membership and that the membership has confidence in Council, truly a splendid relationship that augurs well for the organization.

With all these changes approved, it becomes possible for the whole organization, and in particular Headquarters, to operate more efficiently and with considerable reduction in expenses. The increase in revenue not only meets the heavy increase in the costs of doing business, but, it is hoped, will permit also substantial expansion in services and activities.

The Invasion

For several years on many occasions the Institute has indicated its interest in the letting of engineering work in Canada to non-Canadian consulting engineers. This critical interest has been expressed in many ways such as interviews with cabinet ministers, editorials, letters to and interviews with the companies concerned, proposals to increase the customs tariff on plans coming into Canada, letters to the press, the creation of a register of Canadian consulting engineers, and so on. It appears that these efforts have been of little avail, for the number of cases has increased alarmingly in the last year or two.

Prompted by the urgency of the situation, the Council of the Institute recently appointed a special committee to recommend action which might be taken by the Institute to protect the Canadian engineer. The problem is not easy of solution. There are complications of many kinds. However, the Institute officers feel that the field should not be abandoned and that efforts should be increased to demonstrate to the purchaser of engineering services, that Canadian engineers are among the most competent in the world, that almost all the work required in Canada can be done equally well by Canadians, and that in all justice, organizations that make their profits in Canada should

The cover picture this month illustrates the new 400,000-lb. testing machine installed recently by the Department of Civil Engineering at McGill University. The picture shows clearly the movable head, threaded side or screwed columns and side columns, in the centre foreground, with the console to the right. — *Photo courtesy Peacock Brothers Limited and McGill University.*

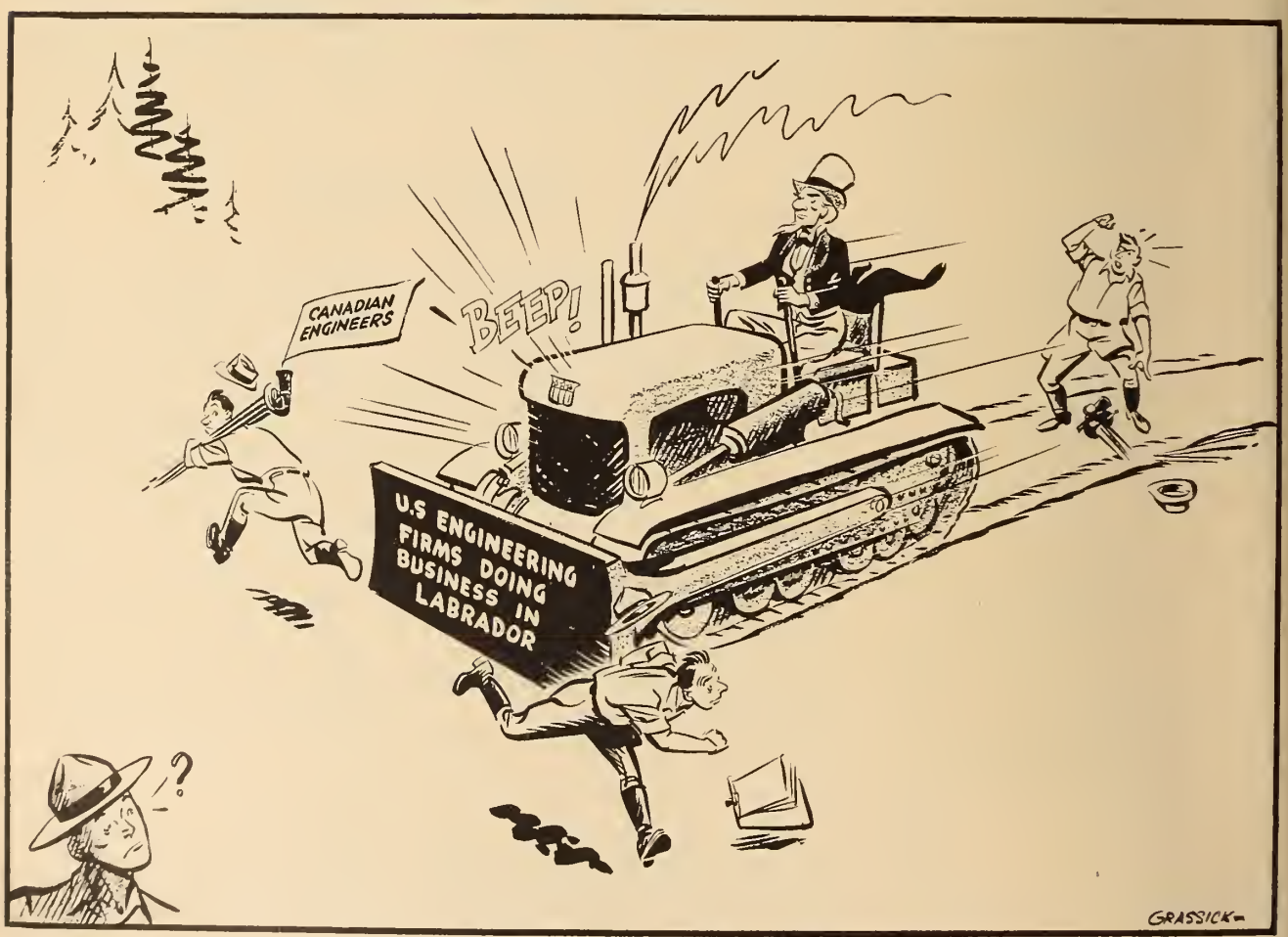
endeavour to use Canadian services and materials.

The first evil that one perceives in this invasion of the Canadian engineering field is not the only one. The employing of outside organizations not only robs the Canadian engineer of his inherent rights, but also leads to the purchase of plant and equipment from outside, and this is perhaps the most important consideration of all, because it cuts deeply into the Canadian economy. When engineers, whose experiences have been all in another country, design a plant for Canada, they are likely to show on their drawings and to include in their specifications, the equipment and materials with which they are familiar. This is common practice with any designer. The trouble is that such equipment is made in the country where they have acquired their experience. Canadian manufacturers thus are denied the opportunity to quote, or they have to work under a severe handicap in their endeavours to get the work.

It is ironical that Canadian industry now complains of this situation, when in so many instances it is Canadian industry that is buying its engineering services in another country. When the Institute presented its brief to the Tariff Board, urging that the tariff on imported engineering drawings be restored and increased, the room was filled with representatives of Canadian industries who, with only one exception, fought the Institute tooth and nail to have the tariff bars left down just where they were—and they prevailed. They did not seem at all disturbed by the fact that they were asking to be allowed to import something which in most instances could have been purchased in Canada without paying any tariff, but that they wanted a tariff as high as possible against goods such as they were manufacturing.

The great increase in recent years in this regrettable procedure is really disturbing. If Canadians continue to give their work to outside organizations and these organizations, prompted by this encouragement, establish sales offices here, it is going to be pretty tough for Canadian consultants and contractors if, as, and when, the volume of available work levels off. They are going to have to share the lean living with a number of giant competitors who, in spite of Canadian incorporation, are not Canadian in any sense of the word.

It should be kept firmly in mind that in some instances there is complete justification for importing engineering services. There are cases where Canadians do not have the experience, but these are limited largely to processes, not to complete plants. Unfortunately, the owners do not seem to realize that Canadians could be employed advantageously to do all the work except the highly specialized portion and, of course, no one could expect the outside firms to call attention to it. Thus we see hydro-electric and steam power plants and industrial buildings in all their details being designed outside of Canada simply because somewhere in the plant there was a process not known to Canadians or some equipment upon



NO CANADIANS NEED APPLY!

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which a patent was held by the non-Canadian organization. The exclusion of Canadians from certain industrial work is a further disadvantage in that they are thus denied the opportunity to learn—a fact of which the outside organizations are not unmindful.

However, industry is not the only offender. Some of the queerest cases involve municipalities, and provincial and federal governments. In many of these one cannot find even a trace of an excuse for ignoring Canadian engineers. There are instances going back for many years, but some of the more recent involve the employment of United States engineers to report on and to design such things as water supply systems, sewage disposal systems, and garages (one storey in height). In one case, an American firm was engaged to design a sewage disposal plant, estimated to cost $100,000, because the town council did not believe there were any Canadians competent to do it.

Recently the press reveals that one large city has sent representatives to the United States to consult "a firm of prominent engineers with a great background of expressway construction experience." In that quotation perhaps lies the answer to the whole situation. Canadians seem to think that anyone or anything from outside the country is better than anything we have here. The outside engineers, of course, are "prominent" and naturally have "a great background of experience". It is the belief of many that right in the city referred to there are several engineers whose knowledge of local conditions coupled with their broad experience and native talents, make them just as qualified or even more so, than any "prominent" engineers who have never seen the city and who it may be suspected do not have such "a great background", as is claimed for them by Canadians.

Surely a problem such as this is not beyond the capacity of Canadian engineers and there would appear to be no reason at all for spending in another country the estimated $150,000 of Canadian taxpayers' money for these services. If a few thousand dollars were spent to send the local engineers to the United States, to South America, and even to Europe to see what others have done, they would then have this "great background" which seems to have been so convincing in this case.

No one can find fault with the outside firms for going after Canadian work, and for going after it in a big way. They advertise themselves in such a way that when prospective buyers need this sort of service, they know the company's name and address and have some knowledge of the sort of work they do and of the organizations for which they have done it. Canadian consultants, although widely experienced and thoroughly competent, seem hesitant to "tell the world". To a great extent this is back of the failure of Canadian government and industry to recognize them when great works are to be let.

American consultants advertise broadly. It is nothing to see a full page advertisement in a magazine or a business paper. Frequently it contains a statement to the effect that that company is best qualified to do work in Canada for American interests proposing to build there. Canadians seem to do nothing to offset this. At the Institute office there is only one example from one firm of Canadian consultants along this line. Perhaps it would help if more firms would study means and methods by which they could tell the other Canadians of their experience, of their competence, and of their clients.

The *Journal* as an Ambassador

At the Council meeting in Halifax, the suggestion was made that *The Engineering Journal* should be sent to Canadian embassies and foreign trade offices in several parts of the world. The idea was that in such offices a Canadian publication of this type could be interesting and useful in many ways, particularly to foreign industrial and financial interests. As the publication was already going to some of these offices it was agreed to consult them to see just how useful it was.

It was interesting to receive in reply such complimentary comments. Every office replied promptly and in every instance stated the *Journal* was valuable to them. Here are some excerpts from their letters.

"The *Journal* is one of the best references in its field and we feel it serves a very useful purpose."

"In our office it is used by: (1) British engineers seeking general impressions of Canadian development; (2) By engineers and industrialists investigating the possibilities of manufacturing in Canada; (3) By businessmen looking into commercial possibilities arising from engineering projects; (4) By qualified engineers and students looking into employment prospects."

From one U.K. Trade Commissioner came these remarks:

"We find *The Engineering Journal* of considerable use and interest in our work. My colleagues in the engineering side read it regularly and it is consulted often by many callers, particularly business visitors."

From another U.K. office we read: "We have appreciated very much receiving copies of *The Engineering Journal* and you may be sure that full use is made of it."

Under these circumstances, consideration will be given to expanding the distribution in such circles. If it is good for Canada, the Institute will be for it.

A Good Year

Canada's biggest publicly-owned utility, the Hydro-Electric Power Commission of Ontario, has recently issued a report in popular form covering its operations in 1952. At first sight, "Ontario Hydro 1952" is attractive because it is a good job of printing of its kind, replete with many illustrations and graphs, both black-and-white and coloured. Private corporations might take a hint from the photograph of the Commission's principal officers in session; most stockholders have a natural curiosity to know what their executives look like.

Figures are not very inspiring things, but we must have recourse to them to give some idea of the magnitude of the Commission's operations during the year. There were 18,694 employees; total generating capacity was raised to 4,495,100 hp.; 15.3 billion kwh. were produced by the Commission and 4.7 billion were purchased; 1.3 million appliances belonging to 268,000 customers had been changed over for 60-cycle

operation; fixed assets increased to just under $1.2 billion: operating income was $114 million and operating expenses $112.5 million; capital expenditure was $163 million; $9 million was spent on rural electrification, bringing the investment in this service to $145 million, $72 million of which has been supplied by the Province, not by the Commission; 60-cycle frequency standardization cost $37 million; long-term debt stood at $862 and sinking funds at $181.5 million. At the end of the year, 1,244 municipalities and 200 large industrial customers were being served. Ontario Hydro is definitely "big business."

The sections of the report dealing with frequency change-over, progress in generating and transmission capacity and with research are most interesting to engineers. The end of 1952 found the "25-cycle island" reduced by more than 5,000 sq. mi. Work in the Stratford, Wallaceburg and Dresden areas was completed and in the Windsor area was about three-quarters done. Over 25,000 customers moving into the 60-cycle area have had their appliances altered during the past four years. Some 25-cycle equipment is no longer sold; it has been replaced by dual-frequency equipment; 176,000 clocks, fans, etc., were exchanged for new 60-cycle ones. The 5½ per cent fee paid to the principal contractor in the change-over was replaced by 5½ per cent up to $16 million expenditure per year and 3 per cent on any excess. Local contractors did more work than hitherto; about 280 of these, as well as over 200 dealers are now involved in the change-over programme.

During the year, the Otto Holden station on the Ottawa River near Mattawa, was put on line with 273,000 hp. The second and third units of the Richard L. Hearn steam station at Toronto, and the second unit of the J. Clark Keith steam station at Windsor, also went into operation.

The Commission's major construction project is the Sir Adam Beck No. 2 station at Niagara Falls, of 1.6 million hp. scheduled capacity, with 25 per cent of that capacity to be available next year. At the end of 1952, most of the power house excavation and of that of the canal, two and one-half miles long, had been completed, the access shafts and cross-cuts of the twin 45-ft. tunnels under the city of Niagara Falls were about finished, and half of the length of one tunnel was done. Over 20 per cent of the power house concrete had been placed.

A considerable amount of work in increasing and improving transmission, transforming and switching facilities was finished by the end of the year, so that the Commission found itself the owner of more than one hundred 115- and 230-kv. step-down stations and of about 575 smaller ones. It had 12,353 route miles of transmission line in its system then.

Research problems in the electrical field dealt with thunder-storm frequency and severity, with single-phase watt-hour metering and with interference with television. The structural division dealt with concrete and its aggregates and additives, with rock samples and with such routine matters as testing hand tools, rope, rubber boots and truck tires. The chemical section was concerned with investigations of plastic insulations, bearing metals, corrosion products and with the inspection of various miscellaneous supplies.

Whether you are "for" or "agin" public ownership, "Ontario Hydro 1952" will repay your reading.

Canadian Conference on Prestressed Concrete

The following information has been prepared by the organizing committee as a first notice of this important conference. As many members of the Institute will be interested in attending, further details will be published in the *Journal* as they are released. Doubtless this conference will be the next step forward in Canada's study of the subject, following the Institute conference in Halifax on May 22. — *Ed.*

The Extension Department of the University of Toronto is planning to hold a conference on prestressed concrete in Toronto on Thursday and Friday, January 28 and 29, 1954. It is hoped that this conference will attract many Canadian engineers who may be interested in the applications of this new and vital structural material.

An organizing committee, under the chairmanship of Professor C. F. Morrison, M.E.I.C., of the Department of Civil Engineering, University of Toronto, is now at work preparing the details of this conference. Detailed information will be made known at a later date, but this preliminary information has been released in order that engineers wishing to attend this important conference may reserve the dates immediately.

Among those who will present papers to the conference are: R. F. Shaw, M.E.I.C., vice-president of the Foundation Company of Canada and President of the Corporation of Professional Engineers of the Province of Quebec; Professor Gustave Magnel of Belgium, internationally known authority on prestressed concrete; Dr. T. O. Lazarides who, besides being an expert on prestressed concrete, is well known for his work on the Dome of Discovery for the Festival of Britain, 1951, and many other important structures; Robert Shama of Empresas Campenon Bernard, Venezuela, whose most recent work has been in connection with the famous arch bridges for the Caracas superhighway in Venezuela; R. B. Young, M.E.I.C., of the Hydro Electric Power Commission of Ontario, past president of the American Concrete Institute; A. T. Waidelich, manager of the Research Division of the Austin Company, Cleveland; Professor M. W. Huggins, M.E.I.C., of the Department of Civil Engineering, University of Toronto; and A. L. Parme of the Structural Bureau of the Portland Cement Association.

Report of the Conservation Council of Ontario

A report on Soil and Water Conservation has just been published by the Conservation Council of Ontario urging on the Provincial Government, the vigorous promotion of conservation practices.

The Conservation Council, is a non-profit, non-political organization whose purpose it is to assist in the co-ordination of all conservation efforts in the Province.

The report, containing 51 recommendations and a survey of regional needs, is directed primarily to the Premier and to his ministers of agriculture, lands and forests, planning and development, and public works.

It recommends that the Minister

of Agriculture, who has been named co-ordinator of conservation in Ontario, be enabled to assume that role in fact. Appointment of an interdepartmental conservation committee is suggested, with a chairman to be appointed from the Civil Service, together with a professionally trained secretary to the committee. Additional estimates should be passed to enable the committee to function.

The report suggests that the Research Council of Ontario should be the co-ordinating body in all research on conservation matters in this Province. Staffs, accommodation and equipment of existing research institutions in the province dealing with conservation should be materially increased, and additional agricultural sub-stations and demonstration farms should be established, the council points out.

In the report, the council deals exclusively with the lands of "Old Ontario". It is the council's opinion that the extension services administered by the Department of Agriculture should be greatly expanded, since many farmers, while willing to discuss their problems of land use and soil fertility, rarely take part in group discussions on agricultural problems. It is also recommended that greater use be made of existing media in urging the adoption of conservation practices.

Additional specialists are needed in the agricultural sections of the Province for farm planning, soil testing, drainage surveys, soil improvement and agricultural engineering. The council urges that these specialists be trained and made available and that the farm management and farm planning services of the Department of Agriculture be markedly expanded.

A wider field of research should be opened in soil fertility, organic content and tillage, the report recommends. Studies should be made to estimate the optimum organic content of soil types and how that optimum can be best achieved. Control measures should be demonstrated in areas where erosion is a problem.

The European minimum percentage of forest cover (20%) is compared with the Ontario percentage of 9.7% (in old Ontario) and the recommendation is advanced that Ontario should aim at 20% cover even in the southern areas of the Province.

Water supply and flow control are dealt with in 11 recommendations, ranging from the need for research to determine the effect of forest cover on water flow to the recommendation that municipalities take advantage of section 26 in the Planning Act in areas where constant and abundant supply of potable water is not available.

The report in general is aimed at basic conservation as a means of preserving soil fertility, maintaining agricultural production and eliminating, as far as possible, costly methods of flood control.

E.I.C. Membership Directory

- Information sheets were sent to all members last month requesting up-to-date particulars for incorporation in our new 1953 Membership Directory.
- The response has been excellent. Nearly two-thirds of our members have already completed and returned their forms.
- If you have not sent yours, please do so at once. If your form did not reach you, let us know by return.

Closing date—October 15, 1953

Correspondence

Dr. L. Austin Wright,
Engineering Institute of Canada.

Dear Sir:

The Canadian Management Council is the Canadian affiliate of the International Committee for Scientific Management (CIOS). This International Committee is composed of twenty National Associations. Its main purpose is the international promotion of the principles and methods of Scientific Management.

The most representative manifestations of CIOS are the International Management Congresses which are held at about three-year intervals. These Congresses offer a unique opportunity:

1) For becoming acquainted with recent developments of theory and practice of Scientific Management as presented by experienced Specialists from many countries;
2) For meeting people facing similar problems in other countries;
3) For bringing back inspiring suggestions and interesting propositions, new Management standards and methods of application.

Thus those in management positions at all levels and of all functions, including businessmen and top-managers, professors of business economics and management, mechanical and consulting management engineers, personnel officers and industrial relations experts, accountants and industrial psychologists, public administrators and experts in farm and home management, find at the International Management Congresses the stimulus of world-wide information and of international contacts.

The tenth Congress will be held in Sao-Paulo, Brazil, from the 19th to 25th of February, 1954.

The programme consists of eight subjects, each of which is prepared by a leading country:—

	Leading Country
No. 1. Management Methods of Improving Human Relations	Belgium
No. 2. Policy Determination, Direction and Control of Marketing	Netherlands
No. 3. Controls for Top Management's Use	Switzerland
No. 4. Executive Development and Training	Italy
No. 5. Developing an Effective and Co-operative Organization Structure	Sweden
No. 6. Policy Making as affected by Conditions outside the Control of Management, particularly those related to Credit and Taxation	France
No. 7. Top Management's Responsibilities toward Modern Managerial Techniques	United States
No. 8. Application of Modern Management Techniques to The Smaller Enterprise	Great Britain

There will be ample opportunity for full discussion with panels of highly qualified experts who have served as collaborators in international teamwork on these management subjects.

Opportunities for getting together

with top level management experts for international discussions are all too infrequent. In the interest of Canada and of industry at large, there should be a good delegation of top management personnel attend from Canada. If you cannot attend, perhaps you can guide others to take advantage of this opportunity. You might find it well worthwhile to send along as a delegate one of your up-and-coming executives whom you wish to broaden by exposure to this sort of management contact.

I believe that most of us in Canada, including the Institute, are interested in what goes on in South America. Evidence of the National interest was clearly established by the recent Trade investigation trip by one of our Cabinet Ministers, the Right Hon. C. D. Howe, and his party to South America. Mr. Howe said in the House of Commons on his return, "I would strongly urge senior Canadian businessmen to go to the countries of Latin America and see for themselves what new fields are open to them . . . " The industrial world of Canada is most certainly interested in new management practices. There is therefore a double-barrelled reason for a substantial delegation of Canadians at the International Management Congress at Sao-Paulo next February.

It is not necessary that you be a member of the Canadian Management Council to be eligible to attend this Congress. If you wish to go or to send a representative, registration can be made by writing to the secretary, Mr. J. A. Coote, 1549 Burnside Place, Montreal. The secretary will also be glad to supply additional information should it be required. If registration is made prior to October 20th, 1953 your name will be included in the printed list of delegates.

Cordially yours,

C. A. PEACHEY, *President*
Canadian Management Council

Mr. Peachey, along with J. Edgar Dion, M.E.I.C., represents the Engineering Institute on the Canadian Management Council.—ED.

The *Journal* Thirty-five Years Ago

The September 1918 issue of the *Journal* gives the program of the third general and professional meeting which was planned for Halifax, September 11th, 12th and 13th. It is interesting to note "all sessions except Mr. Porter's lecture will be held in the rooms of the Halifax Board of Trade, Hollis Street, corner of Duke Street." Apparently even thirty-five years ago the meetings of the Institute were large enough that local hotel facilities could not cope with them. It was pretty much the same experience for the annual meeting held this year and for the larger sessions the Institute had to go to Dalhousie University and the Navy Gymnasium at Stadacona.

Many pages are given over to the discussion of matters which transpired at the second general professional meeting which was held in Saskatoon on August 8th, 9th and 10th. A list of papers for this session was given in the August issue.

It may come as a start for many members of the Institute to be informed that forty-two pages of this issue were devoted to the discussion of the papers at Saskatoon. Only twenty-one pages were devoted to the papers themselves. This is quite a different ratio from that which applies to today's professional meetings. Many of the discussions were longer than the original papers and unfortunately several of them, at least in part, do not seem to be related in any way to the original subject.

The editorial section devotes considerable space to comments on the Saskatoon meeting. The opening paragraph says for instance—"Those present were unanimous in saying that it was the greatest engineering convention ever held in Canada because it was the most enthusiastic, was permeated by the warmest fraternity, was conducted on the highest plane of technical discussion, was a supreme evidence that engineers are public-spirited and was an unusual contribution to the national engineering literature; further it inspired and inaugurated not only one but several movements that will bear direct advantageous results in the interests of the profession in Canada."

One of these movements had to do with registration. Later on there is this comment on it: "Members of the Institute from the Atlantic to the Pacific will read with interest that at this meeting a movement was inaugurated with the expectation expressed by those present that it would lead to early action in providing legislation whereby the public would be protected against incompetent engineering service and the profession given a legal status it did not now enjoy."

Earlier legislation sponsored by the Institute, passed in Manitoba in 1896 and in Quebec in 1898 limited the practice of engineering to members of the Institute. At this meeting in Saskatchewan it was proposed that future legislation should be based on the provincial area rather than the federal. This article states "It was clearly shown as far as the meeting was concerned that it was desirable to secure provincial legislation in every province and in doing so such legislation should be eminently fair to all engineers whether members of the Institute or not."

A news item dealing with the St. Lawrence Waterway is given some prominence. It seems that the New York and Ontario Power Company, organized under the laws of the State of New York had made application to the International Joint Commission for approval of its plan for reconstructing, repairing and improving its dam at Waddington, New York. The report goes on to say that "the Dominion government is opposed to the prayer of the applicant being granted but through the Solicitor-General the Hon. Hugh Guthrie has signified its willingness to enter into immediate and intimate negotiations with the government of the United States, not only with a view to solving the present requirements of the applicant company, but with a view to working out a comprehensive project which will realize the maximum possible advantageous use of the St. Lawrence River, the developing of power at Long Sault Rapids, such project to be carried to completion by the governments of both countries jointly." An awful lot of water has gone through the Long Sault since that item was written and at this date no one can say with any certainty just how this matter is going to be settled.

Town Planning

Apparently there is nothing new under the sun. Even thirty-five years ago there was expressed a need for a course in town planning. It seems that at about that time each province had passed legislation providing for proper town planning. However, it was discovered there were few town planning experts who could be engaged by the provinces. The article to which reference is made stated that there was a controversy as to whether or not the training for town planners should be done by universities or by the Engineering Institute.

There is a strange ring to these words "if something constructive which will lead to the production of properly qualified town planning experts within a few years is not

attempted, the inevitable results will be the introduction into Canada of foreign engineers to do work which should be undertaken and can best be accomplished by our own citizens if properly qualified. It is up to the members of the Engineering Institute to deal with this question actively and without delay."

How true! Even today with properly qualified Canadians available for this class of work, some municipalities still bring in foreigners to do the work.

Personals

In the personals there is a long article about Colonel D. H. McDougall. The basis of this reference was that he had just been appointed president and general manager of the Nova Scotia Steel and Coal Company. Previously he had been general manager of the Dominion Steel Corporation and at that time was a councillor for the Montreal Branch of the Institute. Towards the end of the account it is stated "that within a few months the production of ingot steel will rise to at least thirty-five thousand tons per month." Although there have been some organization changes since then, to-day's production at Sydney is over 700,000 net tons.

Employment

On the employment page there are no openings of particular interest, but there is a quotation from an American publication to this effect: "Definite information as to the average rewards in income to be gained in the various so-called professions is disclosed by the official analysis of the federal income tax payments in 1916. It appears that the highest average income was earned by engineers, although the legal profession held first place in aggregate income. While the conclusions are drawn from the rigid classifications of incomes above the minimum established by the federal income tax law and therefore are based on incomplete data, it is probable that inclusion of the lower income would not effect the results. That engineering of the highly professional sort pays large returns is apparent enough from the rush of students to engineering schools in the past thirty years."

In all employment pages of each issue it is noticeable that the railways are mentioned most frequently as being in need of young engineers. In those days, the railroads had much work to do and were constantly in search of young men to work on surveys and in the field. In the September issue there are advertisements for draughtsmen "for railway office in N.B."; another one for "competent instrument man for Canadian government railways" and then another "experienced instrument man is wanted for the engineering department of a railway company in Quebec province". A transit man is wanted "for temporary work with railway office for Montreal and vicinity". Strangely enough there is an advertisement from the Atlantic Coast U.S. Railway asking for "two or three civil engineers for work in connection with federal valuation".

Technical Personnel in Canada and Other Countries

From "Technical Personnel", Quarterly Bulletin, July 1953, Department of Labour, Ottawa.

Concern with the supply of, and the demand for, technical personnel — engineers and scientists — is not confined to Canada. In many other countries of the world where defence needs have been superimposed on the normal civilian economy, the problem has come to the fore. Because of the absence of available information, the data presented here are confined mainly to Canada, the United States and the Union of Soviet Socialist Republics.

A note of caution should be sounded regarding the accuracy of the statistical data. The figures for Canada and the United States, although estimates in many cases, are considered to be reasonably reliable. The statistics on the Soviet Union, however, should be accepted with reservations. While they have been drawn from responsible sources (see tables), they are, like most Russian statistics, difficult if not impossible to verify.

Table I
Estimated Number of Technical Personnel in Canada, U.S.A. and the U.S.S.R., 1951-52

Country	Engineers	Scientists	Total	Per Cent of Total Non-agricultural Employment
Canada	35,000	25,000	60,000	1.35
U.S.A.	400,000	175,000	575,000	1.07
U.S.S.R.	—	—	620,000	1.44

Sources: Canada: Economics and Research Branch, Department of Labour, Ottawa.
U.S.A.: Manpower Report No. 3 "The Nation's Scientific and Technical Manpower." U.S. Department of Labour, November, 1951.
U.S.S.R.: An article by D. Shimkin, Russian Research Centre, Harvard University in "*Science*", November 7, 1952.

Note: A more recent source, *Fortune Magazine*, February 1953, p. 114, suggests that the number of technical personnel in Russia may total only 475,000 as of 1950, rising to 550,000 by 1955.

The estimated total pool of technical personnel in Canada, the U.S. and Russia is shown in Table I. While these figures appear to show the Soviet Union in the most favourable light with respect to the supply of engineers and scientists, there are other factors, some of them conjectural, to be kept in mind. First, of course, is the reliability of the information (see note in Table I).

Second, agriculture retains a more dominant place in Russia than in Canada or the U.S., and moreover, the collective nature of Soviet agriculture likely places more call on technical persons for actual production. If the pool of technical personnel is expressed as a per cent of the total labour force, the Soviet advantage disappears. Third, the historical background is important. Over the past thirty years, the planners of the controlled Soviet economy have consciously directed a large proportion of resources, including manpower, into basic industrial development, a considerably larger *proportion* than we have invested in the North American economy. In line with this development, between 1928 and 1937 alone, the number of scientific workers in Russia grew almost sixfold, the number of engineers and architects nearly eight times.[1]

This serves to give some indication of the magnitude of their investment program. Thus, if the pool of Russian engineers is considered in relation to the demands made on it — the continuing drive for industrialization — it is probable that the picture would be less favourable than is suggested by Table I. Finally, the table provides quantitative data only. Sound comparisons are difficult without information on the

Table II
Teachers and Students in Canada, U.S.A. and the U.S.S.R.
1950

	Professors and Instructors	Full Time Undergraduates and Graduate Students	No. of Students per Teacher	Teachers Primary and Secondary	Pupils Primary and Secondary	No. of Students per Teacher	Pupils Technical Schools
Canada	9,000	69,000	7	85,000 (a)	2,319,000 (a)	27	..
U.S.A.	210,349	2,659,021	13	1,164,000	30,155,803	26	..
U.S.S.R.	80,000	734,000	9	1,600,000 (b)	37,000,000	23	1,094,000

Sources:—Canada — Survey of Higher Education, 1948-50, D.B.S.
Preliminary Statistics of Education, 1949-50, D.B.S. memorandum.
U.S.A.—Biennial Survey of Education in the U.S. 1948-50 — Federal Security Agency, Office of Education.
U.S.S.R.— *Science*, November 7, 1952. Article by Dimitri Shimkin, Russian Research Centre, Harvard University.
(a) Includes pupils in technical schools.
(b) Two thirds of these teachers had only a secondary education.

quality of technical personnel and on the level of academic and practical achievement. This includes the problem of whether the Russian engineer is the equivalent of his American or Canadian counterpart.

The existing supply is, of course, only a part of the picture. What are likely to be the future trends in supply and demand? The trend in engineering graduates in the three countries from 1940 projected to 1955, suggests that the Soviet Union lost relatively more ground during the early war years, recovered sooner but somewhat more slowly in the immediate postwar period, and appears about to recover its advantage between now and 1955. By the latter date, these projections place the supply of new Russian graduates on a rising trend and at a level substantially above prewar. Between 1951 and 1955, the Russian labour force is supposed to increase by some seven millions.[2] Almost the whole of this increase is expected to be absorbed by basic industry — construction, manufacturing, mining and utilities — and the armed forces. The goals of the current five year plan call for productivity increases of 50 per cent in manufacturing, mining and utilities and 55 per cent in construction. Such targets can only be attained by adding greatly to the input of power relative to labour, by an expansion of the numbers of highly skilled technicians, and by their very intensive use. The increment of engineers alone may bring the total of technical personnel in Russia to the order of 621,000 to 766,000 by 1955. These figures are derived by cumulating the projections to the lower and higher figure in Table I.

[1]*Fortune*, February 1953. p. 127.
[2]*Fortune*, February, 1953, p. 119.
[3]D. Shimkin, *op. cit.*
[4]National Manpower Council "A Policy for Scientific and Professional Manpower." New, York 1953, Columbia University Press, Page 3.

Nor should it be forgotten that Russia may have relatively free call on engineers and scientists from the Eastern European nations.

In Canada and the U.S., on the other hand, the trends are downward. By 1955, the supply of new engineering graduates in the U.S. will have reverted to prewar levels. In Canada, they will be somewhat above. The basic factor in this situation is to be found in the low birth rates of the decade 1930-40. These are being reflected now in falling college enrolments, which unfortunately have coincided with increasing costs at the university level. The solution appears to be in the direction of increasing the proportion of young persons entering college. The problem did not assume serious proportions while the large veteran classes of '49 and '50 were graduating. In fact some concern was expressed as to the ability of the economy to absorb such numbers. However, the demands of defence and development, particularly in Canada, have risen in the face of declining enrolments and have once again created a situation where supplies becoming available are somewhat short of current needs.

In Canada, it is estimated that the number of engineering graduates will total approximately 1,300 by 1955. In the United States graduates are expected to number 12,400 by 1955. These figures have been derived by applying drop-out rates to current enrolments. Cumulatively, the increment of engineers is expected to bring the total pool of technical personnel in Canada to 65,000 by 1955, an 8 per cent increase over 1951-52; in the United States to 630,000 by 1955, less than a 10 per cent increase over 1951-52. In Russia, the target calls for an increase of from a quarter to a third over the period.[3] While the actual figures may be open to question, if the direction of the Russian trend of graduations is maintained, the conclusion is obvious. In one important sector, that of strategic manpower, the Soviet Union will be gaining relatively as against Canada and the United States.

What of the longer run? Table II contains figures showing the numbers of students and teachers at various educational levels in the three countries. These figures suggest considerable superiority in Canada and the United States in terms of the numbers at the university level. However, the student-teacher ratio in Russia is better than the U.S. at both the primary/secondary and university levels. The relation between primary and secondary school enrolments and enrolment at the university level in Russia suggests that rather fewer students go on to higher education there. On the other hand, there appears to be a larger reservoir of students who *could* receive more advanced technical training if the planners so decided.

In Canada and the United States the downward trend in college graduations is expected to reverse itself following the middle of this decade, but recovery will be slow until the higher birth rates of 1940's begin to pay off in terms of larger numbers of students of college age in the 1960's. Preliminary information suggests that the engineering class of 1956 in Canada may approach the 1,800 mark, assuming a continued high level of economic activity. Recovery will be slow, however, unless some method is found of raising the proportion of students who continue on to university. In the words of the United States National Manpower Council: "Only a purposeful and sustained effort can ensure that the United States will have adequate resources of scientific, and professional manpower to meet its needs."[4]

News of Other Societies

C. I. Bacon, M.E.I.C., Cornwall, Ont., was elected president of **Canadian Electrical Association** (704 Tramways Bldg., Montreal) at the 63rd annual convention in June, at Murray Bay, Que. Working with Mr. Bacon will be the newly-elected vice-presidents V. A. Ainsworth, M.E.I.C., Charlottetown, P.E.I.; J. A. Page, Montreal and A. W. Howard, M.E.I.C., Calgary, Alta. Re-elected to the executive committee were: H. F. Beique, M.E.I.C., Quebec, Que.; A. C. Brittain, Ottawa, Ont; C. A. Clancy, Niagara Falls, Ont; W. F. Mainguy, M.E.I.C., Montreal; N. T. Smith, M.E.I.C., Halifax, N.S.; H. N. Walters, Vancouver, B.C.; L. G. Lumbers, Toronto, Ont.; and E. E. Orlando, M.E.I.C., Hamilton, Ont. New members of the committee are N. S. Crerar, M.E.I.C., Montreal; J. C. Dale, M.E.I.C., Edmonton, Alta; C. G. Gliddon, Ottawa, Ont.; and D. S. Young, M.E.I.C., Toronto, Ont. The managing director and treasurer of the Association are, respectively, B. C. Fairchild and W. Booth.

Future meetings of the C.E.A. have been announced as follows: annual conventions, 1954, June 24-26, Murray Bay, Que.; 1955, June 22-24, Victoria, B.C.; eastern division meeting, January 18-22, 1954, Quebec, Que.; western division meeting, March 1-5, 1954, Winnipeg, Man.

Sections of the **National Association of Corrosion Engineers** (1061 M. & M. Bldg., Houston 2, Texas) have been organized at Toronto and at Hamilton-Niagara, Ontario. T. R. B. Watson, of Toronto, and C. F. Makepeace, of Welland, Ont., are chairmen of these sections.

Information about the 34th convention of the **Canadian Good Roads Association,** October 14-17, 1953, at the Empress Hotel, Victoria, B.C., is available from the C.G.R.A., 270 MacLaren Street, Ottawa 4, Ont.

The annual meeting of the **Engineers Council for Professional Development** will be held in New York on October 30 and 31, 1953.

Sessions on industrial safety, traffic and transit safety, farm, school, and home safety, etc., will take place in Chicago during the 41st National Safety Congress and Exposition, October 19-23, 1953. Information can be obtained from R. L. Forney, general secretary, **National Safety Council,** 425 N. Michigan Ave., Chicago 11, Ill.

The southwest regional meeting of the **American Concrete Institute** (18263 W. McNichols Road, Detroit 19, Mich.) will be held October 29-30, at Rice Hotel, Houston, Texas.

Programs are available for the fourth conference on coastal engineering which is scheduled this year at the Del Prado Hotel, Chicago, Ill., for October 29-31. Address enquiries to the secretary of the Council on Wave Research, The Engineering Foundation, 245 Hesse Hall, University of California, Berkeley, Calif.

Illinois Institute of Technology (35 West 33rd St., Chicago 16, Ill.) will be host to the ninth national Conference on Industrial Hydraulics, October 8-9, 1953, at the Hotel Sheraton in Chicago. Conference director will be O. E. Teichmann of Armour Research Foundation, Illinois Institute of Technology. Sections of the main professional engineering societies help Illinois Tech stage the Conference each year.

The **American Public Health Association** (1790 Broadway, New York, N.Y.) announces the 81st annual meeting, to be held at the Hotels Statler and New Yorker, New York City, November 9-13, 1953, in conjunction with the annual sessions of 40 related organizations.

The fifth annual Institute Lecture of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.) will be given at the organization's annual meeting at the Hotel Jefferson, St. Louis, Mo., December 13-16, 1953, by George Granger Brown, dean of the College of Engineering of the University of Michigan, Ann Arbor. His subject will be thermodynamics.

Meetings of A.I.Ch.E., are planned in 1954 for Washington, D.C., March 8-10; Springfield, Mass., May 16-19; and Glenwood Springs, Colorado, September 12-16.

An important addition to the schedule will the A.I.Ch.E.-sponsored meeting on nuclear engineering, to take place at University of Michigan the full week of June 20-26, 1954.

The annual meeting of the **American Society of Civil Engineers** (33 West 39th St., New York 18, N.Y.) for 1953, will be held at the Statler Hotel, New York City, from October 19-23.

Future meetings of the **American Society of Mechanical Engineers** (29 West 39th St., New York, 18, N.Y.) for 1953 are as follows: the fall meeting, October 5-7, Hotel Sheraton, Rochester, N.Y.; the A.S.M.E. Fuels Division and A.I.M.E. Coal Division joint conference, Conrad Hilton Hotel, Chicago, Ill., October 29-30; and the annual meeting, November 29 — December 4, Statler Hotel, New York.

The seventeenth Wright Brothers Lecture, sponsored by the **Institute of the Acronautical Sciences** (2 East 64th St., New York 21, N.Y.) will take place on December 17, at the Chamber of Commerce Building Auditorium, Washington, D.C.

The tenth International Management Congress will be held in Sao Paulo, Brazil, from February 19-24, 1954, under the auspices of the **International Committee for Scientific Management** (C.I.O.S.) of which the **Canadian Management Council** is the Canadian affiliate.

In illustration of the theme of the Congress, "The Leadership Role of Management" there will be eight technical sessions followed by group discussions. In addition to the scientific program, the Brazilian Institute of Management (IDORT) has made elaborate plans for study excursions and a gala program of Latin hospitality.

Members of organizations comprising the Canadian Management Council are qualified to register as delegates. An application form for registration may be secured from the Secretary of the Canadian Management Council, 1549 Burnside Place, Montreal. Registration for the Congress will remain open until October 20, 1953.

Personals

News of the Personal Activities of Members of the Institute

The Hon. C. D. Howe, P.C., HON.M.E.I.C., was the guest of honour at a luncheon at the Savoy given by members of The Institution of Civil Engineers in London while Mr. Howe was at the Coronation. On this occasion Mr. Howe was presented with his Diploma of Honorary Membership of The Institution. He also signed the Roll.

Present at the luncheon were H. F. Cronin, president; A. S. Quartermaine and Dr. W. H. Glanville, past-presidents; W. K. Wallace and David Watson, vice-presidents, and E. G. Clark, secretary.

The following day Mr. Howe visited The Institution's headquarters.

R. M. Hardy, M.E.I.C., consulting engineer and dean of the University of Alberta's faculty of engineering, was elected president of the Dominion Council of Professional Engineers at the annual meeting in Edmonton.

Dean Hardy, who has been on the staff of the University's department of engineering since 1930, received his

R. M. Hardy, M.E.I.C.

B.Sc. degree in civil engineering from the University of Manitoba in 1929, and his M.Sc. degree from McGill University in 1930. He also spent a number of summers at the University of Michigan where he studied structural engineering. In 1939-40 he continued post-graduate work at Harvard University specializing in soil mechanics, a field in which he has become recognized as an expert. He has done extensive consulting work for industrial concerns in eastern and western Canada.

Dean Hardy, who has served as president of the Association of Professional Engineers of Alberta, has also been prominent in the Canadian Good Roads Association and the Canadian Welding Bureau.

G. E. Sarault, M.E.I.C., has resigned his position as director of the Department of Electrical Engineering at Laval University because of the number of his professional duties. However, he will continue on at the University as professor.

Formerly chief engineer with the Canadian Broadcasting Corporation station CBF in Montreal, Mr. Sarault is now a partner in the consulting engineering firm of Tasse, Sarault and Associates in Quebec and Montreal.

Mr. Sarault is a graduate of McGill University, class of 1934. He has been on the staff of Laval University for a number of years.

E. L. Cousins, C.B.E., M.E.I.C., recently retired as engineering consultant of the Toronto Harbour Commission with which he has been associated for many years. He was chief engineer for the Commission for ten years, before being appointed consulting engineer in 1922. His work was in the development of the harbour and waterfront.

Mr. Cousins was Wartime Administrator of Atlantic Ports in Halifax, and was awarded the C.B.E. in the Dominion Day Honours List in 1946.

He graduated from the School of Practical Science in 1906, and after post-graduate work, received his B.A.Sc. degree in 1907. Mr. Cousins had the degree of C.E. conferred upon him by the University of Toronto in 1922.

During his undergraduate days and for a number of years after graduation, Mr. Cousins was connected with railway engineering on location, maintenance and reconstruction.

R. F. Shaw, M.E.I.C., vice-president of the Foundation Company of Canada Limited, has been elected president of the Corporation of Professional Engineers of Quebec. He served as vice-president of the Quebec Association last year.

Mr. Shaw, a civil engineering graduate of McGill University, class of 1933, entered the Foundation Company of Canada Limited as assistant to the vice-president in charge of building construction in 1937. He was subsequently named assistant to the vice-president in charge of shipbuilding; shipyard manager at Pictou, N.S.; assistant to the president; manager of engineering; and in 1950, vice-president.

From May, 1951, Mr. Shaw was on loan to Defence Construction (1951) Limited as chief engineer and vice-president until the beginning of this year.

L. A. Robillard, M.E.I.C., of Shawinigan Chemicals Ltd., is the 1953-4 chairman of the St. Maurice Valley Branch of The Engineering Institute.

Mr. Robillard was born in Glens Falls, N.Y. After gaining his general education, he attended the Shawinigan Technical Institute from 1916 until 1919. Four years later he entered the Uni-

L. A. Robillard, M.E.I.C.

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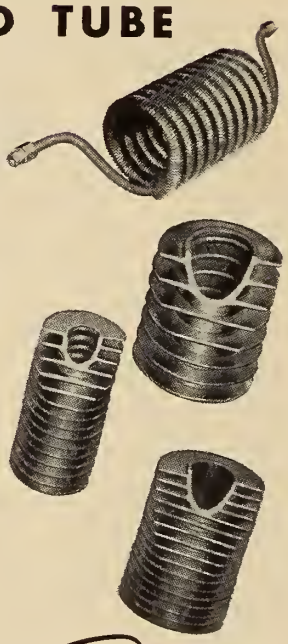

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* Patented in Canada and patents pending.

versity of Michigan where he graduated with a B.Sc. degree in 1927.

During the year following graduation Mr. Robillard was employed by the Laurentide Paper Company, and in 1928 he entered Shawinigan Chemicals Limited as assistant master mechanic. Three years later he became master mechanic in the Carbide Division, and in 1943 he was appointed general master mechanic for all divisions.

G. K. Clement, M.E.I.C., of the Aluminum Company of Canada Limited in Arvida, Que., has been elected chairman of the Saguenay Branch of The Engineering Institute.

G. K. Clement, M.E.I.C.

Mr. Clement was born in New Westminster, B.C. After graduating from the Meaford High School in Meaford, Ont., he entered the University of Toronto in 1937 and received his B.A.Sc. degree in metallurgical engineering in 1943.

During the summer months of his university course, Mr. Clement was employed as rodman with the Ontario Department of Highways, and as laboratory technician and test engineer with the International Nickel Company of Canada Limited in Copper Cliff, Ont.

In 1943 he entered the International Nickel Company of Canada Limited on a full-time basis as junior metallurgist. The following year he joined the staff of the University of Toronto as instructor on ore dressing in the department of mining engineering.

Mr. Clement then joined the John Inglis Company in Toronto as production supervisor in 1945 and in October, 1946, he entered the Aluminum Company of Canada Limited in Arvida, Que., where he has served four years in the chemical division and three years in the fabricating division.

G. S. Halter, M.E.I.C., of C. D. Howe Company Limited in Port Arthur, Ont., has been elected chairman of the Lakehead Branch of The Engineering Institute for 1953-4.

Mr. Halter is a native of Fort William, Ont. He received his general education at the Central Public School and the Fort William Collegiate, and entered the University of Manitoba in 1942 where he graduated with a B.Sc. degree in electrical engineering in 1946.

During the summers from 1942 until 1944, Mr. Halter was employed with

the Canadian Car & Foundry Company in Fort William as inspector of aircraft parts, draughtsman, investigator and shop contact man for the engineering department. In the summer of 1945 he served with the Fort William Hydro as meter technician.

Upon graduation from university in 1946, he entered C. D. Howe Company Limited as electrical design engineer.

G. S. Halter, M.E.I.C.

Dr. J. J. Green, M.E.I.C., chief of Division "B" of the Defence Research Board, and scientific adviser to the Chief of the Air Staff of the Royal Canadian Air Force, is chairman of the Ottawa Branch of the Engineering Institute.

Dr. Green was born in Portsmouth, England. He received his early education at the Portsmouth Municipal College, from which he graduated with a B.Sc. degree as an external student of London University.

Dr. J. J. Green, M.E.I.C.

In 1926 he proceeded to London University — Imperial College of Science and Technology — Royal College of Science, graduating in 1928 with first class honours in physics, B.Sc. (London) and A.R.C.S. degrees. He received the Imperial College Governors' Prize in physics awarded annually to the first student on the graduating list.

Post-graduate study and research in aeronautical engineering at the Imperial College followed, during which time

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Dr. Green held a Busk studentship in aeronautics and later a Beit fellowship in scientific research. He received the D.I.C. degree from this college in 1929 and a Ph.D. (engineering-aeronautics) degree from London University in 1930.

From 1930 to 1943 Dr. Green was on the staff of the Division of Mechanical Engineering of the National Research Council, latterly as head of the aerodynamics section.

In 1943 he was commissioned as squadron leader in the R.C.A.F. and appointed chief research engineer at the R.C.A.F. Test and Development Establishment in Rockcliffe. That same year he received the M.B.E. for valuable public service in the field of scientific research, and two years later the King's Commendation for valuable service in the air.

Dr. Green was appointed chief research aeronautical engineer of the newly-formed Air Transport Board in 1945, and was responsible for technical studies and advice to the Board until 1949 when he was appointed to his present position.

He was elected to Fellowship in the Royal Aeronautical Society in 1948, and two years later, he was named a Fellow of the Institute of the Aeronautical Sciences.

Dr. Green learned to fly in 1934 and took advanced flying training with the R.C.A.F. During his war service as chief research engineer at the Test and Development Establishment, he continued to fly on test pilot duties. He has taken an active part in civil flying, serving a term as president of the Ottawa Flying Club, and treasurer of the Royal Canadian Flying Clubs Association.

His professional career has been concerned with testing, research and development in aeronautics, and since his appointment to the Defence Scientific Service, his responsibilities and interests have been extended to include the field of armaments, as well as other technical subjects of growing interest and importance to defence.

Dr. Green has contributed a number of papers to the *Engineering Journal*. Others have appeared in the *Philosophical Magazine*, the Reports and Memoranda of the Aeronautical Research Council (England), The *Canadian Journal of Research*, the *Royal Aeronautical Society Journal*, and the *Journal of the Aeronautical Sciences*.

J. V. Arpin, M.E.I.C., has been appointed centre section district engineer in the City of Montreal's roads department. Previous to this appointment has was assistant engineer in the department's west section.

After his graduation in civil engineering from Ecole Polytechnique in 1938, Mr. Arpin was resident engineer and assistant division engineer with the Department of Roads of the Province of Quebec. From 1940 until 1946 he was associated with Canadian Car Munitions Limited, after which he served as industrial consultant with La Cie Bédard Ltée., in l'Assomption, Que., and with Rolland Paper Mills, and Laurentian Textile Mills, both of St. Jerome, Que.

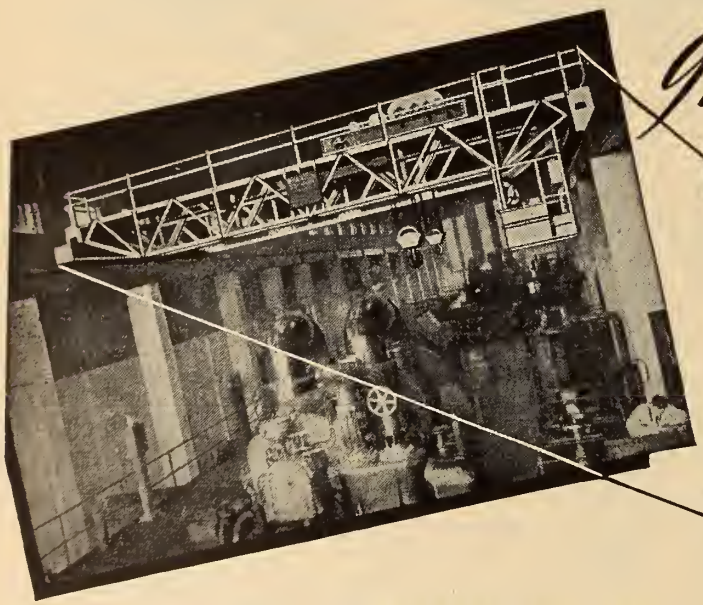
James Richard Johnson, M.E.I.C., of Ottawa, Ontario, formerly with the Technical Information Service of the National Research Council, has been appointed chief of the new development and promotion section of Canadian Patents and Development Limited.

Mr. Johnson was born in Kamloops, B.C., in 1910, and has been connected with the National Research Council since 1948. He graduated from McGill in 1934 with a B.Eng. in mechanical engineering. His industrial experience includes the paper, flour, and rubber industries.

Mr. Johnson served with the R.C.E.M.E. from June, 1940, to November, 1946, as a technical liaison officer on vehicle development, working on both armoured and unarmoured vehicles. He was in command of a Canadian section called Armoured Fighting Vehicle Technical Staff, a team whose duties were to obtain reliable information on design requirements and on performance of these vehicles in action and under enemy fire.

After the War, he was engaged in the Directorate of Vehicle Development in much the same work.

The development and promotion section of Canadian Patents and Development Limited has been formed to ease



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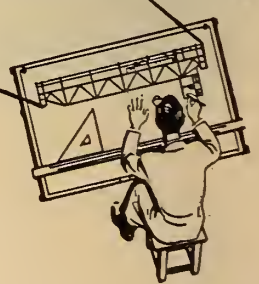

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D. S. Abbott, M.E.I.C., has been appointed president of Arborite Company Limited in Montreal, Que.

Mr. Abbott has been general manager and a director of the Company since its formation in 1948.

He is a 1930 graduate in mechanical engineering from Queen's University.

R. W. Wright, M.E.I.C., has been appointed director of purchasing at the head office of Canadian Allis-Chalmers Limited in Lachine, Que. Mr. Wright was formerly manager of the Company's Ontario District sales office in Toronto, Ont.

He is a B.Sc. degree graduate of Dalhousie University, and a B.Eng. graduate of McGill University. After receiving his engineering degree in 1941 he undertook the training course provided by Canadian General Electric Company, and during the War served in design and plant engineering with that Company.

In 1948 he was appointed manager of Eastern District sales for Canadian Allis-Chalmers Limited, with headquarters in Montreal, and two years later he was appointed manager of the Ontario District office.

J. T. Madill, M.E.I.C., has been transferred by the Aluminum Company of Canada Limited from the Montreal office to Kitimat, B.C., where he will be manager of power operations in British Columbia.

Mr. Madill graduated in applied science from the University of Alberta in 1939. and received his M.Sc. degree in electrical engineering from the Massachusetts Institute of Technology in 1940.

He has been associated with the Aluminum Company of Canada Limited since 1941 when he joined the Saguenay Power Company in Arvida.

G. M. Demarque, M.E.I.C., has recently been appointed chief engineer in Montreal by T. O. Lazarides, Lount and Partners, a Toronto firm of structural consultants specializing in prestressed concrete.

Previous to this appointment, Mr. Demarque served as chief engineer with Preload Company of Canada Limited since July, 1948. In this capacity he was responsible for the design and construction of the prestressed concrete grandstand in Sherbrooke, Que.

Mr. Demarque was born in France. He received his B.A. degree from the University of Paris, and his civil engineering degree from l'Ecole Nationale des Ponts et Chaussées in Paris in 1929.

During the years 1930 to 1939, Mr. Demarque was assistant superintendent in charge of costs and surveys on large construction jobs in French Morocco;

G. M. Demarque, M.E.I.C.

representative and superintendent in Oran, Algeria for a Parisian firm of general contractors; and, on his return to Paris in 1936, director and general manager of a contracting firm.

During the war years, from 1939 until 1943, Mr. Demarque served with the rank of lieutenant in the French Engineers Corps, and was for some time a prisoner of war in Germany.

Upon his discharge from the Army in

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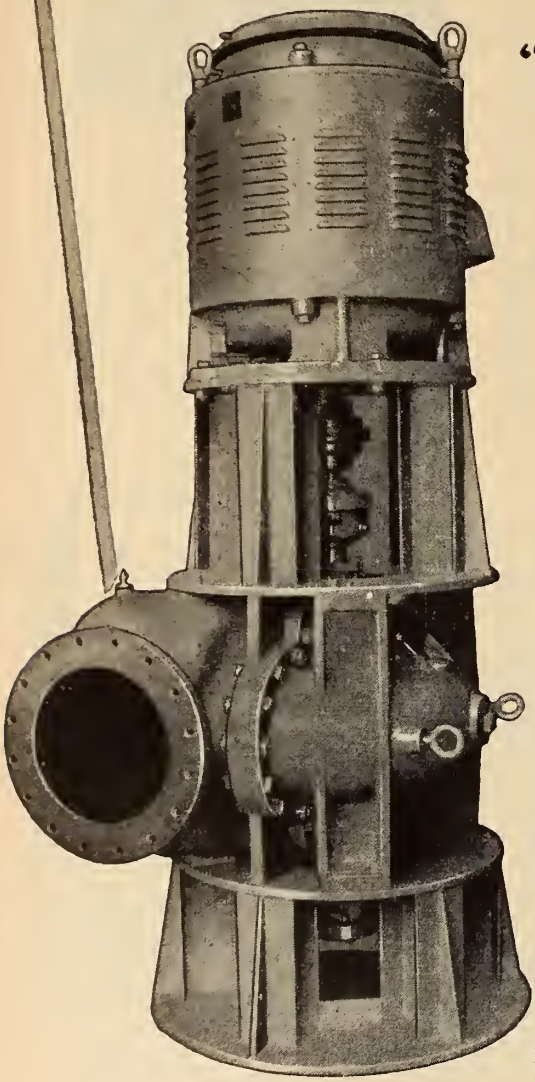

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1944, he was engaged in research and design work, in view of mass production of prefabricated houses, on the construction of their prototypes with precast reinforced concrete frames.

In 1946 he became a member of the staff of La Société Technique pour l'Utilisation de la Précontrainte. Procédés Freyssinet, where he was engaged in research and design on the application of the prestressing techniques to construction using precast concrete elements, and on processing for the manufacture of prestressed concrete elements on a mass production basis.

Mr. Demarque came to Canada in 1947 and entered Mount Enterprises Limited in Montreal where he made further special studies on prestressed concrete.

He is a member of the Corporation of Professional Engineers of Quebec, and a member of the American Concrete Institute.

Major I. M. McLaughlin, M.B.E., R.C.E.M.E., M.E.I.C., was awarded the M.B.E. in the Coronation Honours List in June, 1953, in recognition of his services in Korea.

From April, 1952 until April of this year, Major McLaughlin served in Korea, first as officer commanding No. 191 Infantry Workshop, R.C.E.M.E., and then as second in command of the R.C.E.M.E. Commonwealth Division.

Major McLaughlin is at present attached to No. 202 R.C.E.M.E. Base Workshop in Montreal, Que.

He is a 1941 graduate in mechanical engineering from the Nova Scotia Technical College.

S. M. Bolton, M.E.I.C., is western regional manager of Canadian Westinghouse Supply Company Ltd. in Winnipeg, Man.

He was formerly with Canadian Westinghouse Company Limited in Toronto, Ont.

Mr. Bolton is a 1940 graduate in electrical engineering from the University of Alberta.

J. G. Campbell, M.E.I.C., is now in Kitimat, B.C., where he is serving as superintendent of production for the Aluminum Company of Canada Limited.

Mr. Campbell received his B.Sc. degree in metallurgical engineering from Queen's University in 1940.

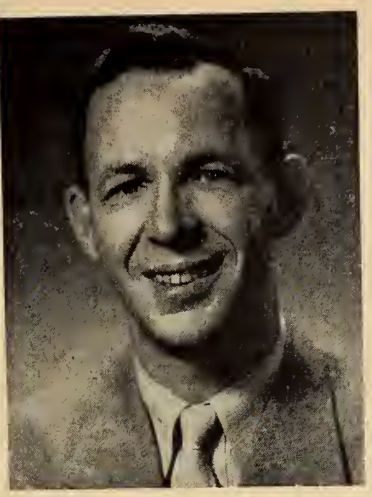
The year following graduation he was employed as instructor at Queen's University, and in 1941, he joined the Canadian Locomotive Company. He entered the Aluminum Company of Canada Limited in Arvida, Que., as assistant engineer in 1943, and three years later was appointed pot room supervisor. He was transferred in 1948 to Shawinigan Falls, Que., and a year later was appointed assistant superintendent of the Reduction Division. In April, 1949, he was placed in charge of this Division as superintendent.

M. E. Gooding, M.E.I.C., has been transferred by the Aluminum Company of Canada Limited from Arvida, Que. to Kitimat, B.C., where he will serve as superintendent of the Carbon Plant.

While in Arvida, Mr. Gooding was a senior supervisor.

He is a 1940 graduate of the Montana School of Mines.

R. "Ben" Goodman, M.E.I.C.



J. G. Boultbee, M.E.I.C.

R. "Ben" Goodman, M.E.I.C., has been appointed acting chief engineer of Mannix Limited, Calgary, Alta. He was formerly Western area engineer.

Before entering Mannix Limited, Mr. Goodman was resident highway construction engineer with the Alberta Department of Public Works.

J. G. Boultbee, M.E.I.C., has been appointed acting western area engineer of Mannix Limited, Calgary, Alta., and has moved to the Mannix central engineering staff after previously serving as Company engineer on the Kenney Dam, Nechako River, Kitimat Project.

Mr. Boultbee is a graduate in civil engineering from the University of Toronto, class of 1941, and in forestry from the same university, class of 1947.

G. H. Gillett, M.E.I.C., has been appointed manager of the Pacific District of the Apparatus Division by Canadian General Electric Company with responsibility for the Company's apparatus products for utility and industrial customers in British Columbia and Alberta.

Mr. Gillett was born in Montreal. He graduated from McGill University in electrical engineering in 1924. Since joining Canadian General Electric the same year he has had wide experience in engineering and sales in Ontario and Quebec. Previous to his recent appointment in Vancouver, Mr. Gillett was manager of sales in the Apparatus Division in the Province of Quebec.

G. H. Gillet, M.E.I.C.

T. G. Barker, M.E.I.C., has been appointed works manager for the Aluminum Company of Canada Limited at Shawinigan Falls, Que., where he has been located since 1951.

Mr. Barker graduated in chemical engineering from McGill University in 1939. He entered the Aluminum Company of Canada Limited in 1940 and undertook a course in 1947 at Centre d'Etudes Industrielles at Geneva, Switzerland. He afterwards returned to Arvida, Que., and in 1951, was appointed assistant works manager.

T. G. Edgeworth, M.E.I.C., has been appointed superintendent of the Reduction Division of the Aluminum Company of Canada Limited at Shawinigan Falls, Que.

Mr. Edgeworth graduated in chemical engineering from Queen's University in 1943.

Upon graduation he joined the Royal Canadian Air Force with which he served until 1945 when he entered the Ontario Department of Mines. A year later he joined Eldorado Mining and Refining Company Limited.

He has been with the Aluminum Company of Canada Limited since 1948. He became paste plant supervisor at Shawinigan Falls in 1949 and pot room supervisor in 1950.

Claud N. Rands, M.E.I.C., has been appointed general manager of Northern Exploration Service in Dawson Creek, B.C., a company which has been recently formed to provide geological, geophysical and geonuclear exploration in Western Canada.

Mr. Rands, who was previously district geologist for Technical Oil Consultants Limited in British Columbia, is a graduate in geology from London University. He also undertook postgraduate research at the University of Chicago.

Mr. Rands served for six years with the Royal Navy during World War II. He is a fellow of the Geological Society of London, a member of the Association of Professional Engineers of Alberta.

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J. S. L. Shales, M.E.I.C., has been appointed general manager of C. A. Meadows and Associates Limited of Toronto, Ont., with responsibilty for coordinating the activities of the firm,

J. S. L. Shales, M.E.I.C.

both in Canada and the United States.

Mr. Shales was formerly manager of the engine, pump and electrical departments of The Canadian Fairbanks-Morse Company Limited in Toronto. Before joining this Company, he was on the staff of Federal Aircraft Limited and DeHavilland Aircraft of Canada Limited.

Mr. Shales is a 1943 graduate in engineering physics from the University of Toronto.

H. F. Schmelz, M.E.I.C., is now serving as consulting engineer for special projects of the Channel Master Corporation in Ellenville, N.Y.

He was previously connected with Engineering Associates in Montreal.

Mr. Schmelz is a 1936 graduate of the Polytechnical Institute of Vienna.

C. M. Hare, M.E.I.C., is with Cobalt Chemicals, Limited in Cobalt, Ont.

He was formerly with the Indian Affairs Branch of the Department of Citizenship and Immigration in Ottawa, Ont.

Before this, Mr. Hare was senior engineer with H. W. Lee, M.E.I.C., consulting engineer in Ottawa. Prior to this he worked in the plant engineer's office of Noranda Mines Limited, and in 1949 was city engineer for the City of Rouyn, Que.

Mr. Hare graduated in civil engineering from McGill University in 1929.

E. R. Zacharias, M.E.I.C., has accepted the position of assistant to the vice-president in charge of manufacturing with the Thermoid Company of Trenton, N.J.

Mr. Zacharias was previously associated as factory manager with the Stokes Division of the General Tire and Rubber Company of Canada Limited in Welland, Ont.

He is a graduate in civil engineering from the University of Saskatchewan class of 1935.

Keith Provost, M.E.I.C., is equipment engineer with Canadian Utilities Limited in Edmonton, Alta.

He was formerly associated with Newfoundland Light and Power Company Limited in St. John's.

Mr. Provost received his B.Sc. degree in electrical engineering from the University of Alberta in 1948 and his M.Sc degree from the same university in 1950.

S. J. Rachfal, M.E.I.C., has been transferred from Toronto, Ont., to the head office of Carrier Corporation in Syracuse, N.Y., where he is serving as application engineer.

Mr. Rachfal is a 1945 engineering graduate of the Institute of Technology in Switzerland.

R. J. Mahoux, M.E.I.C., is associated with Lord and Company Limited in Montreal, Que.

He was formerly with Federal Aircraft Limited in Montreal, Que.

Mr. Mahoux is a 1937 graduate in mechanical engineering from McGill University.

W. E. Ohrner, M.E.I.C., is with Domex Company Limited in Toronto, Ont.

He was formerly with Hub Equipment Limited in Moncton, N.B., and with Fraser-Brace-Terminal Constructors in St. John's, Nfld.

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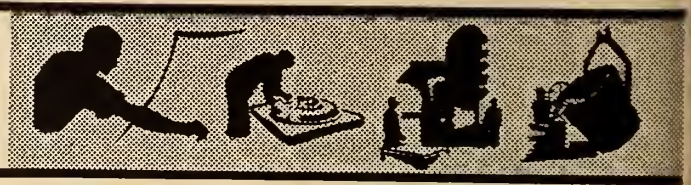

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Mr. Ohrner is a graduate in electrical engineering from the University of Manitoba, class of 1943.

After service with the R.C.N.V.R., Mr. Ohrner served with the Hydro-Electric Power Commission of Ontario.

J. F. Kennedy, M.E.I.C., is with the Canadian International Paper Company in Temiskaming, Que.

He was formerly associated with J. L. E. Price & Company in Montreal.

Mr. Kennedy is a 1941 graduate in civil engineering from the University of New Brunswick.

J. C. Martin, M.E.I.C., formerly with the Quebec North Shore and Labrador Railway, has joined Canadian National Railways as assistant project engineer.

Mr. Martin graduated in civil engineering from the University of Toronto in 1944.

E. W. Rudge, M.E.I.C., is now employed by the W. C. Wells Construction Company in Saskatoon, Sask.

He was previously associated with Sir Alfred McAlpine & Son Ltd. in England.

Mr. Rudge is a 1945 engineering graduate of the University of Manchester.

R. F. MacKenzie, JR.E.I.C., is division engineer for the New Glasgow Division of Canadian National Railways in New Glasgow, N.S.

Prior to this appointment he was assistant division engineer in Campbellton, N.B.

Mr. MacKenzie is a civil engineering graduate of the University of New Brunswick, class of 1945. He began his career with Canadian National Railways with summer work in 1941 and 1942.

In June, 1945, he joined the Company as instrumentman with the Campbellton Division. He was subsequently appointed assistant division engineer in Campbellton on Nov. 1, 1948; acting division engineer in Charlottetown, P.E.I., on April 1, 1951; acting division engineer in Campbellton on April 15, 1951; and assistant division engineer on June 15 of the same year.

A. E. Monaghan, JR.E.I.C., is assistant engineer with Canadian National Railways in Capreol, Ont.

He was formerly senior instrumentman at Allandale, Ont.

Mr. Monaghan graduated in 1949 from the Nova Scotia Technical College in civil engineering.

Jacques Benoit, JR.E.I.C., has been transferred by Canadian Industries Limited from Beloeil, Que. to Hamilton, Ont. In his new position Mr. Benoit will be supervisor of the Company's superphosphate plant.

Mr. Benoit graduated from Laval University in chemical engineering in 1951. He was employed in Beloeil as supervisor of the Company's agricultural chemical department previous to his recent transfer.

M. Kilbertus, JR.E.I.C., is a project engineer with Kitimat Constructors in Kitimat, B.C.

He was previously with Fraser-Brace Engineering Co. Ltd. in Maitland, Ont.

Mr. Kilbertus is a 1948 graduate of McGill University in mechanical engineering.

J. G. Celmins, JR.E.I.C., has been promoted to assistant maintenance superintendent with Catalytic Construction of Canada Limited in Sarnia, Ont. He was formerly party chief.

Before joining the Company he was rodman and instrumentman with International Nickel Company of Canada Limited at Copper Cliff, Ont.

Mr. Celmins is a 1947 engineering graduate of the Technical University in Hanover, Germany.

A. G. Norem, JR.E.I.C., has received his Ph.D. degree from Leland Stanford University and is now on the staff of the Bell Telephone Laboratories at Summit, N.J.

Dr. Norem received his M.Sc. degree at Stanford in June, 1951.

G. Andronidis, JR.E.I.C., is now representing Gardner-Denver Comany Limited in Northern Rhodesia, Tanganyika and the Belgian Congo. He is now located in Ndola, Northern Rhodesia.

During the past three years he has been associated as sales engineer with the Canadian subsidiary of the Gardner-Denver Company in Toronto, Ont.

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Mr. Andronidis is a 1950 graduate in electrical engineering from McGill University.

G. Andronidis Jr.E.I.C.

J. W. Fraser, Jr.E.I.C., is associated with Canadian Warren Pink Limited in St. Catharines, Ont.

Mr. Fraser is a 1947 graduate in mechanical engineering from McGill University.

Hugo Vajk, Jr.E.I.C., is assistant to the president of Standard Iron & Steel Works Limited in Toronto, Ont.

He was previously research assistant at the Graduate School of Industrial Administration of the Carnegie Institute of Technology.

Mr. Vajk is a graduate in mechanical engineering of McGill University, class of 1951.

Ross M. Currie, Jr.E.I.C., is plant engineer with Barringham Rubber & Plastics Limited in Oakville, Ont.

He was formerly design engineer with The Steel Company of Canada in Montreal.

Mr. Currie is a graduate of the University of Saskatchewan in mechanical engineering, class of 1949.

Gordon W. Glaholt, Jr.E.I.C., is now managing director of Midwestern Piping Limited in Calgary, Alta.

Mr. Glaholt graduated in civil engineering from the University of Alberta in 1951.

John K. Abel, Jr.E.I.C., is chief engineer in the Automotive Manufacturing Division of Thompson Products Limited in St. Catharines, Ont.

He was previously associated with Canadian Comstock Co. Ltd.

Mr. Abel is a 1947 graduate of McGill University in mechanical engineering.

Raymond E. Jonasson, Jr.E.I.C., is sales engineer with Canadian General Electric Co. Ltd. in Winnipeg, Man.

Mr. Jonasson graduated in mechanical engineering from the University of Saskatchewan in 1949.

A. Soroka, Jr.E.I.C., is now employed by Trans-Canada Air Lines in the plant and ground equipment engineering department.

He was formerly with C. D. Howe Company Limited in Montreal.

Mr. Soroka is a 1951 graduate in mechanical engineering from the University of Saskatchewan.

J. G. Wynne, Jr.E.I.C., has joined the system planning department of the Hydro-Electric Power Commission of Ontario.

He was previously associated with Canadian Westinghouse Co. Ltd.

Mr. Wynne graduated in electrical engineering from McGill University in 1951.

S. Shapiro, Jr.E.I.C., is employed as quality control technician with Trans-Canada Air Lines in their Pratt & Whitney overhaul base in Winnipeg.

He was formerly with A. V. Roe (Canada) Limited in Malton, Ont., as tool inspector.

Mr. Shapiro graduated in mechanical engineering from the University of Manitoba in 1950.

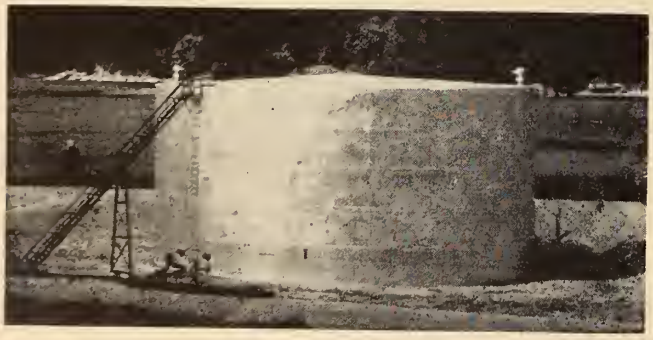
C. V. Flanagan, Jr.E.I.C., is now mechanical engineer with the technical service staff of Goodyear Tire & Rubber Company of Canada Ltd. in Bowmanville, Ont.

He received his B.A.Sc. degree from the University of Toronto in 1951.

F. F. Braithwaite, Jr.E.I.C., is now on the staff of John Labatt Company Limited in Montreal, Que.

Mr. Braithwaite graduated in me-

HORTON FLAT-BOTTOM TANKS



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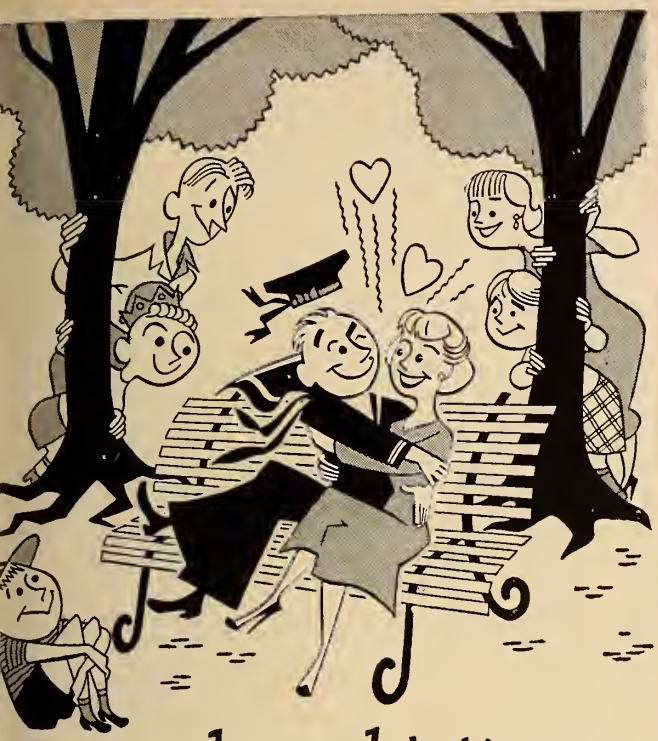

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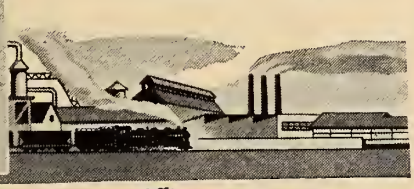

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SIZES. Standard and Extra Heavy wall iron pipe sizes to 6". Standard lengths of 10′ and 20′. Medium-grey color.

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Directory

See page 1163, for particulars re.
our new 1953 Membership Directory.

chanical engineering from the University of Toronto in 1951.

A. Ainlay, JR.E.I.C., has joined Rogers Majestic Electronics Limited in Leaside, Ont., as technical assistant to the manager of the Tube and Component Division.

He was previously in the radio engineering department of Canadian Westinghouse Company Limited.

C. J. Deines, JR.E.I.C., is now chief computer with Inter-American Geophysical Co. Ltd. in Delburne, Alta.

Mr. Deines is a 1951 graduate in electrical engineering from the University of Alberta.

D. H. McLeod, S.E.I.C., is now on the staff of Imperial Oil Limited in Sarnia, Ont.

Mr. McLeod graduated this year from the University of British Columbia in mechanical engineering.

H. P. Roach, S.E.I.C., has joined the staff of the engineering branch of the Department of Public Works in Charlottetown, P.E.I.

Mr. Roach is a graduate in civil engineering from the Nova Scotia Technical College, class of 1953.

H. B. McLenaghan, S.E.I.C., is now employed with J. A. Lamb, consulting engineer in Calgary, Alta.

He was previously assistant resident engineer with Central Mortgage and Housing Corp. in Calgary, Alta.

Mr. McLenaghan is a 1952 civil engineering graduate from the University of Manitoba.

W. O. Johnson, S.E.I.C., has joined the Dominion Oxygen Company in Indianapolis, Ind., as an engineer in training. Mr. Johnson graduated this year as a B.A.Sc. from University of Toronto.

F/O E. G. MacInnis, R.C.A.F., S.E.I.C., has just recently completed an aeronautical engineering course given by the R.C.A.F. at Aylmer, Ont., and since then, has been appointed officer in charge of Eastern Area Detachments of 11 Technical Services Unit (R.C.A.F.) in Dartmouth, N.S.

Flying Officer MacInnis graduated in mechanical engineering from Queen's University in 1952.

V. L. Lewis, S.E.I.C., has been transferred from Belleville, Ont. to Seven Islands, Que., by Stephens-Adamson Mfg. Co. of Canada Limited.

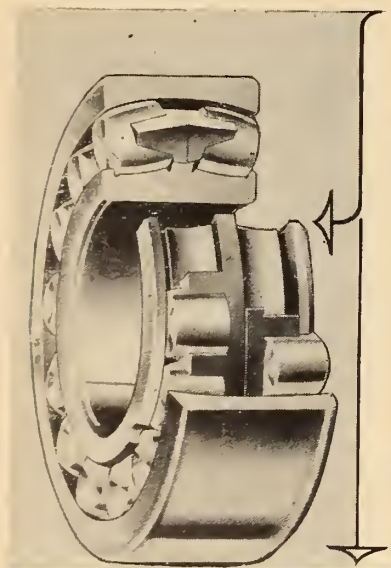
Mr. Lewis graduated in mechanical engineering from Queen's University in 1952.

H. W. Barnes, S.E.I.C., has joined the Dominion Rubber Company Limited in Montreal, Que., as assistant to the hose commodity manager.

G. F. R. Norton, S.E.I.C., has joined the building department of the City of Toronto.

He is a 1952 graduate of the University of Toronto in civil engineering.

R. Hebert, S.E.I.C., has joined the Sanitary Engineering Division of the De-



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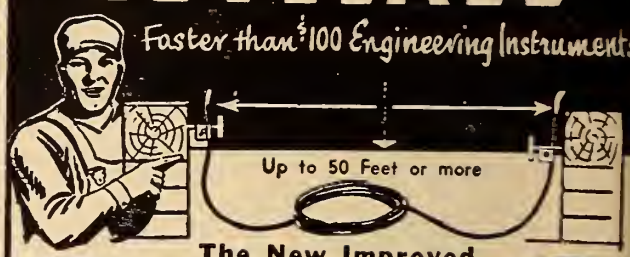

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partment of Public Health for the Province of Quebec in Montreal .

Mr. Hebert graduated this year in engineering from Ecole Polytechnique.

B. L. Barry, S.E.I.C., is employed by the Manitoba Hydro-Electric Board in Winnipeg, Man.

He graduated in 1952 in civil engineering from the University of Manitoba.

Andre J. Berard, S.E.I.C., has joined the Northern Electric Company Limited in Montreal.

He graduated this year in civil engineering from Ecole Polytechnique.

B. Brunton, S.E.I.C., is now employed by the City of Oshawa as junior engineer.

Mr. Brunton graduated in civil engineering from the University of Manitoba this year.

C. G. Gallant, S.E.I.C., is now employed by Montreal Engineering Company Limited in Montreal, Que.

David Broster, S.E.I.C., is in the mechanical engineering department of Imperial Oil Limited in Port Moody, B.C.

Mr. Broster graduated in mechanical engineering from the University of British Columbia in 1952.

Visitors to Headquarters

Eugene Vinet, M.E.I.C., New York, N.Y., July 28, 1953.

A. Gordon Stone, M.E.I.C., Stoke Poges, Bucks., England, July 29, 1953.

James T. Howley, Deep River, Ont., July 29, 1953.

Allan C. Smith, M.E.I.C., Vancouver, B.C., July 30, 1953.

C. N. Laird, Claremont, Calif., July 30, 1953.

C. J. Lacy Sanderson, M.E.I.C., Victoria, B.C., July 30, 1953.

H. D. Dawson, M.E.I.C., Victoria, B.C., July 31, 1953.

Lieut. Col. W. S. Wilson, M.E.I.C., Toronto, Ont., August 3, 1953.

Lieut. Col. J. K. Bradford, Toronto, Ont., August 3, 1953.

S. M. Breuning, JR.E.I.C., Boston, Mass., August 8, 1953.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

John Handley, M.E.I.C., retired lieutenant colonel of the Royal Canadian Engineers and formerly on the staff of Noranda Mines Limited, died in Cannington, Ont., in July, 1953.

Colonel Handley was born at Loughborough, England, on March 26, 1874.

A graduate in agricultural science from Cambridge University in 1897, Colonel Handley came to Canada in 1903 and was employed during his first years in this country as rodman with the Western Division of the Canadian Pacific Railway; as assistant to the consulting engineer of the Ottawa Improvement Commission; as field draughtsman on the Georgian Bay Ship Canal; and as leveller on the National Trans-Continental Railway. In 1906 he became assistant engineer on the staff of T. T. Simpson, Ottawa consulting engineer, and later entered the mining engineering field in Cobalt and Sudbury.

He received his first commission in the Canadian Army in 1912 with the 97th Regiment of the Algonquin Rifles. Two years later he entered active service with the rank of captain in the 4th Canadian Infantry Battalion and was subsequently promoted to the rank of major. He was wounded in action while serving in France in 1916 and was mentioned in dispatches in the London Gazette in 1917. He retired from active service in 1919 with the rank of lieutenant colonel.

In 1920 Colonel Handley led an expedition to the Canadian Arctic for a British company, and afterwards became associated with highway construction in the United States and in Ontario.

He joined the staff of Noranda Mines Limited in 1930 and continued with this company until his retirement in 1947, except for a three-year period from 1940 until 1943 when he served as second-in-command of the Third Battalion of Royal Canadian Engineers.

Colonel Handley was a life member of the Canadian Institute of Mining and Metallurgy and of the Association of Professional Engineers of Ontario.

He joined the Engineering Institute of Canada as a Student in 1904, transferring to Associate Member in 1907, and to Member in 1940. In 1947 Colonel Handley was granted Life Membership in the Institute.

Ivor Francis Rees Roche, M.E.I.C., former manager of the Equipment Division of Vipond Tolhurst Limited in Montreal, Que., died on February 28, 1953.

Mr. Roche was born in Fredericton, N.B., on November 1, 1891. After receiving his general education at Mount St. Louis College, he entered McGill University where he was granted his B.Sc. degree in 1913.

During the summer months of his university course he was employed by Canadian Pacific Railway as chainman, assistant draughtsman, rodman, transitman and concrete inspector.

In 1919 Mr. Roche was resident engineer for the Lignite Utilization Board in Bienfait, Sask., and in 1928, was appointed manager of Fess Oil Burners of Canada in Montreal. In 1949 he was manager of the Equipment Division of Vipond Tolhurst Limited, which position he held at the time of his death.

Mr. Roche joined the Engineering Institute of Canada as a Student in 1913, transferring to Associate Member in 1920, and to Member in 1940.

Desmond Joseph Emrey, M.E.I.C., Waterloo County engineer since 1932, died in the Kitchener-Waterloo Hospital on July 10, 1953.

Mr. Emrey was born in Nevis, British West Indies, on October 19, 1890. He received his general education at St. Kitts-Nevis Grammar School, and in 1913 entered Queen's University. After completing his first year in civil engineering study there, he enlisted with the Canadian Engineers, serving until the end of the war at which time he held the rank of captain. In recognition of his wartime services he was awarded the Military Medal and the Military Cross.

In 1919 he returned to Queen's University to continue his civil engineering course and graduated with a B.Sc. degree in 1922.

Before coming to Canada Mr. Emrey had been employed as rodman and leveller on railroad location work. He had also been in charge of reinforced concrete construction work on the St. Kitts-Nevis Sugar Factory. His first work in Canada was that of rodman and transitman with the Toronto Eastern Railroad in 1912. During the summer of the following year he was transitman on railroad location work with the Ontario Hydro Electric Power Commission, and in the summer of 1914 he was employed in the draughting office of Sutcliffe & Neeland, a contracting firm in New Liskeard, Ont. From 1920 until 1921 he was employed during the summers as assistant engineer with the Department of Railways and Canals, and as foreman in charge of reinforced concrete construction for James A. Vance in Woodstock, Ont.

Upon graduation in 1922, he became field superintendent in the bridge department of Canadian Des Moines Steel

Co. Ltd. in Chatham, Ont. Two years later he entered the Fort William Paper Company in Fort William, Ont., where he was engaged in the design of a mill, and in 1925 he became connected with Price Brothers and Company Limited, as construction engineer at Riverbend, Que., later he was successively construction superintendent and manager of the Donnacona board mill at Donnacona, Que.

Mr. Emrey joined the Department of Northern Development at Minden, Ont., in 1931, and a year later, was appointed engineer for Waterloo County, a position he held until the time of his death.

Mr. Emrey was a past president of the Ontario Good Roads Association, and a member of the Professional Engineers of Ontario.

He joined the Engineering Institute of Canada as a Student in 1914, transferring to Junior in 1920, to Associate Member in 1922, and to Member in 1940.

Ross A. Young, M.E.I.C., project engineer with the Aluminum Company of Canada Limited in Montreal, Que., died on June 24, 1953.

Mr. Young was born at Neepawa, Man., on March 28, 1899. He received his early education at the Neepawa Public and High School, and entered the University of Manitoba in 1920, graduating with a B.Sc. degree in civil engineering in 1925.

During the summer months of his university course he was employed by the Manitoba Power Company, the City of Winnipeg Hydro Electric System, and Kelker De Loew and Company in Chicago, Ill.

After graduation in 1925, Mr. Young joined the American Bridge Company in Gary, Ind. and Chicago, Ill., and two years later entered the Division of Waterways of the State of Illinois as draughtsman on locks and dams. In 1928 he served as designer and draughtsman on structural steel for the Universal Portland Cement Company in Chicago, and later joined the McClintic-Marshall Construction Company in Chicago as detailer and checker on mill and office buildings.

Returning to Canada in 1929, Mr. Young entered Dominion Bridge Company Limited in Winnipeg, Man., as estimator and designer on steel and concrete, and the following year served as designer on subways and bridges in the Office of the City Engineer for the City of Winnipeg. He was appointed assayer and assistant to the manager of Wylie-Dominion Gold Mines Limited in Cranberry Portage, Man., in 1934, and the following year joined Neepawa Salt Limited in Neepawa, Man., as assistant to the manager on construction. Mr. Young was employed during 1936-1937 by the Greater Winnipeg Sanitary District on the design of concrete and steel on a disposal plant, and in May, 1937, he joined the staff of Montreal consulting engineer J. Charles Day. In January, 1938, he entered the Canadian Car and Foundry Company in Montreal where he was engaged in the layout of railway passenger cars.

In 1943 Mr. Young became superintendent of construction for McColl-Frontenac Oil Company Limited in Montreal; and three years later he joined the Aluminum Company of Canada Limited in Montreal as project engineer, the position he held at the time of his death.

Mr. Young was a member of the Association of Professional Engineers of Manitoba.

He joined the Engineering Institute of Canada as an Associate Member in 1938, transferring to Member in 1940.

Olof Joel Koreen, M.E.I.C., chief draughtsman with Port Arthur Shipbuilding Company Limited, and Swedish vice-consul in Port Arthur, Ont., died on July 26, 1953.

Mr. Koreen was born at Ornskoldsvik, Angermanland, Sweden, on July 13, 1892. After receiving his general education at Svartostaden Public School, he entered the Lulea Technical School in 1908. During his four-year technical course, he served as machine shop apprentice in the summer months.

Mr. Koreen came to Canada in 1913. His first two years in this country were spent as an apprentice in a Port Arthur shipyard. In 1917 he worked on the detailing of ship sections, and two years later joined Port Arthur Shipbuilding Company Limited where he served as chief draughtsman and assistant to the naval architect.

In 1939 Mr. Koreen was appointed Swedish vice-consul in Port Arthur, a position he held until the time of his death.

He was an active member of the Lakehead Branch of the Engineering Institute, and served as its chairman in 1950.

Mr. Koreen joined the Engineering Institute of Canada as an Associate Member in 1939, transferring to Member in 1940.

Frederick Anderson Killer, M.E.I.C., staff geologist in the Calgary office of Imperial Oil Limited, died suddenly in the Royal Alexander Hospital in Edmonton, Alta., on March 18, 1953.

Mr. Killer was born at Stratford, Ont., on May 2, 1917. After completing his general education there, he entered the University of Western Ontario where he majored in geology and graduated with a B.A. degree in 1939.

In 1940 he served as demonstrator in geology at the University of Western Ontario, and the following year entered Queen's University for a two-year postgraduate course. During the summers from 1939 to 1941 he was employed as geological field assistant with the Ontario Department of Mines.

Mr. Killer joined Imperial Oil Limited in May, 1942, as a surface geologist in Moose Jaw, Sask. He was appointed wildcat supervisor at the time of the discovery of Leduc, Redwater, and Golden Spike, and in 1951, was named district geologist in the Edmonton area. A year ago he became staff geologist in the Calgary office.

He was a member of the Association of Professional Engineers of Saskatchewan, and was widely known in the oil fields throughout Alberta and Saskatchewan.

Mr. Killer joined the Engineering Institute of Canada as a Member in 1945.

Frederick Austin Crawley, M.E.I.C., former chief engineer with the Nova Scotia Department of Highways in Cape Breton, died at North Sydney, N.S., on June 21, 1953.

Mr. Crawley was born in Wolfville, N.S., on June 16, 1886.

He received his education at Horton Collegiate Academy and Acadia University, and was employed from 1906 until 1915 with the Grand Trunk Pacific Railway in Prince Rupert, B.C.; with MacDonnell, Gzowski and Company in Vancouver, B.C.; the Oregon Trunk Railway in The Dalles, Oregon; the National Transcontinental Railway in Ottawa, Ont.; the Canadian Northern Railway in Winnipeg, Man.; and with the Alberta Peace River and Pacific Railway.

In 1915 he served with W. L. MacFarlane, Dominion Land Surveyor in Buffalo Lakes, Alta., and in 1917, joined the Canadian Expeditionary Force with which he served for two years.

Upon his discharge from the Army in 1919, he became road construction engineer with the Nova Scotia Highways Board in Halifax, N.S., and the following year was appointed the Department's division engineer for Colchester and Cumberland Counties, which position he held until 1925.

For the next ten years Mr. Crawley was connected with power projects in Florida, Texas, New Mexico and British Columbia.

He rejoined the Nova Scotia Department of Highways in 1935 as chief engineer in charge of operations in Cape Breton, a position he held until his retirement in December, 1952.

Mr. Crawley was a member of the Professional Engineers of Nova Scotia

He joined the Engineering Institute of Canada as a Member in 1950.

Robert Everson Taylor, M.E.I.C., former engineer of buildings for the Western Region of Canadian National Railways, died in October, 1952.

Mr. Taylor was born in South Shields, England, on April 14, 1890. He received his early education at South Shields Public School, and in 1906, entered the South Shields Marine School after which he studied from 1908 until 1911 at the Sunderland Technical College. During the five years from 1906 until 1911, Mr. Taylor was an apprenticed pupil of the North Eastern Railway in England.

He came to Canada in 1911, and during his first year in this country, served as rodman and instrumentman on railway location and construction work for the Grand Trunk Pacific Railway. The following year he was employed as draughtsman on the design of roundhouses and machine shops for the Hudson Bay Railway, becoming instrumentman and resident engineer on construction in 1914, a position he held until 1917 when he joined the Canadian Expeditionary Force and served with the Canadian Engineers overseas until 1919.

On his return to Canada he became associated with Canadian National Railways in Winnipeg, Man. He was employed as architectural draughtsman and structural designer until 1927 when he was appointed chief draughtsman in charge of the design of machine shops, power houses, steamship docks, freight sheds and related railway structures. In 1938 he was appointed engineer of buildings for the Western Region of Canadian National Railways, a position he held until his retirement in 1952.

In the course of his 41 years with Canadian railways, Mr. Taylor developed designs for coaling plants that have served as standards until today. He personally carried out all structural design of the million dollar C.N.S.S. dock at Vancouver, and all buildings at Jasper Park Lodge and Minaki.

Mr. Taylor was a member of the Association of Professional Engineers of Manitoba.

He joined the Engineering Institute of Canada as a Member in 1951.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CIVIL

PROJECT ENGINEER REQUIRED, for large Newfoundland manufacturer of pulp and paper products. Man selected would be responsible for complete follow up of progress on all construction work including costs, etc. Work would cover general construction, hydro-electric development, railway and port projects. Excellent opportunity for right man, would possibly be considered for senior position in organization within three or four years. Previous pulp and paper mill experience valuable but not absolutely essential. File No. 4632-V.

EXPERIENCED ERECTION ENGINEER, required by a medium sized steel fabricator located in Toronto Supervisory ability and willingness to travel are important. Civil engineering degree preferred but not essential. Company offers pleasant working conditions, participating hospitalization insurance, pension plan, etc. Your resume should include a personality sketch, record of qualifications and past experience, and references. Salary open. Only experienced applicants will be considered. File No. 4641-V.

CIVIL ENGINEER preferably college graduate and registered professional engineer with at least fifteen years practical experience in a supervisory capacity, specializing in design of structural steel and reinforced concrete buildings, to supervise group of engineers and draftsmen in consulting engineer's office in Windsor. Please write giving full details including experience, age, salary requirements, references, et cetera. Interview will be arranged. File No. 4649-V.

CHEMICAL

CHEMICAL ENGINEER required, bilingual with experience in food canning, specially meat canning. Work will entail management of Montreal plant production of present manufactured goods and of future products. Salary will depend on experience and qualifications. All replies will be held confidential. File No. 4650-V.

ELECTRICAL

ELECTRICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicants should have pulp and paper experience. Salary range $700. to $750. File No. 4653-V

MECHANICAL

MECHANICAL ENGINEER, required as sales representative by machinery manufacturer. Recent graduate and preferably bilingual. Territory Montreal and Province of Quebec. File No. 4634-V.

JUNIOR MECHANICAL ENGINEER, required for design and general duties in machine works located in Montreal. File No. 4635-V.

DESIGN ENGINEERS, experienced in commercial vehicle design and production methods are required for general trailer design. In reply, state age, experience references and salary expected to File No. 4636-V.

ENGINEERS, are required with previous experience in the design and construction of aluminum transport trailers. Replies stating personal history and salary required should be addressed to File No. 4636-V.

MECHANICAL ENGINEER, required by long established manufacturing firm, graduate mechanical engineer, preferably between ages 25-32 should have some experience in plant engineering duties. Position offers better than average possibilities of working into responsible duties in production. Apply by letter giving full information. File No. 4640-V.

ASSISTANT MECHANICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicant should have pulp and paper experience. Position will eventually lead to mechanical superintendent. Salary range $700. to $750. File No. 4653-V.

MISCELLANEOUS

RECENT GRADUATE, preferably with experience in the pump or oil refinery fields to act as sales engineer in the Vancouver area for expanding Western manufacturing operations. Salary and bonus arrangement for successful applicant. File No. 4633-V.

YOUNG CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance, preferably in the pulp and paper industry. Applicant should be fluent in either French or English and able to get along in the other. Replies should outline qualifications, experience, age and salary expected. File No. 4637-V.

OPENINGS ARE AVAILABLE, for mechanical and chemical engineers in a large Eastern Canadian paper mill. Single men preferred who have experience in the paper industry. Applicants please give complete detail of experience and personal history. File No. 4638-V.

JUNIOR ELECTRICAL OR MECHANICAL ENGINEER, for administration department of consulting engineering firm in Montreal. Duties would be to aid management in operation of Latin American electric utilities with opportunity in the future for field assignment. File No. 4639-V.

GRADUATE CHEMICAL OR MECHANICAL ENGINEER, required. Preferably with some experience for Eastern Ontario food industry. Apply stating experience and salary expected. File No. 4642-V.

WELL KNOWN firm of Management Consultants is prepared to appoint additional engineers to their staff. Candidates should be Canadians, aged between 30 and 35, possessing engineering degree and several years executive experience with increasing responsibilities in manufacturing industry. Only those should apply who have a definite interest in management and who are well informed on present-day management techniques and general industrial trends. File No. 4643-V.

PROFESSIONAL ENGINEER, required to work on steam boilers and associated equipment. Applicants should have four to six years recent experience in this field and be capable of handling contract work, be conversant with heat transfer as it relates to steam power plant equipment. Location Toronto. File No. 4644-V.

THE DEFENCE RESEARCH BOARD, requires scientific information officers for employment in Ottawa, Canada. Bachelors degree in science with additional credits given for post-graduate study; preferably research experience; ability to work as an independent member of a scientific team; Canadian citizen or British subject. Vacancies: aeronautics and related subjects, physiology, biochemistry and bacteriology, electronics. Salary range $2,800.00 to $4,300.00 per annum. Competition No. 53-DRP-3. File No. 4645-V.

A GRADUATE ENGINEER, preferably civil or mechanical to develop, with assistance of economic research staff, industrial opportunity proposals for new industry and expansion of present industry. Must be able to meet the public. Post graduate experience required. Senior position with good opportunities for advancement. Location Regina, Saskatchewan. File No. 4646-V.

SALES REPRESENTATIVE over five years experience to industrial manufacturing plants. Successful proven sales record and the following; over thirty, mechanical background essential, preferably metal shop experience; knowl-

edge conveyors, or dust collection, or mixing, screening equipment preferred. Exclusive territory to acceptable representative opportunity American machine company with manufacturing facilities in Canada. File No. 4648-V.

AGRICULTURAL ENGINEER, required by Eastern Canadian Agricultural College for teaching and field experimental work in farm power and machinery. Post graduate training preferred but not required. Salary commensurate with experience and training, good prospects for advancement. File No. 4647-V.

ENGINEERING GRADUATE or equivalent, bilingual, with proven sales record to sell construction equipment, earthmoving machinery, diesel engines, electric sets and marine engines. Progressive company, good working conditions, salary, expenses and commission. Salary dependent on experience. Location Montreal. File No. 4651-V.

SALES ENGINEER bilingual for Quebec City area. Experience in water treatment beneficial but not essential. File No. 4652-V.

SALES ENGINEER for Eastern Ontario. Experience in water treatment beneficial but not essential. File No. 4652-V.

GENERAL SUPERINTENDENT required to take complete charge of paper mill for large organization with headquarters in Montreal. Salary $850 to $900. File No. 4653-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEER required age 25 to 35 who has had some experience in formulating lacquer, lacquer thinners and brake fluids. The work will entail laying out evaluating programs in our application labs and contacting accounts all over Canada. Salary will be dependent on experience and qualifications and all reolies will be held confidential. File No. 4599-V.

SALES ENGINEER required by a Canadian manufacturer of vacuum washers and thickeners for the pulp and paper industry. Applicant must have five to ten years experience in a pulp and paper mill and preferably a graduate in chemical engineering. Excellent opportunity for engineer with sales aptitude. Salary open depending on qualifications. File No. 4613-V.

CIVIL

CIVIL ENGINEER, required in the bridge section of a large transportation company with headquarters in Montreal. File No. 4504-V.

Research and Sales Engineer

required by

Saskatchewan Industrial Development Office

A graduate engineer, preferably Civil or Mechanical, to develop, with assistance of economic research staff, industrial opportunity proposals for new industry and expansion of present industry.

Must be able to meet the public. Post graduate experience required. Senior position with good opportunities for advancement.

For further information write to: Industrial Development Office, Government Administration Building, Regina, Saskatchewan.

CITY IN NEW BRUNSWICK requires a municipal engineer. Qualifications: university graduation in civil engineering, supplemented by extensive related experience in all municipal services including water works and services. Salary commensurate with ability and responsibilities. File No. 4574-V.

POSITION OPEN AS ASSISTANT TO THE PLANT SUPERINTENDENT. Duties in connection with the operation and maintenance of a low head hydro plant consisting of 5 Francis type units with a total capacity of 167,000 K.W. Location about 125 miles from Rio de Janeiro in a healthy climate. Preferably single between 30 and 40 with at least 5 years experience in hydro plants. File No. 4583-V.

COMMISSIONER OF WORKS required in Halifax, Nova Scotia. This position involves administrative and professional engineering work in directing, under the jurisdiction of the City manager all activities of the Public Works Department. Extensive knowledge of the modern principles and practice of administration as applied to the design, construction and maintenance of streets, sewers and other public works facilities. File No. 4608-V.

GRADUATE CIVIL ENGINEER preferably with graduate work in public engineering and some public health engineering experience, to do field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewage systems, stream pollutions, deficient drainage and other environmental factors. File No. 4617-V.

YOUNG RECENT CIVIL graduate, thoroughly bilingual for sale of concrete pipe and building units in the Montreal region. Salary open. File No. 4630-V.

ELECTRICAL

RECENT GRADUATE electrical engineering (Power Option) required by industrial organization in Ottawa. Engineer would be employed in the design and control department working on electrical power installation. He would be trained in the company's methods of design, cost accounting, material expedition and personnel relations. Salary would be commensurate with past experience and ability. File No. 4598-V.

ELECTRICAL SALES ENGINEER wanted in Toronto. Preferably experienced in design of rectifiers, control equipment and communication power systems. File No. 4612-V.

ELECTRICAL ENGINEER with considerable experience as electrical draftsman and office work on plans for substations, motor distribution and general lighting and power work. Location Northern Ontario. File No. 4620-V.

ELECTRICAL ENGINEER (power option) age 30-45 required by heavy electrical manufacturing company located in vicinity of Montreal with a minimum of 3 years experience for transformer electrical design, quotations and cost estimating on power transformers up to 10,000 KVA. Should be able to take over duties of department head in his absence. Salary commensurate with past experience and ability. Good prospects for advancement. File No. 4623-V.

AN ELECTRONICS SPECIALIST is required to study the design of electro-mechanical control systems and in particular to develop a reading unit applicable to either fluorescent or ordinary markings for sortation purposes. The work will be done by a team which will study all aspects of high speed mechanical sortation systems and the aerodynamics of interference in the movement of papers at high speed. A knowledge of electronics and in particular pulse circuits is required. Graduation in applied science is a preferred qualification. File No. 4623-V.

MECHANICAL

INSPECTING ENGINEER with wide experience in the erection and maintenance of materials handling equipment to organize a service department covering the Provinces of Ontario and Quebec and there after assume full responsibility for technical installation of all new equipment and the servicing of that already in use. File No. 4597-V.

YOUNG ENGINEER for industrial engineering in textile industry. Experience in textiles preferable but not necessary. Full training will be given in our plants in N.B. and Ontario. Besides technical ability work will require ability to sell ideas and to deal successfully with mill personnel. Replies should outline experience, age and salary expected. File No. 4602-V.

MECHANICAL GRADUATE with at least one year's draughting experience wanted for engineering department of a structural steel company in Southern Ontario. Permanent position with opportunities for advancement in engineering and contracting. File No. 4610-V.

CHIEF ENGINEER home appliances. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design styling, standardization, lab, etc. Canadian engineer with experience in home appliances design age 35 to 40 preferred. This is an excellent opportunity for creative engineering since this company is Canadian owned and wishes to produce Canadian designs for the Canadian market. Location Ontario. File No. 4616-V.

IN THE PATENT OFFICE of the Secretary of State Department at Ottawa, six mechanical engineers are required to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the mechanical engineering field with a view to making recommendations for the award or denial of patents. The desired qualifications include graduation at the bachelor's level with specialization in applied science and some experience in the production or research field having to do with mechanical problems. File No. 4628-V.

MISCELLANEOUS

ENGINEERS REQUIRED for work on new types of electro-mechanical instruments for marine and aircraft use. University degree and two to eight years experience required. Preference given to men with manufacturing experience. All replies will be treated in confidence. Please write full details of education and experience. File No. 4594-V.

A WESTERN CANADIAN manufacturer requires an experienced and capable sales manager to direct the sales of its products which includes commercial semi-trailers and sheet metal and plate products for the petroleum and petrochemical industry. The company wishes to enlarge its operations in the sheet

Project Engineer

Project Engineer required for large Newfaundland Monufacturer of Pulp and Paper products. Man selected would be respansible for complete follow up of progress an all construction work, including costs, etc. Work would cover generol canstruction, hydro-electric development, railway ond port projects. Excellent opportunity for right man, would possibly be considered far senior position in orgonization within 3 or 4 years. Previous pulp ond paper mill experience valuable but nat obsolutely essential. File No. 4632-V.

metal plate work and mechanical fields and requires an energetic and capable man with vision to assist in this department. File No. 4595-V.

MECHANICAL ELECTRICAL ENGINEER as factory manager for medium sized plant engaged in the manufacture of both light and heavy industrial handling equipment in Southern Ontario. Essential qualifications comprise sound knowledge of plant engineering and factory layout, contract estimating, wage incentives, methods study for volume production and quality control. Must be good disciplinarian. File No. 4597-V.

PRODUCTION CONTROL SUPERINTENDENT. Engineering graduate or equivalent. Background and experience in methods trade automotive or production machine industry. Knowledge of plant layout, process engineering, industrial engineering, production control and cost control essential. Salary $8,000. Location Ontario. File No. 4600-V.

INDUSTRIAL ENGINEER, mechanical or metallurgical graduate or equivalent. Background and experience in production standards, time and motion study, plant layout and process engineering in metals trade industry. Salary $4,500.00. Location Ontario. File No. 4600-V.

SALES ENGINEER, engineering graduate or equivalent. Proven sales record in heating field or allied industry. Contacts with architects, engineers and contractors desirable. Should be capable of developing plans and estimates for radiator and boiler installations in dwellings, apartments, institutions, commercial and industrial buildings. Salary $5,000.00. Location Ontario. File No. 4600-V.

WORKS MANAGER, mechanical or metallurgical graduate. Experience plant engineering and factory management in grey iron foundry and machine shop production. Knowledge of production engineering industrial engineering, plant rehabilitation, time and motion study and cost control. Salary $10,000. Location Ontario. File No. 4600-V.

SIX SALES ENGINEERS, graduate mechanical or civil. Sales experience in air conditioning, refrigeration, heating products or technical products. Graduates 1949 to 1953. File No. 4600-V.

INSPECTION ENGINEER required in Toronto. The job involves making inspection of a wide variety of power equipment, including prime movers, generating equipment and switch gear, pumps and compressors, and other types of power equipment. Applicant will work out of Toronto in various plants in Province of Quebec and Ontario. Age range 25 to 35 years. Degree in mechanical or electrical engineering. File No. 4603-V.

METALLURGIST REQUIRED with some experience in the heat treating of stainless steel, should be interested in development work and have sales ability. Three months training period. File No. 4606-V.

SALES ENGINEER required by Canadian manufacturer of mine hoist machinery. Some experience with mine hoist equipment desirable. Contact experience with Canadian mines essential. This position will lead directly to the management of the mine hoist division for the right man. File No. 4609-V.

MECHANICAL OR CHEMICAL engineer required for selling and servicing accounts by sound well-established Canadian paper company engaged in the corrugated and solid fibre box field. Splendid openings in both Toronto and Montreal are due to retirement of long-service personnel and also large scale expansion program of manufacturing facilities. Thorough training will be given prior to assignment. Replies are invited from recent graduates as well as those with four years minimum selling experience. File No. 4611-V.

SALES ENGINEER required by Canadian manufacturer of continuous vacuum filters for the chemical metallurgical and industrial field. Applicant must have five to ten years experience in chemical metallurgical plants. A graduate chemical engineer with sales ability preferred. Salary open depending on qualifications. File No. 4613-V.

SALES ENGINEER bilingual and married preferred. Proven sales record, capable of handling mining and industrial equipment and supplies. Salary commensurate with experience and ability. Ideal living and education facilities. Bright future. Permanent position. File No. 4614-V.

AN ENGINEER $6,420-$7,200 for the Board of Transport Commission at Ottawa. Details and application forms at your nearest civil service commission office, national employment office and post office. File No. 4618-V.

MECHANICAL OR CHEMICAL engineer required who is willing and financially able to accept small present remuneration in the prospect of ownership of business carrying lines for industry. Sales and administrative ability required. File No. 4622-V.

PULP AND PAPER COMPANY requires for its engineering department a graduate in mechanical or civil engineering to act as engineer on diversified mill projects. Candidates should have a minimum of five years experience in the pulp and paper or related process industry. This opening offers good opportunities and our location presents excellent recreational, educational and housing facilities. Replies treated confidentially. File No. 4624-V.

METALLURGIST with approximately five years experience. Graduate of recognized University in metallurgy, capable of taking charge of electric furnace operation, iron cupalo, and to supervise metallurgical laboratory. Location in Western Canada. Salary depending on experience and to be negotiated. File No. 4626-V.

EXPERIENCED ADMINISTRATOR required for work in industrial training. Duties to investigate, develop and coordinate in plant training for engineering graduates and other professional trainees, and advanced technical workers. To locate and select suitable trainee material from all sources. To carry out essential liaison with other in plant training and personnel functions. This is a responsible position in a growing Ontario industry. It requires maturity, versatility and breadth of outlook. There is opportunity for advancement. Applications are encouraged from industrial personnel or from well-qualified teachers and educational administrators who have successful industrial experience. Successful applicant must have broad training and experience which covers both personnel work and engineering or allied fields. A specialist in either personnel or engineering would be acceptable providing he had support through either education or experience in the other field. Special consideration would be given to an applicant who, in addition to the above, had administrative or business experience. Send details of background, education, experience interests and occupational goals. All replies in confidence. File No. 4629-V.

COST ENGINEER, with 10 years practical experience preferably on Hydro-electric projects. To train and supervise a small staff in the field to report and analyze costs. To assist in preparation of estimates, budgets and other similar work. Location in Sao Paulo, Brazil, with frequent trips to camps in the vicinity of Sao Paulo and Rio de Janeiro. Age 35 to 45. File No. 4631-V.

Situations Wanted

TOOL AND PRODUCTION ENGINEER, age 44, McGill 1931, fully qualified in production planning, supervision and organization requires position of a permanent nature which would utilize past experience. Preferably work on executive level as a production or works manager. File No. 551-W.

ELECTRICAL ENGINEER, 32 years of age, veteran, married, graduated in 1950 from McGill University. For the past 3 years worked on a large diversification of electrical equipment for a power and paper company whose mills are undergoing rehabilitation and speed up programs. Experience in layout and design of lighting power distribution, motor control, industrial electronics, etc.; estimating and preparing of spe-

THE DEFENCE RESEARCH BOARD REQUIRES SCIENTIFIC INFORMATION OFFICERS

FOR EMPLOYMENT IN OTTAWA, ONTARIO

Duties:

To procure, catalogue, and distribute scientific information for the use of the Board's scientific staff.

Qualifications:

Bachelor's degree in science, with additional credits given for post-graduate study; preferably research experience; ability to work as an independent member of a scientific team; Canadian citizen or British subject.

Vacancies:

1. Aeronautics and related subjects.
2. Physiology, biochemistry and bacteriology.
3. Electronics.

Salary:

The initial salary will depend on qualifications and experience, but will fall in the range $2,800 to $4,300 per annum.

Employee Benefits:

Superannuation and Medical-Hospital Insurance Plans in effect; generous provision is made for sick and annual leave. Application forms may be obtained from the Director of Research Personnel Defence Research Board, Department of National Defence, "A" Building, Ottawa, Ontario. Please refer to Competition No. 53-DRP-3.

Two Sales Engineers

Required by manufacturer of "code tested" convector radiators, unit-heaters, fluorescent and incandescent fixtures, etc., to contact architects, engineers, contractors, plumbers and electricians. To prepare plans and estimates. Must be bilingual. Good salary and commissions. Apply personally or write, Mr. Maurice Beaumont, Rosemount Industries Ltd., 2090 Moreau St., Montreal.

cifications. Prefer position offering advancement and incentive to ambitious engineer. Will accept position anywhere in Canada or U.S.A. Available on short notice. I have also several years of practical experience as electronics technician and electrician. File No. 666-W.

McGILL GRADUATE, Jr.E.I.C., 1950, age 25. Experience consists of 2½ years consulting work in plumbing, heating and ventilation seeks employment in the air conditioning and ventilating field. Other experience in electrical switchgear and illumination. File No. 691-W.

MECHANICAL ENGINEER, graduate 1940, age 37, married with 2 children. Has experience as manufacturing manager, superintendent, plant engineer, maintenance, construction, manufacturing methods, quality control and inspection in metal fabricating and process industries. Desires a job as manufacturing manager or superintendent, or plant engineer, in metal fabricating or process manufacturing preferably in Alberta, British Columbia or Ontario. File No. 1586-W.

ELECTRONICS ENGINER, age 40, Queen's University 1944. Miscellaneous industrial experience, ten years teaching experience in radio, television and industrial electronics, at technical school and college levels, experience in organizing and directing small staff, bilingual, desires position with small progressive electronics firm with an eventual view towards management. File No. 2625-W.

MECHANICAL ENGINEER, sound technical and administrative background gained through 15 years of practical engineering experience. Seeking position with greater scope than present senior supervisory position offers. B.Sc. in M.E., M.E.I.C. and P.E. of Ontario. Canadian, age 38, married. If there is a future in your organization for such an engineer please contact File No. 2745-W.

CIVIL ENGINEER, Jr.E.I.C., married, presently employed, with over 5 years experience in all types of structural design, field work and some sales, desires first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., A.M.I.C.E., P.Eng. 42, with 17 years of varied experience (England, U.S.A., Canada) in: structural design (industrial and municipal buildings, power stations, oil refinery plants, hospitals, schools, harbour and river works, bridges, concrete cylindrical shells and domes, prestressed concrete), sewerage, surveying, estimating. 3 years experience in supervision of const. Seeks responsible position. Also would be interested in partnership. File No. 3369-W.

MANUFACTURING EXECUTIVE with sound administrative ability and successful record with leading Canadian Company offers rare combination of production and engineering experience in sheet metal, machine shop and electrical appliance fields. Graduate engineer, M.E.I.C., age 34, married. Interested in works management position with progressive medium sized company File No. 3392-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., McGill 1951, P.Eng., Quebec. Age 31 years, married, two children. Bilingual. Veteran 5½ years R.C.N. Familiar with West Indies, South America, South Africa, India, Egypt, Britain. Experienced one and one half years city engineering, six months railway maintenance of way; two years supervision of construction of biofilter sewage treatment plant, water filtration plant, sewerage system, airport facilities, for consulting engineer. References and resume on request. Presently employed Montreal area. Seeks further opportunity in Canadian or foreign employment. File No. 3788-W.

CHEMICAL ENGINEER, B.Sc., Alberta 1949, P.Eng., Alberta, Jr.E.I.C., war veteran, married. Experience operation of municipal lime-soda softening plant and boiler water treatment high pressure turbo-generator plant, desires change to more progressive position where past experience may be applied. File No. 3897-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc. (University in Austria, 1944), good Canadian experience, age 36, married, development and research minded, extremely good knowledge of theoretical and applied engineering sciences, well founded machine shop practice and 8 years of engineering practice in development, research and designing of machinery, equipment and tools, wants a responsible position with good opportunities, or independent work. File No. 3990-W.

ELECTRICAL ENGINEER desires position with consulting firm or utility. Jr.E.I.C., B.Sc.E.E., University of Manitoba, 1949, Canadian citizen, age 26, married. Experience record: 1949-50 electrical designer-draughtsman with well known firm of consultant engineers in Los Angeles, Calif., on steam power plant, substation and transmission line projects. 1950-52 on active duty in U.S. Army, assigned to guided missile centre as electrical engineer on related power and lighting projects. At present with former employer as electrical designer on substation, control house; transmission line project, but contemplate returning to Canada if suitable employment is found. References and further details on request. File No. 4030-W.

EXPERIENCED VIBRATION ENGINEER, seeks part-time consultation work for solving industrial problems on vibration isolation and noise attenuation. File No. 4091-W.

MECHANICAL ENGINEER offers services as part-time consultant for design of special purpose machines and preparation of shop detail drawings. File No. 4091-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., Sask. 1949, age 25, single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng. (McGill 1951). Experience: two year training course with Canadian Westinghouse Company including courses toward a Masters Degree. Desires position with consulting firm in Montreal, in power or industrial electronics field. Presently employed in Ontario. Available on approximately one month's notice. Age 25, married. File No. 4235-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.E. (mechanical) Nova Scotia Technical College 1949. Several years experience in machine shop practice, some experience in the design and installation of mechanical drying systems, three summers experience on survey parties, desires an engineering position, not necessarily in the mechanical field, in or in the vicinity of St. Johns' Newfoundland. File No. 4255-W.

ELECTRICAL ENGINEER, P.Eng. (Ont.) B.A.Sc. U.T. 1951 age 28, married. Have completed training course with large electrical manufacturer. Additional experience on power and lighting layouts for large buildings. Prefer position in plant engineering or inspection work in vicinity of Toronto. File No. 4256-W.

ENGINEERING PHYSICIST Ph.D., British. Married with about 20 years experience in industry and government service desires responsible position in Canada. Special experience: vibrations, noise, wear, metrology and design of research apparatus for laboratory, test bed and field use, particular on steam and gas turbines and gears. File No. 4257-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc. University of Alberta, 1949. Test course graduate and two years field experience on power apparatus. Desires position in Western Canada. Age 30, married with one child. File No. 4263-W.

CIVIL ENGINEER, B.A. degree in engineering, Cambridge, England. 1945. A.M.I.C.E., M.E.I.C., single. Experience in airfield work in Malaya. Hydroelectric and other works in the United Kingdom. Since 1948 and until leaving for Canada in 1952 employed by a well known firm of consulting civil engineer in London. Experience in reinforced concrete design, hydraulic design and investigations, site experience on tun-

Opportunity for Electrical Engineer

Required for design of electrical installation in generating stations and substations. Will be responsible for lay out, purchase specifications, scheduling and general supervision of installations and placing in service. Excellent fringe benefits including attractive pension plan. Apply stating salary required and giving full details of qualifications and experience to W. B. Clipsham, Chief Engineer, Saskatchewan Power Corporation, Regina, Saskatchewan.

nels, dams and associated works. Presently employed as resident engineer on the supervision of defence contracts in the Province of Alberta and comprising hangars, other buildings, water supply project and service. Would like work on engineering supervision, or administrative staff or on investigations, and preferably in the Provinces of British Columbia or Ontario or Eastern Canada. File No. 4264-W.

PARTNER WANTED to form construction company with McGill 1944 graduate M.E.I.C., who has had previous experience with own company. Applicant should have available capital and experience. File No. 4268-W.

CIVIL ENGINEER, Jr.E.I.C., available. Experience includes one year in Canada. Interested in field work on construction or design with highway department, railway or construction firm. File No. 4270-W.

ELECTRICAL ENGINEER, age 31 years; formerly electrical superintendent of large mining and milling property, at present distribution superintendent in city of 300,000; experience in hydro, steam, and diesel plant operation and maintenance, electrical construction of lines and substations, electrical shop operation. Desires similar work of equal or greater responsibility in Canada. File No. 4271-W.

CHEMICAL ENGINEER, 43, graduated at the Technical University in Danzig, Europe, in 1935 with practice in analytical and research work in Poland and several years of activity in open-hearth steel plants as production engineer and assistant manager in Poland and in South America, seeks an adequate position preferably in Quebec or Ontario. File No. 4272-W.

CIVIL ENGINEER, Jr.E.I.C., McGill 1951, married, one child. Two years experience in steel, concrete, and timber design, architectural planning on office and industrial buildings. One year on projects involving piping layouts for the petroleum industry. Seeks further opportunity for advancement and diversified work. Available on reasonable notice to present employer. File No. 4273-W.

AGRICULTURAL ENGINEER, 1942 graduate, M.E.I.C., P.Eng., (Sask.) age 37, married. Ten years experience with oil companies. Process work, drafting, in the production department, drafting, designing, construction and maintenance in the marketing department. Desires position in West. Available on reasonable notice to present employer. File No. 4277-W.

CIVIL ENGINEER, B.E., National University of Ireland. Arriving Montreal approximately August 15th. 2 years experience in structural steel design, and draughting of steel-framed buildings and various types of steel roofs. Also some surveying experience. Position in housing, road construction, sewer and water services preferred but willing to remain in same line if suitable employment offered. Location preferably Montreal or Eastern Ontario. Age 23, married. File No. 4283-W.

INSTRUMENT ENGINEER, graduate chemical engineer, Jr.E.I.C., McGill 1950, with three years experience in instrumentation, desires a position in the chemical or petrochemical industries. File No. 4284-W.

MECHANICAL ENGINEER, university graduate. Age 54, married, 2 children. Over 10 years experience as factory manager, 4 years experience as field engineer. Experience covers production, administration, maintenance, standards, plating, etc., 1½ years working in Canada. Presently employed and available from the 1st of August. Fluent in French, German, Polish and Czech. Depending on nature of position would consider going elsewhere. Willing to start in junior position with the possibility of advancement. At present located in Montreal (Longueuil). File No. 4287-W.

ELECTRICAL ENGINER, S.E.I.C., B.Sc., 1950, B.Eng., 1952 McGill, age 25, married. Experience: 2 years during summers, surveying prospecting, 1 year in design group for a chemical plant. Desire a position with wider scope and responsibility, preferably with a small progressive firm either in engineering or sales engineering. Location preferred Montreal but not mandatory. File No. 4288-W.

CIVIL ENGINEER, B.A.Sc. (Honors-Toronto) P.Eng., (Ont.) Jr.E.I.C., seeks a position with an aggressive company in Vancouver or vicinity that needs a man who is well experienced in all phases of bridge design, both reinforced concrete and structural steel, who has also served as a resident engineer on a large road construction project, who has an abundance of energy and initiative. File No. 4289-W.

YOUNG ENGINEERING EXECUTIVE, experienced sales and general management, M.E.I.C., M.S.A.E., D.L.C. (Eng.), A.M.I.I.A., Grad. R.Ae.S., age 30. Experience covers production, research, sales-domestic and export, advertising, general management over a wide range of engineering products including jet engines, air, oil and fuel filters, abrasives, fans and blowers, machine tools. Widely travelled in Canada, U.S.A., South America and Europe. Experienced in preparing technical articles, delivering lectures. Would like to join a progressive organization where drive, initiative and organizing ability would be utilized to the fullest extent. File No 4295-W.

CHEMICAL ENGINEER, graduate (1950) M.C.I.C., age 27, single. Three years production experience in large chemical factory including two years in production of caustic chlorine by electrolysis also experience in pulp and paper plant. Interested in production, pulp and paper, chemical, paint and varnish industry. Available on short notice. File No. 4299-W.

GRADUATE MECHANICAL ENGINEER, married with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., M.I., Mech.E., experience includes apprenticeship 7 years draughting, office and research, technical executive on foreign railways, 5 years works manager railway workshops. At present mechanical superintendent of sulphite pulp mill. Would prefer change to Ontario or Maritime Provinces. File No. 4302-W.

GRADUATE NOTTINGHAM UNIVERSITY, England, 1st class certificate in mining. Experience includes technical work as planner on major reorganization programme research engineer and chief safety engineer. One year in Canada engaged in design and plant engineering. Wishes to relocate in responsible position in production processes. File No. 4303-W.

MECHANICAL ENGINEER, 25 H.N.C., G.I., Mech.E. Indentured apprenticeship; 4 years Junior Development Engineer, production and prototype machinery; 2 years design office on diesel and gas engines, arriving September in British Columbia. Presently employed in Ontario. Seeks position in B.C. File No. 4311-W.

STRUCTURAL ENGINEER, P.Eng. 3 years experience in steel and concrete wants part time employment from Hamilton-Toronto area. File No. 4313-W.

CIVIL ENGINEER, B.Sc. Queen's University, Belfast, 1951. Age 23, recently arrived in Canada, seek position with structural engineering firm, location unimportant. Keen to tackle difficult problems. Experience in structural steel and reinforced concrete design, estimating, preparation of bills of quantities, and model testing. Also some surveying experience and at present on building construction work in Toronto. File No. 4314-W.

MECHANICAL ENGINEERING DESIGNER A.M.I.Mech.E. A.F.R. Ae.S., English immigrant, seeks position in Ontario, Montreal or West. Experience on gas turbines, axial flow compressors and reciprocating aero engines. Will consider wide range of activity, including design, sales or testing. Presently employed in Maritimes. File No. 4315-W.

CIVIL ENGINEER, Jr.E.I.C. Nova Scotia Tech., 1951. Age 30 (married, two children). Experience includes field and office work with Maritime contractor on bituman paving, water and sewer installation. Past two years as assistant engineer with Public Works Department of Tanganyika, East Africa. Experienced in all phases of engineering concerned with the development and maintenance of roads, airports, buildings, water supply and sanitation. Desires position with consultant or contractor with opportunity of advancement. Location preferably Toronto or area. Available early February 1954. File No. 4316-W.

ELECTRONICS ENGINEER, Jr.E.I.C., B.A. Ottawa, 1943. B.A.Sc. Laval, 1949. Age 30, married with children, bilingual. Four years experience in radio physics, equipment design and basic research. Desires job offering good advancement possibilities. File No. 4317-W.

CIVIL ENGINEER, graduate Delft Technological University, Holland (specialization: hydraulics, dikebuilding), age 28, 1½ years experience in reinforced concrete structures and surveying; interested in prestressed concrete. Presently employed as instrumentman in Western Canada. Desires position with possibilities for advancement. Available on about one week notice anywhere in Canada. File No. 4318-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. N.S.T.C. Age 28, single. Considerable experience in housing projects and timber construction. Some architectural experience, concrete form design on large hydro-project, pipe design and field supervision. Interested in isolation work in Northern Canada or South America, but will consider other foreign positions. Minimum salary for isolation jobs $7500. I would like experience and do not mind responsibility. Available on short notice. File No. 4319-W.

MECHANICAL ENGINEER, 52 graduate. Single. Desires position in research and development, automotive or allied fields. Presently employed in the pulp and paper industry. Bilingual. Preferred location Montreal or Ottawa area. File No. 4320-W.

ENGINEERING PHYSICIST, S.E.I.C., B.C.S., Georgia, 1950 (Psychology with chemistry) B.Eng. North Carolina 1950 (Nuclear Physics, reactor theory with mathematics). Fluent German, French, English. Two years general practical electronics, three years university teaching experience. Canadian army veteran. Desires permanent position with opportunity of furthering interests in research organization. Location anywhere in Canada. File No. 4321-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill, 1950, also graduate in management and business administration (McGill 1953). Age 28, married, one child. Three years experience with large Canadian manufacturing concern. Duties have included product design, cost reduction work, product engineering and engineering liaison with all manufacturing department and suppliers. Requires responsible position with broad scope for an engineer with production and business administration ability. File No. 4323-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 24, single, experience includes 18 months pulp and paper industry, 8 months materials handling. Desire permanent position with opportunities for advancement. Location preferably Maritime Provinces. File No. 4322-W.

PROFESSIONAL ENGINEER, age 35. Married, B.Sc. Civil Engineering 1941. A.M.I.C.E., A.M.I. Struct. E. Specialist in design and construction of reinforced concrete framed and factory buildings and industrial plant structures including foundations, sound knowledge of structural steelwork design and soil mechanics. Seeks responsible position with firm of engineers or architects. Preferably with view to eventual partnership. File No. 4041-W.

News of the Branches

Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings

Amherst

J. J. Leydon, Jr.E.I.C.,
Secretary-Treasurer

Activities Reviewed

The Amherst Branch held its annual election of officers meeting on June 26 at the Amherst Hotel.

The retiring chairman, C. D. Carter, heard the year-end report of Ron McIntyre, the outgoing secretary, who summarized the activity of this newly-formed branch. Seven meetings were held during the year, the first two mainly concerned with the organization of the branch and the election of officers. Three of the meetings were highlighted by talks given by Amherst Branch members. Dr. H. W. McKiel addressed a meeting in December on the subject "The Engineering Institute of Canada." He traced the history of the E.I.C. from its beginning in 1887 as the Canadian Society of Civil Engineers mentioning also the formation of the Nova Scotia Society of Engineers which embraced among others those engineers not eligible for membership in the Canadian Society of Civil Engineers. As a point of interest, Dr. McKiel pointed out that Montreal, Halifax and Saint John were the only branches mentioned in the first issue of the *Journal* published in 1918. In January H. L. Steel gave an excellent talk on "Structural Steel," and in April L. F. Kirkpatrick addressed the meeting on "Thermal Power as Applied at Canada Electric".

Highlight of the year's activity was the March inaugural dinner, attended by Dr. J. B. Stirling, immediate past-president, E.I.C., Mrs. Stirling and Dr. L. A. Wright, general secretary.

The principal business of the evening was the election of a new slate of officers for the forthcoming term. The meeting approved the election of the following officers: L. F. Kirkpatrick, chairman; D. Robson, vice-chairman; and J. J. Leydon, secretary-treasurer. J. R. MacQuarrie, A. G. Baxter and D. H. Stonehouse were elected to the executive committee.

The meeting extended a vote of thanks to retiring officers, C. D. Carter and Ron MacIntyre, for their splendid work during the past year and to Norman Ritchie for his report on the visit to the Annual Meeting held this year in Halifax.

Central British Columbia

H. L. Topham, *Jr.E.I.C.*,
Secretary-Treasurer

M. L. Zirul, M.E.I.C.,
Acting Secretary

Meeting with B.C. Engineering Society

A joint general dinner meeting of the Central B.C. Engineering Society and the Engineering Institute of Canada was held on the *S.S. Sicamous* at Penticton on Friday, July 10. A total of 38 persons, including the guests, were present. Guest speaker at the meeting was Reg Thurber of Victoria. The public relations officer for the society, Mrs. Francis, of Vancouver was also present. The meeting was sponsored by the Engineering Society.

Paul Walker, executive member of Penticton, occupied the chair for the Society in the absence of the regular president and vice-president.

It was decided that Vice-President R. Harris assume the responsibilities of President S. D. Pope for the remainder of the season in view of the latter's transfer to the coast.

Public Relations Report

Mrs. Francis gave a report on the public relations committee progress. She stressed the necessity of bringing the importance of the work carried on by the engineers, to the public. Engineers were advised to use the media of the press and the radio where possible to advertise the work that is being done by them. All members must make an effort to advance this public relations work and if approached by newspaper or radio representatives or other writers to be as co-operative as possible in giving them information, she said.

Student Guidance Discussed by E.I.C.

The chairman of the Branch, R. L. Bigg, took over the chair for the Institute portion of the meeting. Minutes of the May meeting in Kamloops were read and adopted.

The matter of student guidance work was introduced by the chairman. Paul Walker advised that he had been approached and had addressed the graduating class at the Penticton High School this year. The chairman said that he had done the same at the Kamloops High School in place of the student guidance chairman, F. McCallum, who was ill at the time. Mr. Walker added that he had been asked by the high school principal if other engineers might be available to address high school clubs from time to time and asked for names of any who might be available for this work.

The next joint meeting at Kelowna, August 14, to be sponsored by the E.I.C., would be a Ladies' Night, it was announced.

Reg Thurber Guest Speaker

The speaker of the meeting, Reg Thurber, materials engineer, Department of Public Works, Victoria, was introduced by Lloyd Willis of Penticton.

Mr. Thurber pointed out that the application of the science of soil mechanics is comparatively new in British Columbia but that the science is now being employed by the Department of Public Works through his office in the distributing of materials for highway work.

The application of soil mechanics to road construction has been made necessary by the heavy traffic imposing tremendous wheel loadings, and by alignment requirements that make heavy cuts and fills necessary, he said. The size and weight of trucks and buses with their corresponding heavy wheel loadings has increased tremendously, especially since the last war, and roads that have been satisfactory up until recently are now rapidly breaking down. This has necessitated the placing of stringent limits on traffic on the older roads and the application of higher design specifications employing soil mechanics theory in the construction of new highways. The speaker went on to describe the eight basic soil tests and the practical application of these tests.

The talk was very well received and a vote of thanks was tendered the

speaker by H. R. Hatfield on behalf of the meeting.

E.I.C. Executive Meeting

A meeting of the executive of the Central British Columbia Branch of the Institute was held in conjunction with the joint meeting on July 10.

The executive members attending this meeting were R. L. Bigg, chairman; W. H. Ker; H. R. Hatfield; A. F. Joplin; and M. L. Zirul.

Cornwall

L. H. SNELGROVE, JR.E.I.C.,
Secretary-Treasurer

J. E. PESCOD,
Branch News Editor

Air Vice-Marshal James Guest Speaker

Air Vice-Marshal A. L. James, R.C.A.F., was special speaker at a dinner meeting of the Cornwall Branch of the Engineering Institute of Canada, held on the evening of June 23, at the Cornwall Golf and Country Club. The speaker who is Air Officer Commanding, Air Defence Command, spoke on "Canada's Air Defences."

A/V/M James graduated in engineering from McGill University in 1924 and joined the R.C.A.F. after graduation. After serving in several flying and engineering posts he took a post-graduate course in aeronautical engineering in England. In the years prior to and during the last war he served in various posts of increasing responsibility.

In 1951 he was made Air Officer Commanding, Air Defence Command, charged with the job of building up an air defence system in co-operation with the United States Air Force, to defend the North American continent against air attack.

The full text of A/V/M James' address is reported in the May issue of *The Engineering Journal.*

About 50 members were present at the meeting, the last to be held until autumn.

Drummond Giles introduced the speaker; Bob Blackett thanked him.

John Hawkes was chairman of the meeting.

Eastern Townships

T. E. CHALMER, JR.E.I.C.
Secretary-Treasurer

Branch Conducts Professional Development Course

During the winter season 1952-53, from November through April, the Eastern Townships Branch, E.I.C., organized and carried out an Engineers Professional Development Course for branch members. The course was comprised of three lectures each month, or 14 in all. Total enrolment was 31 members, while attendance varied from 12 to 21.

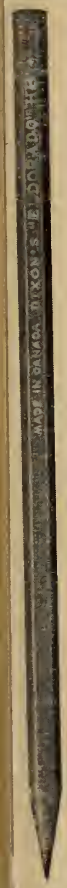
Encouragement by the field secretary of the Institute, Col. L. F. Grant, led to a Committee being formed in October, when a program for the season was drawn up. Since some 40 per cent of the participants would likely be from out of town, it was decided to hold three lectures a month at the Ecole Polytechnique in Sherbrooke.

Subjects included two lectures on Public Speaking; three on Labour Relations, from points of view of Management, Labour and the Public; Labour Law; How Business Systems Operate; Business Management; What Industry Expects from the Engineer; the Economic Situation; Corporate Finance; Law — Civil Code; the Stock Exchange; and Obligations of the Engineer.

Speakers included professors from McGill University and Bishops College, a representative list of industrial leaders, as well as a number of prominent professional men and economists The attendance and the interest shown, testified to the good judgment on the part of the committee in its choice of speakers.

Branch members and affiliates were assessed $6.00 for the course, while the fee for non-members was $10.00. It was felt the course should be self-supporting, but the Branch underwrote the project to the extent of $100.00 should such aid become necessary. Fees collected of $206.00 paid for speakers and miscellaneous expenses, leaving a balance on hand of $53.00, without the need of drawing on Branch funds.

At the end of the course letters were sent employers of members showing 50 per cent or more attendance. It is planned to continue with a supplemental course next season, with a smaller number of topics suggested, to be



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D. K. Sherry and H. Rankin were co-chairmen of the course.

Hamliton

J. A. Reid, jr.e.i.c.,
Secretary-Treasury

F. S. Gue, jr.e.i.c.,
Branch News Editor

Fall Activities Plonned

Activities of the Hamilton Branch for the fall and winter season are scheduled to begin September 17, when the Branch will have the opportunity of visiting the Dominion Glass Co. plant in Hamilton.

The 1953 Engineers Ball Committee is active and plans for this annual function are well crystallized by now. The Ball is to take place Friday, October 9, at the Burgundy Room in downtown Hamilton, and will take the form of a buffet supper-dance. This is a departure from practice of past years, the suggestion having been put forward by several and enthusiastically received by many others over the past several months. Admission will probably be $5.00 which will include the supper.

Montreal

R. J. Harvey, m.e.i.c.,
Secretary-Treasurer

S. T. Rudkin, m.e.i.c.,
Publicity Vice-Chairman

Fall Seoson Storts

As the fall season approaches, heralding the resumption of full scale activities of the Institute, it seems of more than passing interest to record that our Branch Executive has been far from idle during the summer months. One worthwhile accomplishment has been the adoption of a definite and constructive policy towards the not insignificant number of members of the British institutions of engineers who have migrated to our shores during the past several years.

The following letter sent out by Branch Chairman Gerry Martin, to some 90 such members in the Montreal area implements the policy established by Council:—

August 17, 1953

TO: Resident members of the British institutions of chemical, civil and electrical engineers

Dear Sir:—

Last summer the Engineering Institute of Canada acted as hosts to the presidents and secretaries of the British Institutions of civil, mechanical and electrical engineers during their visit to this country. Your name was sent to E.I.C. headquarters as a member of one of these institutions residing within the Montreal Branch area.

You may be aware that at a recent Conference of Commonwealth Engineering Societies, an agreement was adopted whereby a member of the institution would be offered guest membership facilities for a period of six months by the engineering society in the country within the Commonwealth to which he had moved.

The Montreal Branch of the E.I.C. wishes to take this opportunity to extend to you a most cordial welcome to its meetings, be they social, technical or otherwise.

During the last few years we have established several sections where technical papers are presented and discussed by a group of specialized engineers. They are Chemical, Civil, Electrical, Management, Mechanical and Transportation. We feel sure that they would interest you. Moreover, we should appreciate the contributions you can make by offering your comments based on experience gained abroad. Furthermore, our members are desirous of meeting you and, we trust, that you will appreciate knowing your Canadian confreres.

For these reasons, we have made arrangements to have your name put on the mailing list of the Montreal Branch, without any obligation on your part, for a period of six months commencing with our technical program activities this fall.

It is indeed with pleasure that we anticipate meeting with you.

Yours very truly,

(sgd.) G. N. Martin, Chairman,
Montreal Branch, E.I.C.

It might be stated that this guest membership for the six months period includes *The Engineering Journal*.

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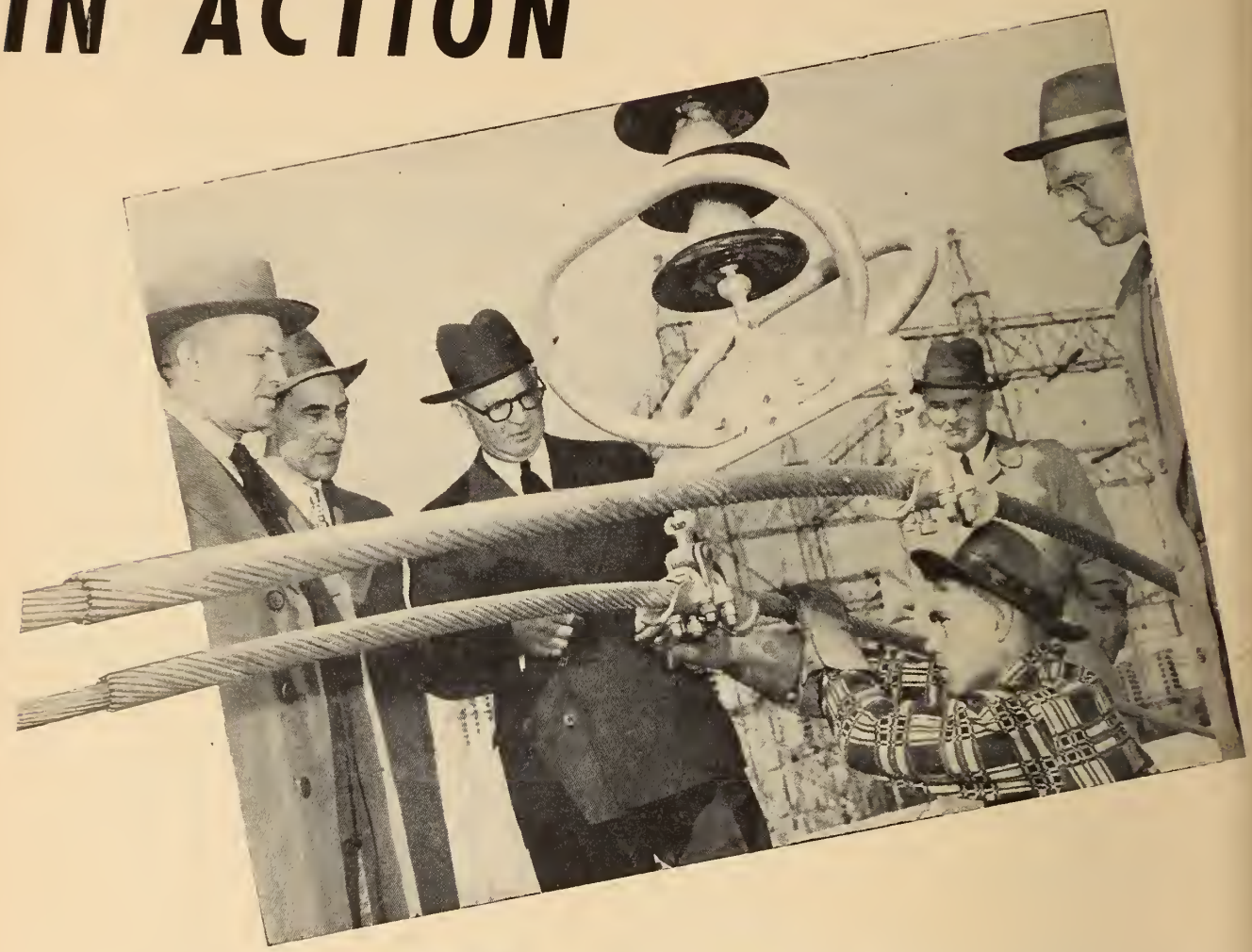

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Shown in the picture are, left to right: J. P. Froser, ossistant chief engineer, electrical division; F. O. Wollaston, superintendent of design, engineering division; T. Ingledow, vice-president and chief engineer; J. H. Steede, executive assistant to vice-president and chief engineer; H. W. Smith, assistont chief engineer, engineering division.

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MONTREAL WINNIPEG EDMONTON VANCOUVER

As in past years the Montreal Branch will continue to work with members of the American Societies of engineers residing in the area. All program activities of our electrical section and of the A.I.E.E. are integrated through our program committee, and invitations to attend our meetings are addressed to all Montreal members of the A.S.M.E. and A.I.Ch.E.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

Electrical Section

L. E. Marrin, Jr.E.I.C.,
News Editor

L. M. Connors Guest Speaker

The highly successful papers program for the Electrical Section was brought to a close for this season with the presentation of a paper entitled "Lightning Protection of Substations" by L. M. Connors of Canadian General Electric Company Limited.

Mr. Connors, no stranger to Winnipeg, was introduced by T. J. Halme.

Lightning has long been recognized as one of the most serious hazards to equipment and continuity of service throughout the development of the electrical industry, said Mr. Connors. By obtaining a better understanding of lightning phenomena and the severity of their effects upon electrical apparatus, it has been possible to develop more effective safeguards for apparatus and service.

The overhead transmission system is most vulnerable to lightning because of its relatively greater exposure. The protection of station or terminal apparatus is somewhat different because experience and studies of lightning have shown that it is uneconomical to build into the terminal equipment sufficient dielectrical strength to withstand unmodified lightning strokes. However, because of the importance of the apparatus to the whole system, it is possible to go to greater expense in reducing the lightning voltages in this area by the use of lightning arresters, he said. Illustrating his talk with numerous slides. Mr. Connors went on to discuss the inter-related phases of this protection problem and the proper engineering considerations required.

Although it is not possible to prevent lightning from striking objects on the earth, it was Mr. Connors' opinion that it is possible to practically immunize lines and substation equipment from its damaging effects. And relative to the cost of the equipment, the cost of such protection is an inexpensive form of insurance.

Another feature of the evening was the showing of "Lightning Masters", a beautifully coloured movie illustrating the behaviour of lightning surges and some of the developments being done on the subject.

A discussion period followed and was concluded by a well deserved vote of thanks to the guest, Mr. Connors, by Paul Shane.

C. D. Osterland, section chairman, brought the evening to a close, informing the members that the papers program would be resumed in the fall.

Shawinigan Falls

When these pictures appeared in the July issue of the *Journal*, on pages 889 and 916, there was some confusion in identification. The names of some St. Maurice Valley Branch members and guests photographed at meetings in April last, are listed correctly below.

Standing, left to right: L. A. Robillard, now Branch chairman; President J. B. Stirling, D. E. Covey, the past chairman, and C. Yoshida, past secretary-treasurer.

St. Maurice Valley Branch entertains a distinguished visitor. Left to right: His Worship Mayor Francois Roy of Shawinigan Falls; Dr. Lillian M. Gilbreth, D. E. Covey, then branch chairman, and Mrs. Covey; Prof. H. O. Keay, Robert Dorion and Charles Yoshida.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Planning elementary school buildings. N. L. Engerhardt et al. New York. F. W. Dodge Corp., 1953. 268 pp., illus.

"The design of an elementary school begins with the design of the things that take place in it. The pattern of activities takes its shape from the desires of society for its young."

Bearing out the above statement, this present volume certainly indicates that we wish nothing but the best for the rising generation.

With the decentralization of the urban populations, the school building now fulfills a slightly different role to that of former days. It is more inclined to be a community centre after classroom hours, or at least a meeting place for home and school groups.

Also, it may be a result of the over-vitamin consciousness of our age, or the distances travelled to schools by children picked up by the local bus from widely scattered areas, but no school, be it ever so junior, is properly equipped today without a lunch room and cafeteria.

Plans in this volume also include libraries, assembly and community rooms, playrooms, the multi-purpose room, and administrative and teacher space.

Alas, the bicycles, formerly piled row on row against the school wall are a thing of the past, as bicycle and automobile parking space is now considered another necessary adjunct. Even the flag is provided with a built in storage box when not in use. Fire extinguishers now no longer hang on the wall, they are recessed in a niche. And how they can be seen from a distance in the hurried moment they are needed I find an unanswerable question. Children's wet clothes no longer hang on pegs, they also are in niches in the wall. But these, say the authors, "should be provided with mechanical warm air ventilation."

Record playing arrangements, radio and TV are also to be included in today's school, as are also motion pictures, and conduits for the motion picture speaker cables.

And we think the final blow in this volume, is the installation of electrically operated vacuum eraser cleaners! How times have changed.

This book will interest, and intrigue you. Perchance also it will give rise to the controversial question — why take the taxpayers' money for public buildings when he would prefer more adequate personal living space. It seems as public buildings become more elaborate, the private house becomes more inadequate for comfortable living. Whatever party you belong to, you should see this book.

—E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Coast erosion and protection: studies in causes and remedies. R. R. Minikin. London, Chapman and Hall, Toronto, British book service, 1952. 240 pp., illus., $6.00.

The object of this book is to provide a background for a better understanding of shoreline stability in a readable form. There is little reliable official information available regarding coast erosion, and the author was encouraged by this lack to expand his earlier articles into the present book. Much of the information given is based on personal observation, and the book is well illustrated with diagrams and photographs, the majority being of beaches and installations in England. Causes of erosion and the form it takes on various types of beach, different methods of protection, and their several functions, are all discussed in considerable detail. The author emphasizes the fact that it is impossible to control the sea completely, and that only with a thorough understanding of the whole subject may a working compromise be evolved.

Diesel engine manual, 2nd ed. E. Molloy. London, George Newnes Ltd., Toronto, British book service, 1953. 224 pp., diagrs., $4.00.

The installation, maintenance and operation of stationary, marine, and automobile diesel engines of the two- and four-stroke class, the IC/CI type, and other designs now in use, are discussed in this manual. It begins with the basic principles of the compression-ignition engine and proceeds to various types of fuel-injection equipment with special notes on the products of some of the leading English manufacturers. Improvements to different diesel engine components, e.g. the new Robey governor, and the Ruston fuel pump and injector, are described in their respective sections. A complete chap-

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Short subject bibliographies are compiled on request.

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Please give as much detail as possible when requesting information of either type.

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ter is devoted to governors, and to testing methods for I.H.P. and B.H.P. and exhaust gas analysis tests. The concluding chapter contains valve and injection timing diagrams for most of the leading types of industrial and automobile oil engines, which provide a convenient means of comparison between different types of engines. This book, well illustrated and indexed, will interest erectors, and installation and plant engineers concerned especially with British manufactured engines and parts.

Examples of the design of reinforced concrete buildings in accordance with the British Standards Codes. C. E. Reynolds. London, Concrete Publications, c1952. 214 pp., figs., $2.40.

Designs for the principle parts of a reinforced concrete building are considered in this book. These include roofs; floors; walls; stairs; and foundations; both for beam-and-slab and flat-slab structures. These designs, and the loads a concrete structure can bear are discussed in the first part of the book, together with the stresses, resistance to bending, and shearing forces of beams. In Part 2 there are the actual calculations and drawings for the design of the parts discussed in the first section of the book. All the designs and calculations conform to the recommendations of the British Standard Code of Practice No. 114, and its sub-codes, and the author includes many comments on the application of these codes. There are tables and graphs summarizing the requirements of the codes, and for quick assessment of the bending movements in continuous beams; the shearing resistance of groups of bars; allowable loads on concentrically loaded columns, and other problems found in the design of reinforced concrete structures.

Historical metrology. A. E. Berriman. Toronto, Dent, 1953. 224 pp., illus., $3.50.

Many readers will be intrigued by this story of weights and measures, from the cubes of the ancient Indus Valley to the systems used in modern America and Great Britain. Interesting historical facts, such as the oldest weight in the world or the intended dimensions of the Great Pyramid, are interspersed with precise tables of the principal ancient standards of length and mass and such information as the relationship of the U.S. bushel to the U.S. gallon. All the important metrological systems, including Chinese, Russian, Babylonian and Egyptian, are covered. These are followed by a chronological history of the metric system and historical aspects of English metrology. The book is illustrated and there is a lengthy classified bibliography, and an index.

Major faults on power systems. A. F. Lyle. London, Chapman & Hall, Toronto, British book service, 1952. 355 pp., illus., $9.00. (Monographs on electrical engineering, volume 13).

The author of this monograph here examines the behaviour of power systems under fault conditions with the hope that this will give the practising engineer a guide to the cause and prevention of failures and outages resulting from such conditions. This also involves the discussion of protective equipment, including surge-arrestors, absorbers, and suppressors, as well as relay systems and circuit-breakers. Simple cases and representative problems have been stated and worked out in the text, and typical protective systems in actual use are described in relation to calculated fault currents, using the theorem of symmetrical components. Breakdowns are classified according to the reason for their occurrence: deterioration of insulation; damage due to ulterior causes, such as the perching of birds; direct lightning strokes or consequent disturbances. There is also a rough classification of the type of damage resulting from these faults, with the dangerous conditions which may occur, such as fires. Separate chapters are devoted to fault calculations and the various types of protective gear. In the last three chapters the author considers the design of switchgear structures, the consistency of system designs and the question of neutral inversion. In the appendices we find an analysis of circuit-breaker test results. The book is adequately illustrated and has a detailed subject index.

Mechanics of materials. Seibert Fairman and C. S. Cutshall. New York, Wiley, c1953. 420 pp., illus., $6.40.

Written for engineering students and instructors, this textbook presents an unusually large number of problems to be solved, with their solutions, to aid in ap-

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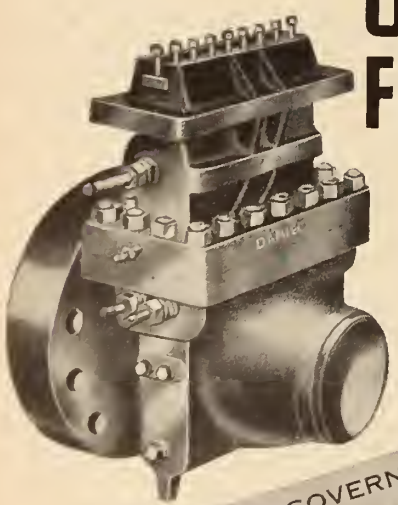

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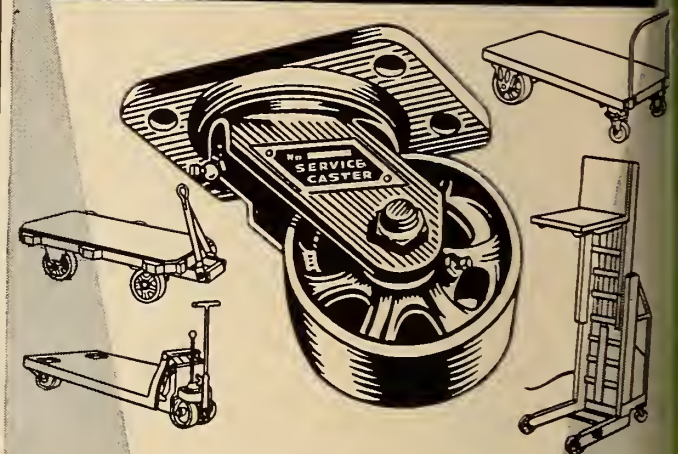

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plying the theory. The topics covered are quite elementary in nature and do not include those concerned with special fields of engineering. Each chapter is well developed with the problems ranging from simple to more difficult ones. The authors have selected for discussion and explanation such topics as stress and strain, riveted and welded joints, torsion, shear, moment and stresses in beams, deflection of beams and statically indeterminate beams, columns, combined stresses, and strain energy and impact. A large number of diagrams and formulae illustrate the text and in the Appendix are found tables dealing with specific weights of materials, allowable unit stresses in structural timber and in metals, properties of structural sections, etc. Both authors are professors of engineering mechanics at Purdue University and have had a great deal of experience in the teaching of strength of materials. There is a detailed index to the book.

Newnes electrical pocket book, 11th ed., 1952. E. Molloy, ed. London, George Newnes Ltd., Toronto, British book service, 1952. 375 pp., illus., $2.00.

This small reference book begins with a section on theoretical groundwork then proceeds to technical descriptions of such electrical apparatus and processes as accumulators, battery charging, lighting, magnetism, motors, rectifiers, transmission, switchgear, automatic circuit breakers, wiring and installation, arc welding, electronics, and high frequency heating. In this edition the information on electrical equipment of buildings has been changed to conform with the 12th edition of the I.E.E. wiring rules. New sections deal with electrode boilers, electronic voltmeters, and stud welding. The book is well illustrated and indexed.

Newnes engineer's reference book, 5th ed. F. J. Camm, ed. London, George Newnes, Toronto, British book service, 1952. 1,909 pp., diagrs., $12.75.

More than 150 pages of new matter have been included in this 5th edition, as well as over 300 tables and many new sections. It has been expanded from a reference book of mechanical engineering only to one covering civil, structural, automobile and aeronautical branches of the profession. It also contains information on gauge and toolmaking, foundryworking, die-casting, milling, wire-working, heating and ventilating, costing and production engineering, electro-plating, welding and time and motion study. There is new material on mechanics and mechanisms, broaching, single spindle automatics, lapping and honing, and gear cutting. The index has been greatly enlarged and now contains over 6,000 fully cross-referenced entries. British Standard specifications have been brought up-to-date and a large number of new illustrations introduced. At the beginning of the handbook are listed abbreviations, chemical symbols, engineering and scientific institutions in Great Britain, and mathematical tables. The last section contains tables of weights of various substances.

Plane surveying, 2nd ed. F. R. Theroux, L. A. Smith, L. V. Nothstine. New York, Pitman publishing corp., c1953. 407 pp., illus., $4.75.

This textbook was written for university students in elementary survey courses and attempts to present the most essential information in a concise form. Practical problems are presented and the illustrations and graphs are a further aid to understanding. The authors deal with such basic survey subjects as leveling, measurement with compass and transit, land survey computations, stadia and plane table surveying, curves, city surveying, mapping, hydrographic and photogrammetric surveying, earthwork and astronomical observations. Adjustments of all instruments are given in the last chapter rather than in the chapters where their uses are discussed. At the end of the book are found tables of stadia coefficients, logarithms and trigonometric formulas, and an index.

Remote control by radio; an amplitude-modulation and an impulse-modulation system. A. G. Bruinsma. Eindhoven, Philips' technical library, 1952. 96 pp., illus., $1.95 (U.S.).

This booklet describes the use of electronic valves in the technique of remote control by radio but is limited to the treatment of two systems. The first of these uses amplitude modulation and is in particular a system with two independent channels. The second system, which is covered in more detail, is based on the impulse technique and uses eight channels. Various matters connected with this system are considered e.g. generating, separating and detecting the channel pulses, detection of the I.F. signal, and cross-talk of the channels. One chapter describes a receiver constructed for pulse-height modulation with eight channels and is followed by a description of a demonstration boat equipped with the eight-channel receiver. The main data of the "Miniwatt" valves employed are given in the appendix. The book contains illustrations but no index.

Les rendements planetaires en diagrammes. G. Fleischel. Paris, Dunod, 1953. 52 pp., diagrs., $4.75.

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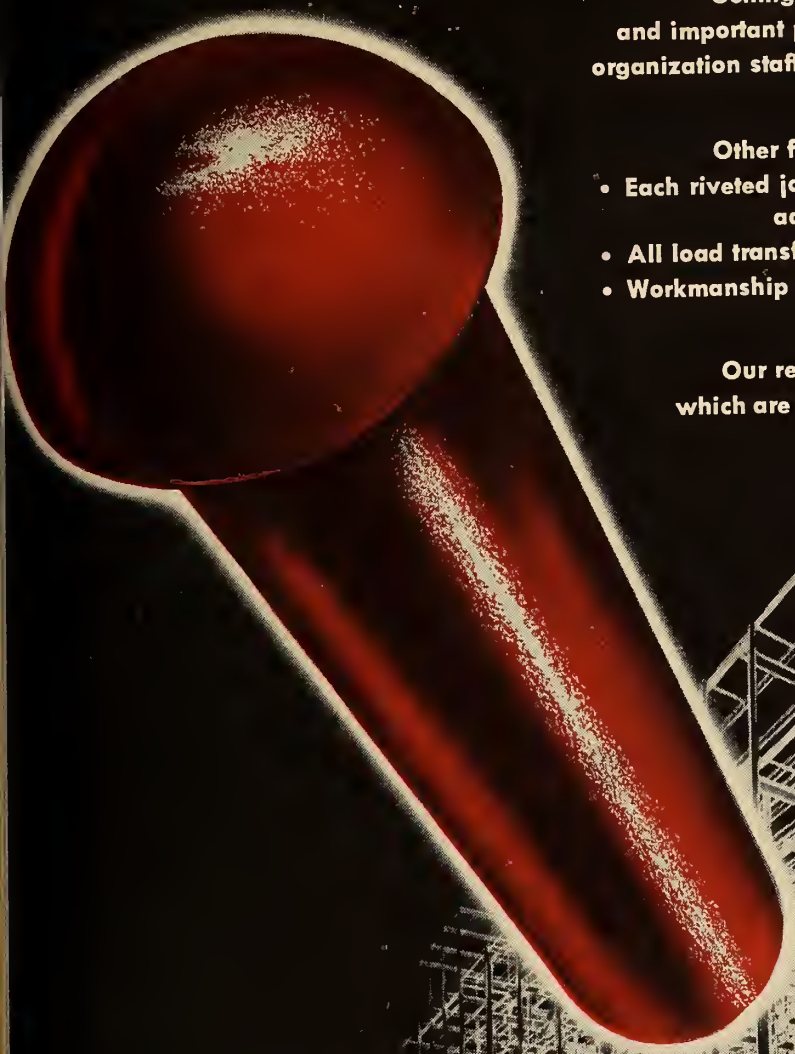

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By means of a series of diagrams the author presents a method of calculating the efficiency of planetary gears which avoids the long and complicated calculations usually associated with this operation. To complement the diagrams there is a section on the properties of planetary mechanics, with an outline and explanation of factors which must be taken into consideration. Examples are used to point out variations resulting from different arrangements of planetary gearing. The necessary formulae are found in the appendix but the author has not explained how they formed the basis for his diagrammatic method of calculation. Those readers concerned with this branch of engineering may find this original method of calculation of interest and value to them.

The resonant cavity magnetron. R. S. H. Boulding. London, George Newnes Ltd., Toronto, British book service, 1952. 147 pp., illus., $4.25.

A book on the resonant cavity magnetron, which is one of the important developments in the field of electronics, will interest all those readers concerned with the study, manufacture, servicing or operation of radar equipment. The first part of the text deals with early magnetrons and other types of high frequency oscillators and develops the basic principles of the operation of the resonant cavity magnetron. The origin and cure of the difficulties encountered in practice are then discussed, followed by a brief treatment of waveguides, transmission lines and cavity resonators. In the final chapter the author describes commercial magnetrons manufactured by the M-O Valve company and the English Electric Valve company, with constructional details, operating figures and performance diagrams. The book contains illustrations, a bibliography and an index.

Rocket propulsion. Eric Burgess. London, Chapman & Hall, Toronto, British book service, 1952. 235 pp., illus., $4.25.

This is one of the first books on rocket propulsion to appear in the English language and is intended for both the general reader and the serious student. The author is an official of the British Interplanetary Society and he gives in this book a well-developed account of the science of rocketry: its basic theories, the source and use of fuel, the engines in use which are the most powerful in the world, the latest rockets, the long-range projectiles, the artificial moon and the possibility of interplanetary travel. An interesting chapter speculates on the possible use of atomic energy for spaceflight, including mass ratio tables for return trips to Mars and Venus. The appendices cover the laws of rocket motion and efficiencies, expansion nozzles and rocket motor thermal efficiencies, extra-terrestrial missiles, and a history of the rocket and interplanetary movement in Great Britain. There is an index and a few illustrations.

Television receiver design; I. F. stages, monograph 1. A. G. W. Uitjens. Eindhoven, Holland, Philips, 1953. 177 pp., figs., $4.50 (U.S.)

One of a new series of specialized monographs intended to supplement big general treatments of the subject, this book deals with the application of the pentode in the intermediate frequency part of a superheterodyne receiver and the R.F. amplification in a direct receiver. This frequency range lies roughly between 10 Mc/s and over 100 Mc/s. The chapter headings indicate the scope of the book: gain and bandwidth with two-terminal coupling networks; response curve of the complete amplifier; distortion; gain, bandwidth and distortion with four-terminal coupling networks; noise; feedback; practical considerations following on the theory. In the five appendices the formulae which were used in the text are discussed. These are followed by a list of symbols. Graphs and diagrams illustrate the text but the book is not indexed.

Tennessee Valley authority. Annual report, 1952. Washington, U.S. government printing office, 1952. 76, 99 pp., illus., $0.50.

This nineteenth annual report not only presents an account of developments during 1952 but also reviews the progress made during the past twenty years. It reports on the work of the TVA and also on the accomplishments and problems of the inhabitants of the region, the government and educational institutions. Industry, agriculture, electric power and national defence, as they apply to the Tennessee Valley, are discussed. Dam and turbine construction are described, as well as the operations of the power system. One of the most important tasks of the TVA is water control and one chapter deals with this. Chemical engineering development, and the use of land and forests each are given a separate section. The report concludes with the world significance of TVA and its financial statements for the fiscal year. Several photographs highlight some of the accomplishments of the TVA.

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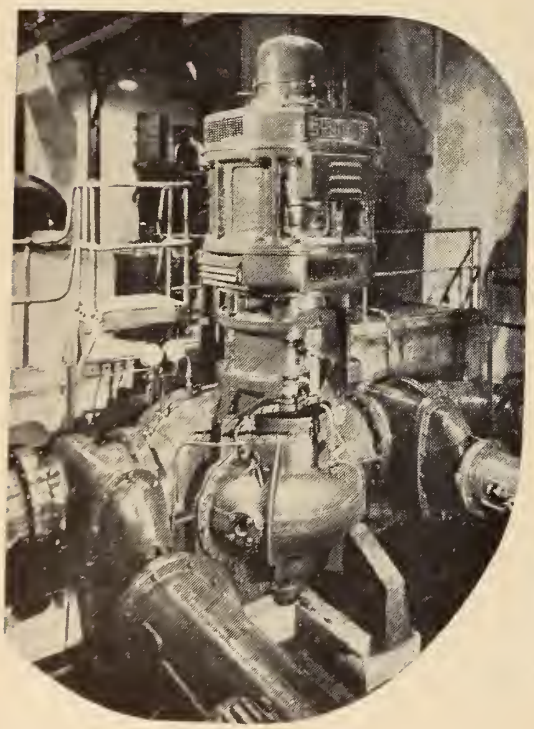

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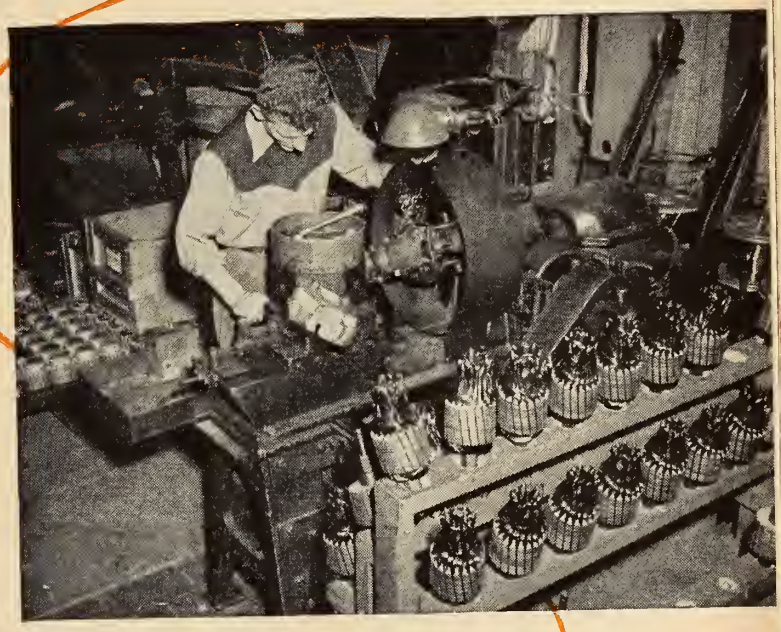

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The theory and practice of reinforced concrete, 2nd ed. C. W. Dunham. Toronto, McGraw-Hill, c1944. 558 pp., illus., $7.80.

This textbook presents the theories upon which the design of most ordinary types of reinforced-concrete structures is founded, and also shows how the conditions under which these structures are erected will affect them. The first seven chapters discuss the theoretical side of concrete design; the material itself; and the fundamentals of flexure, bond, shear, compression and stresses. Three chapters deal with the application of the theories to the design of retaining walls, foundations, flat slabs and cellular construction. Other chapters are devoted to the design of rigid frame bridges, arches, and building frames; and the architectural treatment of reinforced-concrete. Tables and diagrams are included in the Appendix, but the author stresses in his Preface that these tables are not to be regarded as a substitute for an understanding of the theory of design of concrete structures, and that shortcut methods should be used only when the theory has been mastered. Various changes have been made in this edition; special attention has been given to the design of beams; there is a fuller treatment of the bond between concrete and reinforcement; and the information on the design of columns, two-way slabs and flat slabs has been rewritten. The book is well illustrated with diagrams and photographs showing the various types of structure and points under discussion. It carries a detailed table of contents, but is not indexed.

Transmission lines and a.c. networks. T. F. Wall. London, George Newnes, Toronto, British book service, 1953. 328 pp., diagrs., $6.00.

The leading principles of the design and operation of normal three-phase transmission lines are the subject of this book. The author describes the present stage of development of underground cables, with special attention to the more recent use of oil-filled and gas-filled cables. A chapter is devoted to an explanation of the operation of the transformer as a link between the generator and the transmission line, and to the significance of harmonics in this system. Several sections treat network short-circuits and protective systems used against such faults, with special mention made of the "Impedance distance-relay" which gives a time-delay action proportional to the distance of the fault from the generator. Certain specific devices e.g. the "Petersen Coil" and the use of the "j"-operator are given detailed attention. Other subjects discussed are reactive currents and the use of static condensers to compensate such currents, and the most economical cross-section for a transmission line. The use of symmetrical-component analysis is explained with special reference to transmission-line problems. The appendices include trigonometric tables, and there are also diagrams and an index.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

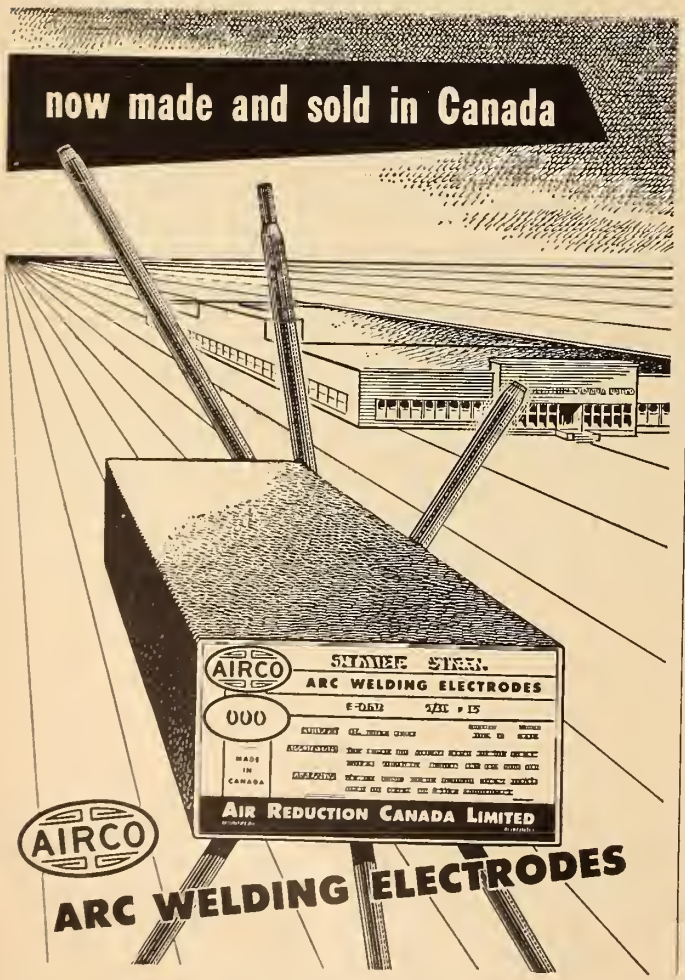
Basic mechanics of fluids. Hunter Rouse and J. W. Howe. New York, Wiley, c1953. 245 pp., illus., $4.50 (U.S.).

This is a textbook for junior students, similar in theme to Professor Rouse's "Elementary Mechanics of Fluids" (1946), but completely rewritten, with minor rearrangements of material. Major subjects covered are the principles of fluid statics; kinematics of fluids; the effects of weight, viscosity and compressibility; resistance to flow under various conditions; and a brief chapter on lift and propulsion. General methods of analysis are stressed rather than isolated procedures, and the emphasis on useful application is shown in the problems as well as in the text.

Cast bronze. J. Roast. Cleveland. American Society for Metals, c1953. 458 pp., $4.00 (U.S.).

Beginning with a chapter on the layout and equipment of a theoretical bronze foundry, the author continues with the purchase and handling of metal; with fuels, furnaces, and foundry sand; and with the making of castings, cores, and dry sand molds. He discusses the general metallurgy and testing of metals, and then takes up the commercial and special types of bronzes in separate chapters. The engineer's viewpoint is considered particularly with respect to specifications and properties, and there is a long historical summary of bronze casting.

Covered bridges of New England, revised ed. E. Wagemann. Rutland, Vermont. Charles E. Tuttle, c1931. 151 pp., illus., $5.50.



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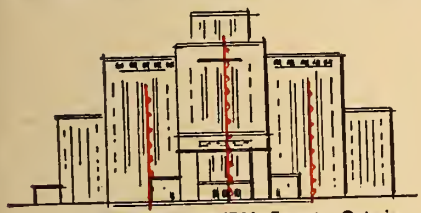

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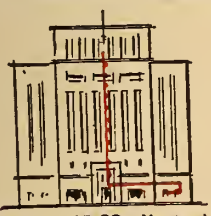

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A pleasant study of the history, romance, poetry, and folklore of covered bridges, the book is a revised edition of the author's original work published in 1931. Included in the revision is information on bridges demolished since that time and a census of all New England and New York bridges standing in 1952 with their approximate locations mapped. Illustrated with etchings by George T. Plowman.

Elements of electricity. 4th ed. W. H. Timbie and Alexander Kusko. New York, Wiley, c1953. 631 pp., illus., $6.05.

In this revised edition, as in previous ones, the intent is to provide an adequate treatment of the fundamental principles which a technical student needs to know well. The electrical and magnetic data and theories are brought up to date, and the book reflects modern practice particularly in the problems which cover contemporary applications. Additions or revisions are most extensive in the field of electronics and control, particularly radar, transistors, television, ceramic capacitors, dry and gaseous rectifiers, and similar developments.

Engineering valuation and depreciation, 2nd ed. Anson Marston, Robley Winfrey and J. C. Hempstead. Toronto, McGraw-Hill, c1953. 508 pp., illus., $9.60.

This text deals with concepts and procedures involved in the appraisal of industrial, commercial, utility, and natural resource properties, illustrating their application by specific examples. There are complete and detailed discussions on depreciation, service lives, and limited-life enterprises, and a comparison of depreciation methods when applied to property groups as distinguished from single units. Controlling court decisions for valuation practice are cited. The extensive revision includes a new chapter on fair rate of return.

Filter design data for communication engineers. J. H. Mole. London, Spon. Toronto, British book service, 1952. 252 pp., diagrs., $12.75.

Intended for the practical designer, this book provides an extensive compilation of charts, tables and formulas to facilitate the necessary calculations and to supplement the existing textbooks on theoretical principles. The explanatory text stresses design methods and the use of the charts and formulas, with no derivations except where they clarify the presentation. The book is concerned mainly with the Zobel filter, although the last chapter is devoted to design on a general basis of certain simpler filters, also applicable to transformer design. An elementary knowledge of the principles of line transmission and filters is assumed.

History of strength of materials. S. P. Timoshenko. Toronto, McGraw-Hill, 1953. 452 pp., illus., $12.00.

Based on Professor Timoshenko's lectures on engineering mechanics, this book traces the development of the science of strength of materials from Archimedes to the present. Brief biographies of workers in the field are included; and the relation of progress in the science to industrial development and engineering education is considered. Some discussion of the history of the theory of elasticity and the theory of structures is also included.

Microwave spectroscopy. Walter Gordy, V. Smith and R. F. Trambarulo. New York, Wiley, 1953. 446 pp., illus., $8.80.

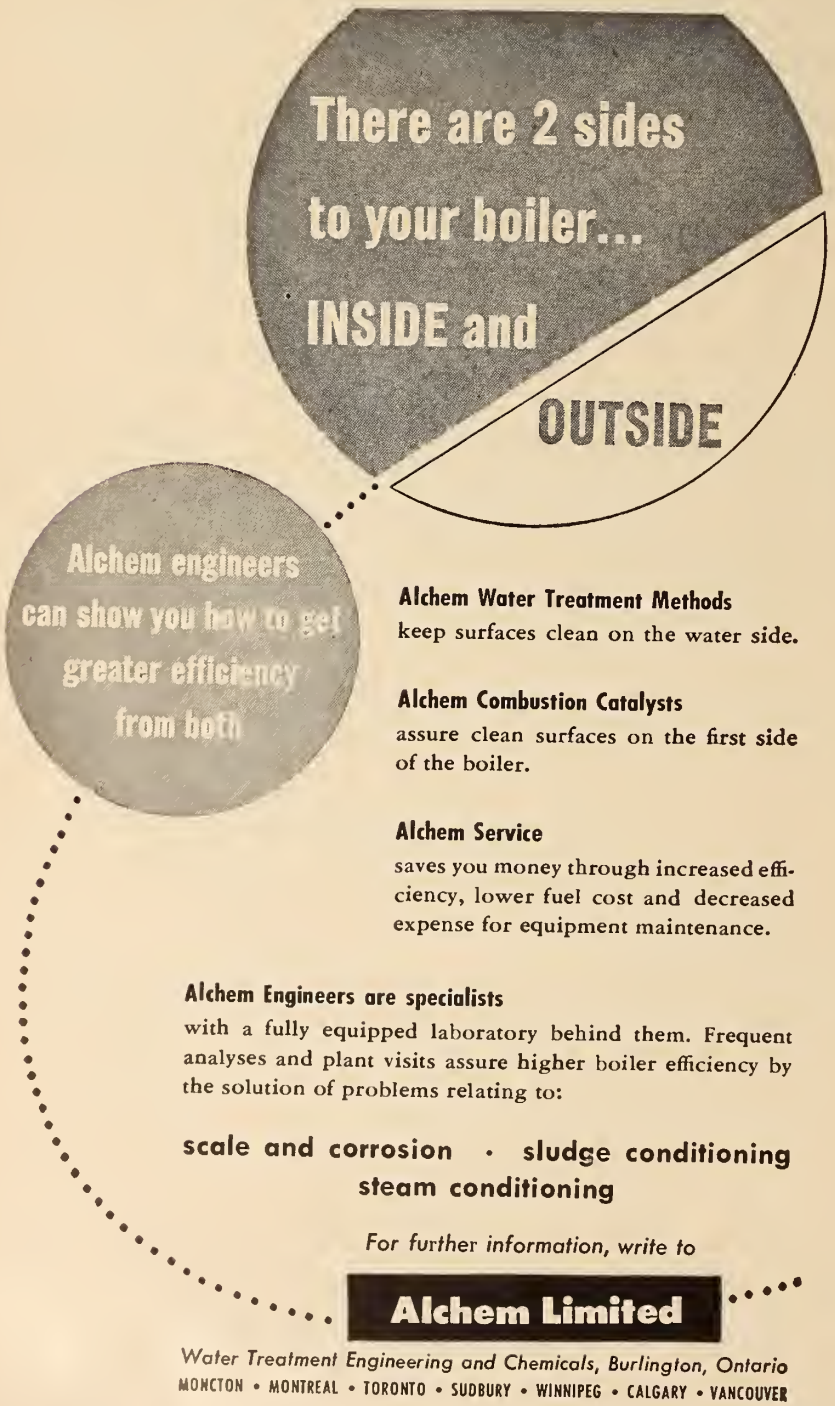
This first book in a relatively new field provides a comprehensive statement of the present knowledge of the subject. It describes the types of spectrographs, microwave and electronic components, and measurement methods. It discusses microwave spectra of gases, spectra of solids and liquids, nuclear properties, molecular structures, and applications in other fields. Extensive data tables and a 600-item bibliography are appended.

Pompes, ventilateurs, compresseurs. A. de Kovâts and G. Desmur. Paris, Dunod, 1953. 336 pp. illus., $12.00.

Beginning with an elementary discussion of turbo-machines and fluid flow, this treatise continues with detailed considerations of the design and construction of pumps, blowers, and compressors, both centrifugal and axial. The mechanical and hydraulic aspects of impellers, casings, and other elements are analysed; detailed calculations are carried out with practical examples; and brief comment is made on special pump types, selection of equipment, and test methods.

The principles and practice of surveying, Volume II. Higher surveying. 7th ed. c. B. Breed and G. L. Hosmer. New York, Wiley, 1953. 675 pp., $7.70.

The five sections of this standard work have been generally revised to conform to current practice. Topics covered are as follows: Part I, Survey control, astronomical observations, leveling practice; Part II, Topographical surveying by the stadia method and by the plane-table method, with discussion of the relation of geology to topography; Part III, Ground, aerial, and stereo-photogrammetry; Part IV, Hydrographic surveying and stream gaging; Part V, Constructing and finishing maps. Effectively illustrated, the volume



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also contains some 30 pages of tabular data in addition to that included with the text. Methods for the adjustment of triangulations and level circuits are appended.

Statically indeterminate structures. Chu-Kai Wang. Toronto, McGraw-Hill, 1953. 424 pp., diagrs., $9.00.

Thorough in treatment and development, this text for seniors and graduate students covers the following topics: finding deflections of statically indeterminate beams, rigid frames, and trusses; the analysis of statically indeterminate structures by the method of consistent deformation, by the three-moment equation, by the slope deflection and moment distribution methods, and by the method of column analogy. The analysis of fixed arches, secondary stresses in trusses with rigid joints, and composite structures are also treated. The effective coverage of basic principles and methods provides a useful reference work for the practicing engineer.

Water supply and sewerage, 3rd ed. E.W. Steel. Toronto, McGraw-Hill, 1953. 582 pp., illus., $9.60.

An engineering treatment covering both design and operation in two related fields. The water supply material includes consumption of water, development of surface and groundwater supplies, pumps and pumping, water distribution systems, and methods of water treatment. The sewage part covers sanitary, storm, and combined sewer systems, pumping of sewage, stream pollution and recovery, and treatment methods of preparation of sewage for disposal. The general revision includes elimination of obsolete material as well as the incorporation of recently developed practices.

STANDARDS REVIEWED

ASTM Specifications, American society for testing materials. 1916 Race Street, Philadelphia 3, Pa.

ASTM standards on copper and copper alloys. pa. $5.00.

This book brings together in up-to-date form all the ASTM standards on copper and copper alloys as developed by Committee B-5. The 115 standards cover copper, copper alloy, and copper covered steel electrical conductors; copper and copper alloy plate, sheet, strip and rolled bar rod, bar, and shapes; wire; pipe and tube; filler metal; copper-alloy ingots and casting; and test methods for copper and copper alloys. There is also a group of specifications covering non-ferrous metals such as slab zinc; pig lead; nickel; and others. Much of the material included in the earlier edition has been revised, and four of the methods are new. An extensive index is included.

ASTM standards on electrical insulating materials (with related information). $5.25.

The insulating materials covered by the 75 standards in this latest edition include shellac and varnish; plates, sheets, tubes, rods, and molded materials; mineral oils; ceramic products; solid filling and treating compounds; fabrics; papers; mica products; plastics; and rubber tape. There are 56 test methods for these materials. The use of Bible paper reduces this book to a convenient size. An easily usable table of contents is included (by subject and ASTM serial designation), and an extensive index.

ASTM standards on plasties. $5.25.

The 27 specifications cover quite a wide range of molding compounds, such as phenolic, polystyrene, melamines, ureas, cellulose, acetates, vinyl chloride, methacrylate, and materials made from these. The test methods are arranged in various classifications, including the strength, hardness, thermal, optical, and permanence properties of plastics; analytical methods; molds and molding processes; conditioning; plates, sheets, tubes, rods, and molded materials; and electrical tests. There is also a section on definitions and nomenclature. The book includes a Table of Contents by subjects, and another listing the standards in their numeric sequence.

British Standards, British standards institution, 24-28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 885:1953—Brass tubes for general purposes 70/30 brass, aluminium brass. 2/6.

This revised standard incorporates re-

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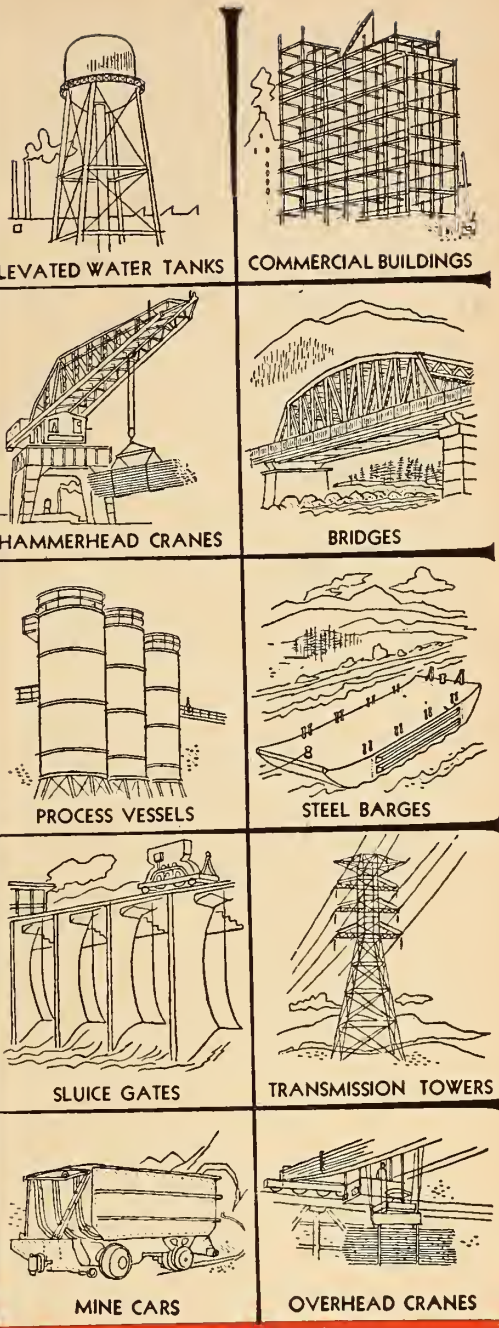

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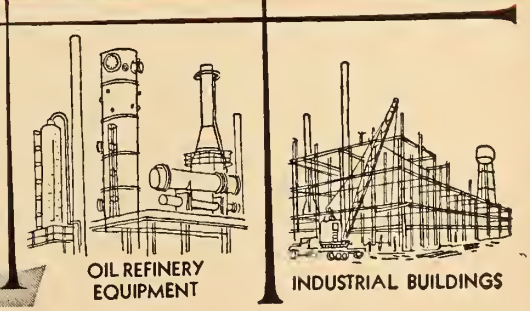


quirements for 'as drawn' and annealed tubes, previously numbered separately as B.S. 885 and B.S. 886. The optional addition of tin to 70/30 brass has been deleted and aluminium brass has been included as an additional alloy. Many clauses have been redrafted, and certain modifications made to the tests required and tolerances allowed. An appendix includes a table of sizes of 70/30 brass and aluminium brass pipe for the petroleum industry.

B.S. 1972: 1953—Polythene tube for cold water services. 3/6.

This standard has been prepared to meet the needs of industry, but must be regarded as subject to revision in the light of further developments. The standard applies to black polythene tube for use in cold water services, and in flush, overflow and warning pipe applications, and outlines composition, dimensions with tolerances, and methods of test. Two classes of tube are provided for — normal gauge, suitable for connection by means other than screw threading, and heavy gauge, suitable for screw threading. An appendix is included giving notes on the use of polythene tube for cold water services.

B.S. 1977: 1953—Copper for electrical purposes. Tubes (High conductivity). 2/6.

The fourth in a series of standards for copper for electrical purposes, this standard lays down requirements of copper tubes of high conductivity, and does not apply to cable sockets or conduits for electrical wiring. Provision is made whereby the purchaser can specify that tubes shall be made from oxygen free high conductivity copper complying with B.S. 1861 recently published. The other standards for copper for electrical purposes are numbered B.S. 1432/1434.

Canadian standards, Canadian standards association, National research building, Ottawa, Canada.

C.S.A. C22.4 No. 101-1953—Radio noise measuring instruments and general methods of measurement. $1.25.

This standard is intended for the guidance of those desiring to measure radio frequency voltages or radio frequency fields. It is primarily intended for use in connection with the investigation of radio noise. Instruments having characteristics in conformity with the standard characteristics are referred to as Class I instruments and when properly calibrated may be used for measurements of radio frequency voltages and radio frequency fields of an interfering character, where a high degree of accuracy is required.

C.S.A. 043—1953—Specifications for structural timber, 2nd ed. $1.00.

This specification covers the requirements for structural grades of timber and tabulates safe working stresses for each structural grade of each of the species. It differs slightly from the first edition (A43-1937); safe working stresses have been increased for certain properties; adjustments are recommended for different degrees of seasoning; provision has been made for increased safe working stresses for short-term loadings; and certain points have been clarified.

C.S.A. Z7.0 Series—Specifications for general photography. Complete set (List No. 1). $4.50.

Here are collected the standards in this series issued in 1950 and 1951 relating to photography in general. The subjects covered include film exposure, and exposing equipment; printing and projecting equipment; and processing and processing equipment.

C.S.A. Z7.1 Series—Specifications for motion picture photography. Complete set (Lists Nos. 1 and 2). $5.50.

These two lists of standards issued in 1949 and 1950 cover various aspects of motion picture photography, although the standards in Z7.0 Series—General photography are also applicable. Topics included are cutting and perforating dimensions for different widths of film; sound and sound recording; projection and projectors; and nomenclature used in studios and processing laboratories.

C.S.A. Z7.2 Series—Specifications for still photography. Complete set (List No. 1). $16.50.

This compilation brings together the specifications relating to still photography. However, here again the standards in Z7.0 Series are also applicable. Many of the specifications are intended to establish criteria of purity of photographic grade chemicals for processing photographic materials; other subjects covered are films and plates; camera tripods, lenses; microfilm; and processing.

BOOKS RECEIVED

Aluminum in iron and steel. S. L. Case and K. R. Van Horn. New York, Wiley, c1953. 478 pp., illus., $9.35.

British chemical plant. London, British Chemical Plant Manufacturers' Assoc., 1953. 356 pp., illus.

Canadian trade index: annual issue of 1953. Toronto, Canadian Manufacturers' Assoc., c1953. 1,126 pp., $7.50.

Centennial of engineering: 1852-1952. L. R. Lohr, ed. Chicago, Centennial of Engineering, 1952, c1953. 1,079 pp., illus.

Les circuits de contrôle électronique dans l'industrie. W. D. Cockrell. Paris, Dunod, 1953. 334 pp., illus., $9.00.

City planning in Soviet Russia. M. F. Parkins. Chicago, University of Chicago Press, Toronto, Gage, c1953. 257 pp., illus., $6.00.

Color in business, science and industry. D. B. Judd. New York, Wiley, c1952. 401 pp., illus., $7.15.

Design of machine elements. M. F. Spotts. 2nd ed. New York, Prentice-Hall, 1953. 504 pp., illus., $9.65 (U.S.).

Handbook of material trade names. O. T. Zimmerman and Irvin Lavine. Dover, New Hampshire, Industrial Research Service, 1953. 794 pp., $22.50 (U.S.).

Introdnction to solid state physics. Charles Kittel. New York, Wiley, c1953. 396 pp., illus., $7.70.

Mesures des vibrations et isolation des assises de machines. A. Tenot. Paris, Dunod, 1953. 243 pp., illus., 1950 fr.

Modern naval architecture. W. Muckle. London, Temple, 1951. 154 pp., illus., $2.00. (Technical trends series).

Physique industrielle, 29. éd. Julien Izard. Paris, Dunod, 1953. 458 pp., illus., $2.00. (Aide-mémoire Dunod).

Pratique du percement des tunnels. H. W. Richardson and R. S. Mayo. Paris, Dunod, 1953. 494 pp., illus., $18.00.

Prestressed concrete. Y. Guyon. London, Contractors' Record, 1953. 543 pp., illus., $14.00.

Public health engineering. P. C. G. Isaac. London, Spon, Toronto, British book service, 1953. 277 pp., diagrs., $7.25.

Refractory hard metals: borides, carbides, nitrides, and silicides. Paul Schwarzkopf and Richard Kieffer. Toronto, Macmillan, c1953. 447 pp., diagrs., $11.00.

Saudi Arabia. K. S. Twitchell. Princeton, Princeton University Press, Toronto, S. J. R. Saunders, 1953. 231 pp., illus., $6.75.

Trees to news: a chronicle of the Ontario Paper Company's origin and development. Carl Wiegman. Toronto, McClelland & Stewart, 1953. 364 pp., illus.

Wind-tunnel technique. R. C. Pankhurst and D. W. Holder. Toronto, Pitman, 1952. 702 pp., illus., $11.50.

TECHNICAL BULLETINS RECEIVED

American Society of mechanical engineers.

A.S.M.E. boiler and pressure vessel code interpretations. (Corrected to February 1, 1953).

Bell telephone system. Monographs:

No. 2050—Atmospheric corrosion of steel wires, by A. P. Jahn. No. 2052—Economics of high-speed photography, by A. C. Keller. No. 2053—Effects of oscillating forces on contact surfaces, by R. D. Mindlin (and others). No. 2055—Single-sideband system for overseas telephony, by N. F. Schlaack.

Canada. National research council. Associate committee on the national building code. Revision of national building code; part VI, General Services.

Canada. National research council. Canadian government specifications board. Specification:

39—GP-3—Axes.

H.M.S.O. National building studies. Research paper:

No. 17—Reactions between aggregates and cement. Part 3, Alkali-aggregate interaction: the expansion bar test, by F. E. Jones and R. D. Tarleton.

. . . Selected government research reports:

v. 6—Strength and testing of materials. Part 1 Theoretical papers on strength and deformation. Part 2 Testing methods and test results.

Illuminating engineering society.

American standard practice for street and highway lighting.

Les moteurs électriques: leurs applications industrielles.

La technique moderne, v. 45, no. 5, May 1953.

Routes et aérodromes.

La technique moderne—Construction, v. 8, no. 4, April 1953.

STEAM power for "THE LIGHT"

STEAM

ıo Paulo to have largest boilers

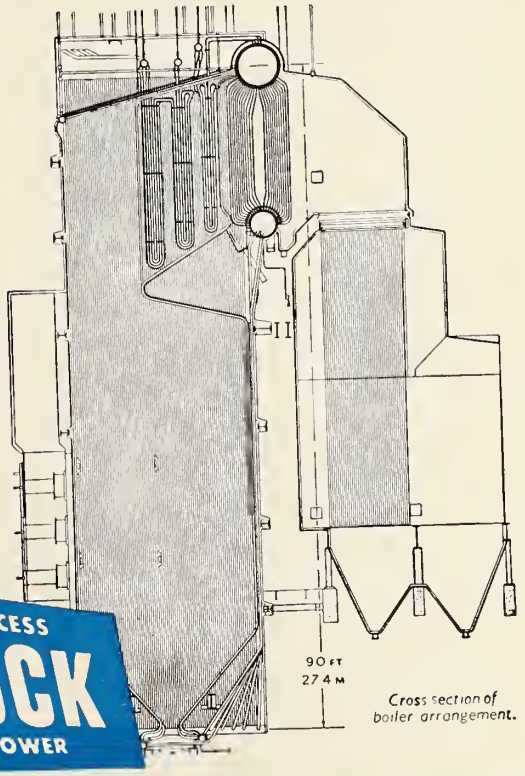
Sao Paulo Light and Power Company Limited is an operating ıbsidiary of the Canadian Corporation, Brazilian Traction, Light nd Power Company Limited, known to Brazilians simply as "The ight". "The Light" supplies electric energy to the cities of Rio de aneiro, Sao Paulo and Santos, as well as for electric railways and ıuch of Brazilian industry, including the great Volta Redonda steel ıill with its planned annual production of one million ingot tons.

In order to help satisfy the increasing demand on its hydro-electric ystem, "The Light" has ordered a new 160,000 kW thermal plant /hich will be located on the outskirts of Sao Paulo

This will be equipped with the largest boilers in South America, wo BABCOCK & WILCOX units, which are being manufactured y Babcock-Wilcox and Goldie-McCulloch Limited of Canada.

Each of these huge oil-fired boilers will supply 850,000 lb. of team per hour, at a pressure of 850 pounds per square inch and a emperature of 925°F., to a turbine driving an 80,000 kW. hydrogen-ooled generator.

Design and procurement for this mportant plant are by Stone & Webster Engineering Corporation of Boston, Massachusetts, and con-truction and all activities in Brazil ıre being conducted by Stone & Webster Construction Company. Babcock & Wilcox (Caldeiras) S.A. Rio de Janeiro, will erect the boilers.



Cross section of boiler arrangement.

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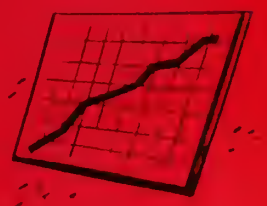

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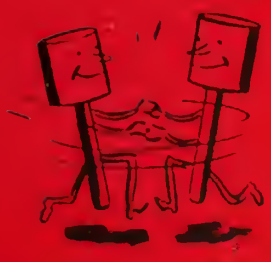
Improvements in materials, design and manufacture — the result of constant General Motors research — have achieved phenomenal parts life; e.g., G.M. pistons, without replacement, now travel a million locomotive miles.



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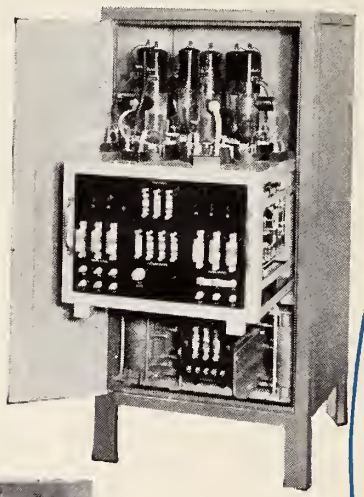
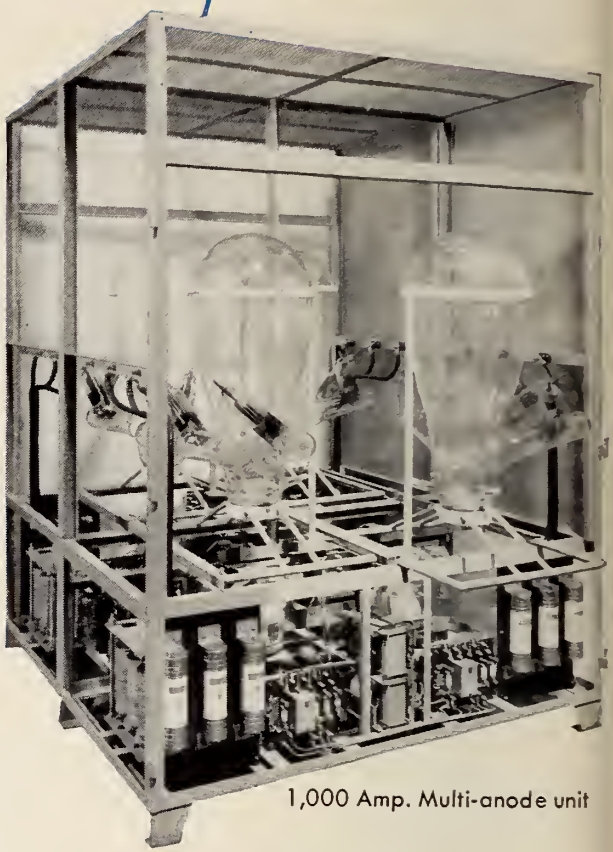
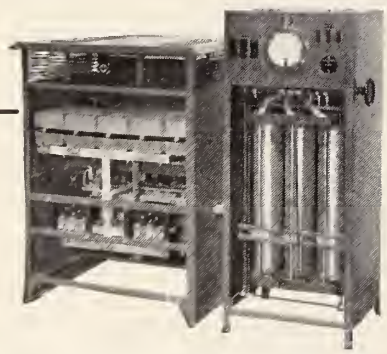
we illustrate our "NEVITRON", a revolutionary single-anode rectifier that requires no condensing chamber. The unit illustrated is rated up to 150-KW and yet measures only 2'-6" square x 5'-3" high. NEVITRONS have the highest efficiency of any pumpless rectifier because of their low arc drop. This unit is in an advanced development stage and we invite your inquiries.





1,000 Amp. Multi-anode unit



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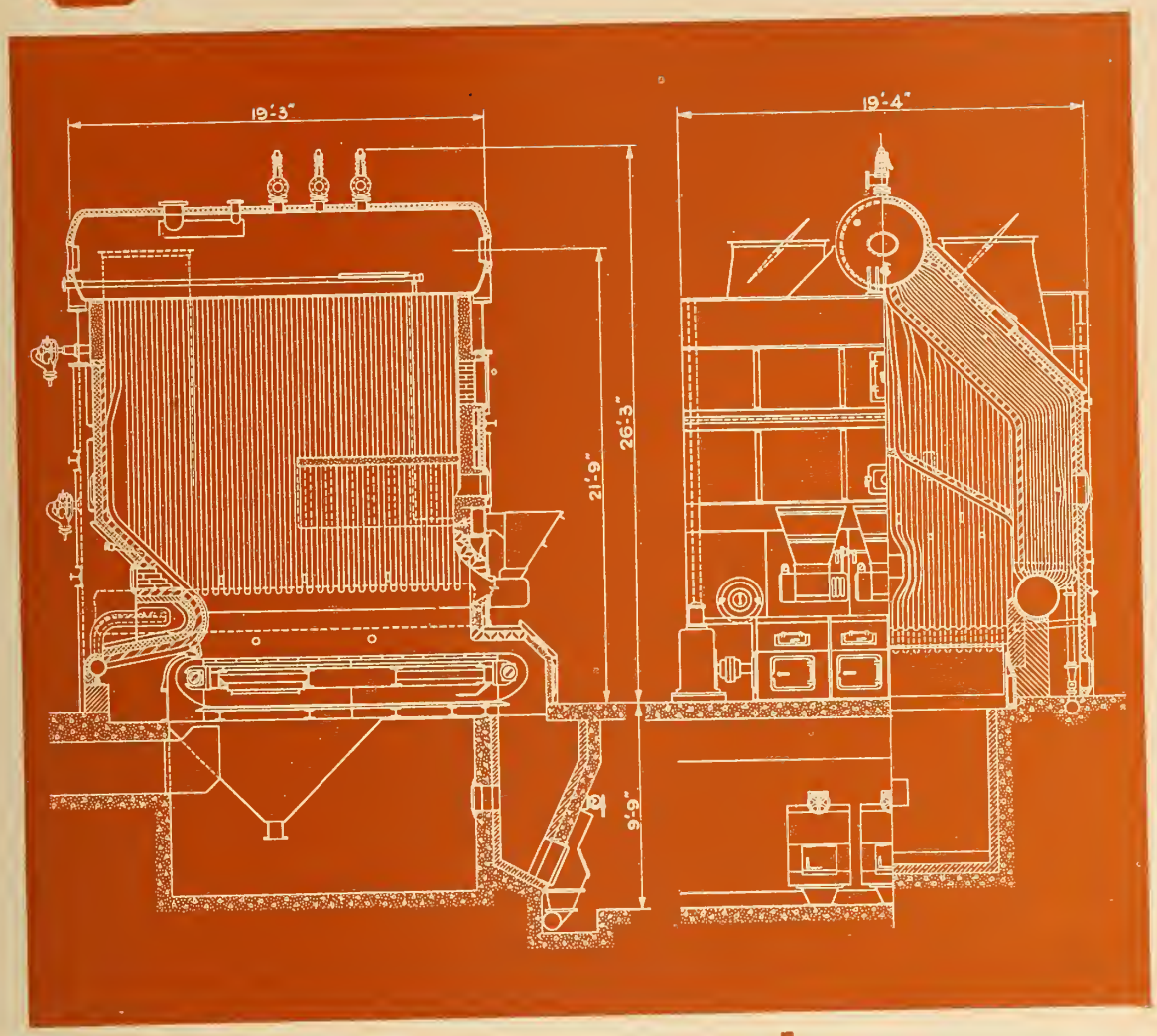

Number of Units	Two
Steam Capacity	60,000 lbs. per hour.
Design Pressure	250 p.s.i.
Operating Pressure	200 p.s.i.
Final Steam Temperature	388° F
Feed Water Temperature	220° F
Fuel	Bituminous Coal
Firing Equipment	FW, Riley Travelling Grate Spreader Stoker
Heat Recovery Equipment	FW Tubular Air Heater
Efficiency	83.2%

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The view of the Powell River Company's plant gives some idea of its extensive operation. The power plant can be seen at the centre. A three-year exponsion pragram has just been completed, which will increase production by 40,000 tons annually.

Day after day G-E Application engineers design easily-operated equipment to solve complex industrial drive problems. The system illustrated here was built expressly to increase production on the No. 5 and 6 paper machines at the Powell River Company, in B.C. Although the drives have been installed for only a short time, their effective operation has already resulted in much greater output.

Now the Powell River mill holds two world's production records. The first for the largest daily output of newsprint by an individual plant . . . 1173 tons. Second, a single month's production averaged over 1100 tons per day.

You too can achieve higher production consistently on any industrial process by simplifying and integrating operations with G-E Co-ordinated Equipment. For full information, contact your nearest C.G.E. sales office, or 212 King St. West, Toronto, Ontario.

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CO-ORDINATED
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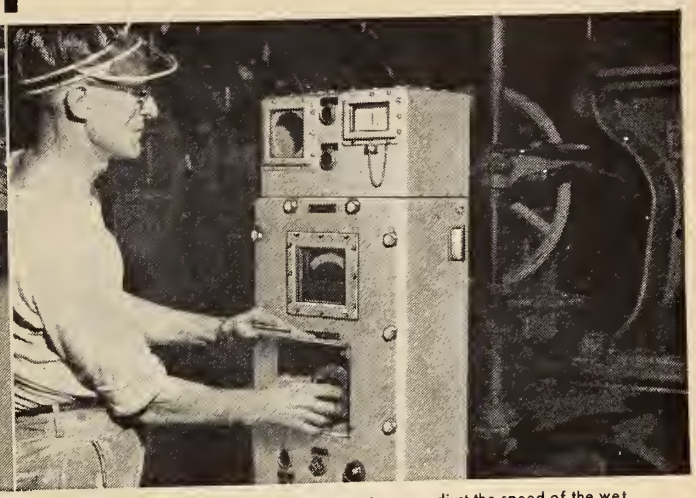
APPARATUS

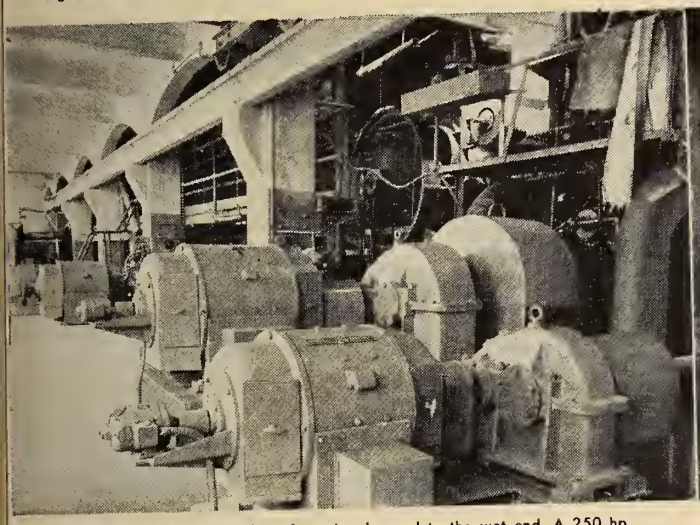
CANADIAN GENERAL ELECTRIC COMPANY LIMITED

Drives increase production 40%

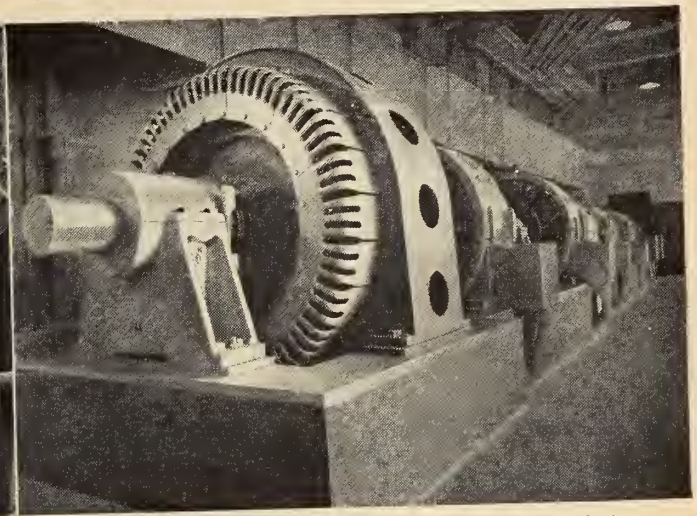
The wet end of the Company's No. 5 paper machine. The complex operations of the machine are synchronized with G-E electronic sectionalized equipment engineered especially for this application.



From a centralized control station, this operator can adjust the speed of the wet end couch motor. Custom-built G-E Co-ordinated Equipment makes it easy for a small crew of operators to control machinery for continuous quality production.

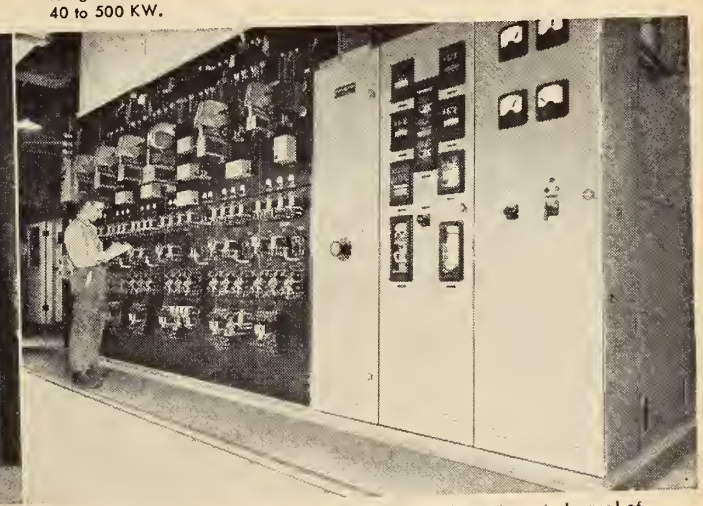


Paper machine motors, looking from the dry end to the wet end. A 250 hp, DC motor drives the calendar section in the foreground. Two 200 hp DC motors drive the dryer section.



This multiple generator drive has an 8 unit M.G. set, shown above. In the foreground is the 1500 hp drive motor. The 7 d-c generators, range from 40 to 500 KW.

The key of the entire system, the amplidynes take tiny input signals and amplify them instantly, as much as 10,000 times to make the powerful equipment operate faster, smoother, and with more positive control.



This shift electrician is noting meter readings from the main control panel of No. 6 paper machine. Centralized control makes G-E Co-ordinated Equipment highly effective where a complex production system must yield a high-quality product at maximum speed.

AAD-108

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The new General Electric motor control centre is the most up-to-date equipment for the centralized control of a-c motors up to 200 horsepower. Each control centre is planned for the job it is to handle, but it can rapidly be modified to meet changed requirements. Standard units can be easily interchanged or substituted, new units can be quickly added. Units may be mounted back-to-back in same standard enclosure. Master terminal boards may be located at either top or bottom of cabinet.

Accessible. Installation is simple — just a matter of sliding the unit into its compartment. Stab-on connectors grab the vertical bus. Wiring is easy because even push-buttons and terminals are mounted on the unit frame for simple front connecting. Doors swing more than 90°, so unit can be lifted out of compartment for accessibility from all sides. Barriers between units can be slipped out, making a four-inch wiring trough. Master terminal boards can be swung out of place for connecting without "fishing" of wires.

Appar

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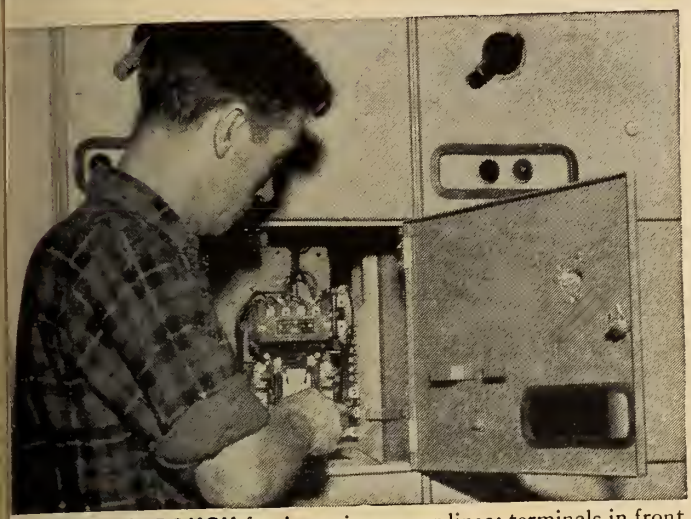
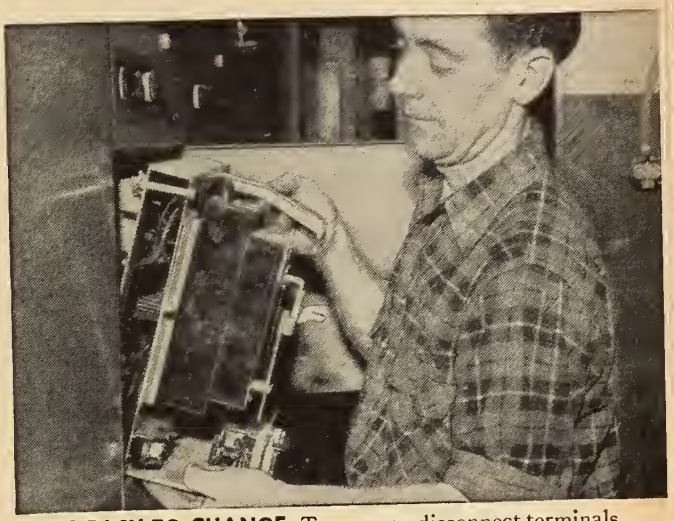
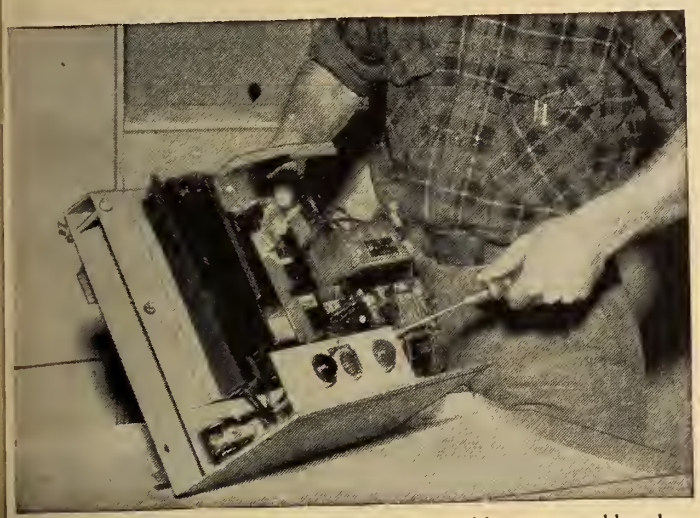
hould specify
CONTROL CENTRE . . .



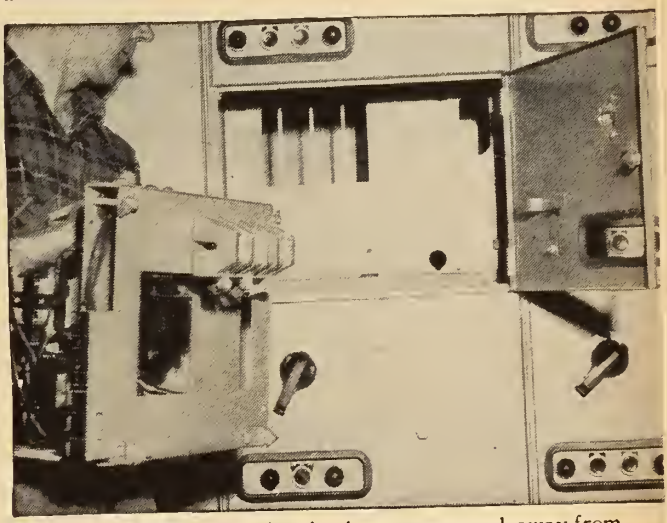
FOUR-INCH TROUGH for incoming power lines; terminals in front for easy wiring, maximum accessibility.



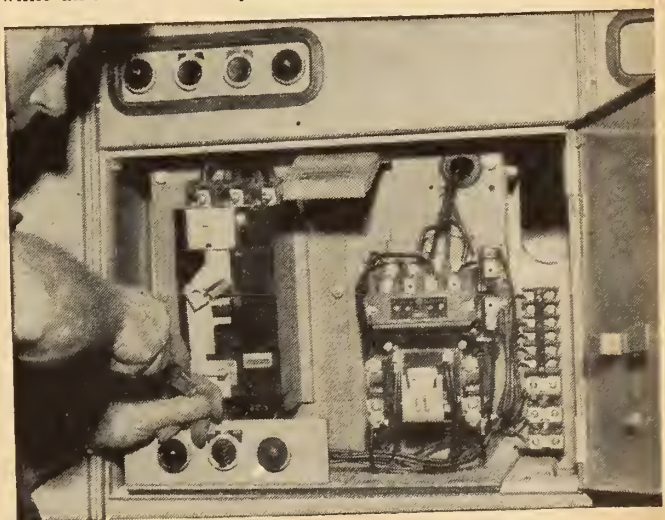
UNITS EASY TO CHANGE. To remove, disconnect terminals, pull unit out. Units easily changed since *all* components are on unit frame.



ACCESSIBLE WIRING. Contactors, relays, pushbuttons, and breaker are easily accessible from all four sides.



BUS PROTECTED. Steel barrier keeps personnel away from bus. For added safety, compartment doors can be closed while unit is out of compartment.



DISCONNECT POSITION cuts unit power off; bus connection made automatically in operating position.

AAD-107

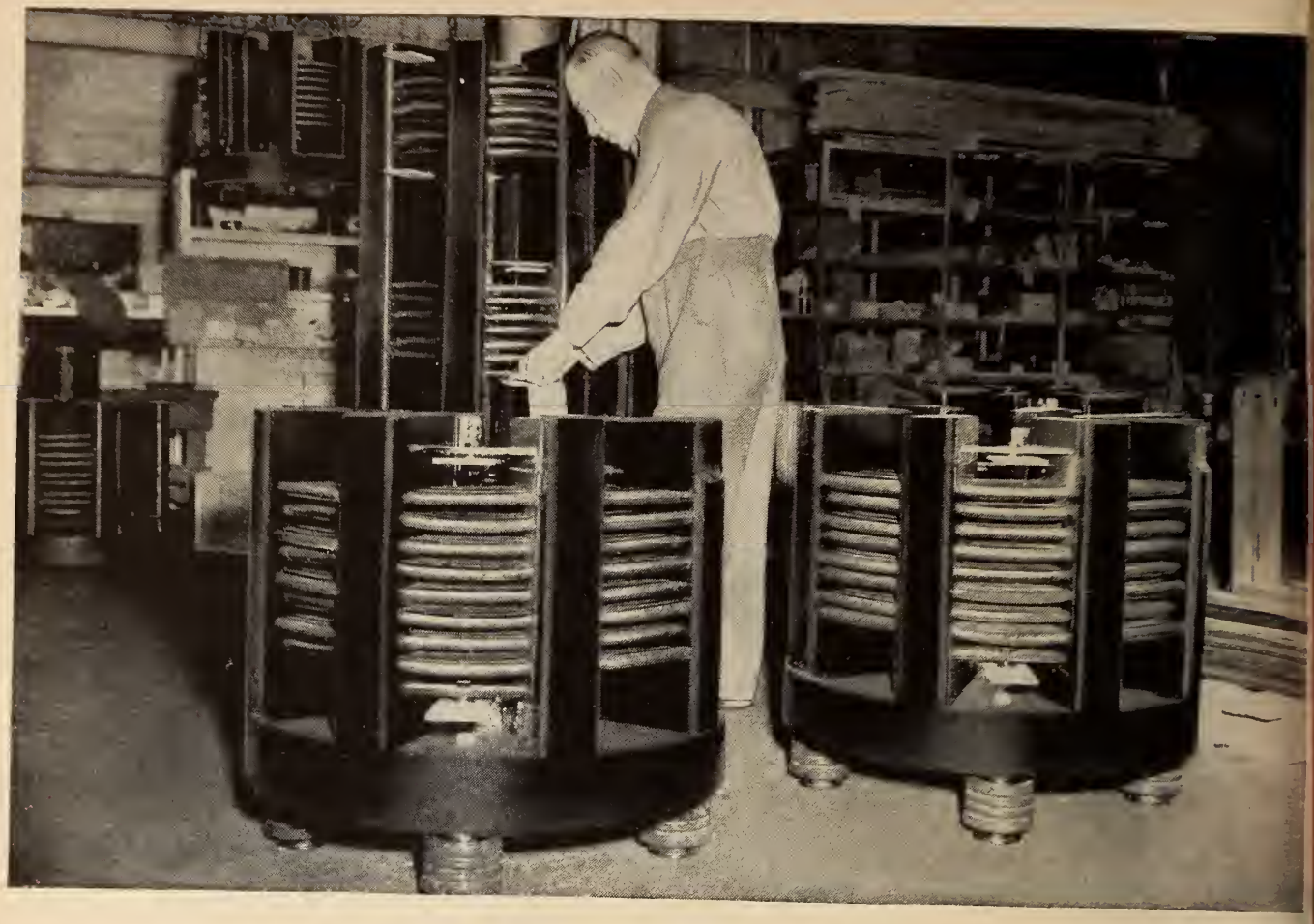
For More Information, contact your nearby Canadian General Electric apparatus sales office, or write for GEA-4979A today. *Apparatus Division, Canadian General Electric Company, Limited, Toronto, Ontario.*

GENERAL ELECTRIC

MOTOR CONTROL CENTRE

vision

EAD OFFICE: TORONTO—SALES OFFICES COAST TO COAST



Save 10% on new G-E reactors with aluminum conductors

Same long life, same low maintenance, same high short-circuit strength . . . at 10% less cost

Now you can save 10% by buying General Electric cast-in-concrete reactors with aluminum conductors. These new G-E aluminum reactors will give you the same dependable performance—the same high degree of protection—as G-E units built with copper . . . at 10% less cost. There has been no sacrifice in the reactor quality that has been the favorite of industry for more than 35 years.

The "extra service" features of G-E reactors—both aluminum and copper types—provide practically unlimited life and make maintenance a minor factor.

Wet steam curing assures full strength of concrete at shipment—no dangerous waiting period which occurs if concrete must cure after reactor is placed in service.

Other features include: good clearances; crossovers made within concrete supports and smooth, flameproof black japan finish.

Metal housings, with provisions for cable entrance and exit can also be provided that will match the appearance of G-E switchgear. These housings minimize stray currents and electrical losses, protect reactors against damage, and increase safety for personnel.

You can buy these sturdy, dependable G-E cast-in-concrete reactors with either aluminum or copper conductors. *For full information contact your nearest C-G-E Sales office or write Canadian General Electric Company, Limited, 212 King St. W., Toronto, Ontario.*

GENERAL ELECTRIC CONCRETE REACTORS

Apparatus Division

AAD-143

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

NI-RESIST

Proved to be the answer for this pump casing

The Canadian Sumner Iron Works, Limited, Vancouver, utilized Ni-Resist's unique combination of properties—corrosion and wear resistance—for this high speed centrifugal pump which will handle material containing acid.

Resist is strangly resistant both ta corrasion at
h temperatures and ta wear—abviaus
vantages in a high speed centrifugal pump
ndling hot acids. In applications where
n must resist bath wear and carrasion—such as
pumps, valves and blow-pit pipes in pulp
d paper mills, furnace grates, sewage
pasal equipment and so farth—maderately
ced Ni-Resist cuts replacement casts.

*Registered trade mark

EMBLEM OF INCO SERVICE TRADE MARK

INCO *proven* SERVICE GOES WITH INCO *nickel*

Loss, due to corrosion, in Canada is estimated in millions of dollars annually. How much of this comes out of your pocket?

A proven service in helping to eliminate losses through corrosion is Inco Corrosion Engineering Service. Our technical staff offers assistance on problems involving selection of materials, corrosion data or mechanical properties of metals and alloys. Inco's long experience in working closely with design and production engineers, metallurgists, foundries and research men on a wide range of metal problems, is at your service.

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

25 KING ST. WEST, TORONTO, ONT.

CUT HOISTING COSTS

Electric Hoist, Type 223. 2-rope. Hoisting speed 23 ft/min. Motor driven, single rail trolley.

Use Munck Hoists

Cost 30% Less Than Comparable Hoists

Before you invest in new equipment, or start major repairs on your old hoists, look into Munck Electric Hoists. Used extensively throughout Europe for many years, Munck Hoists are famous for rugged, durable performance. And they're new in Canada this year.

You have 349 types to choose from — fixed mounts, trolley mounts (motor-driven, hand-geared and push-type) and special low-headroom mounts. Capacities from ½ to 10 tons.

You'll find these important features on all Munck Hoists—

Built-in motor, inside drum, saves space, weight
High-grade steel shaft and gears
Unique conical rotor brake
Automatic two-way limit switch
Ingenious cable guide to prevent overriding.

—And you save as much as 30% on purchase costs. Fast delivery—complete line and servicing facilities now in Canada.

Write now for more information.

Sverre
MUNCK
Bergen, Norway

Distributed and serviced in Canada through
ALLIANCE ELECTRIC WORKS LTD.
Montreal • Toronto

Approved by the Canadian Standards Association

Sverre Munck
P. O. Box 7500
Montreal, P. Q.

Gentlemen:
I am interested in learning more about Munck Hoists. Please send me, without obligation, illustrated specification folders on

☐ Fixed Mounts ☐ Travelling ☐ Both

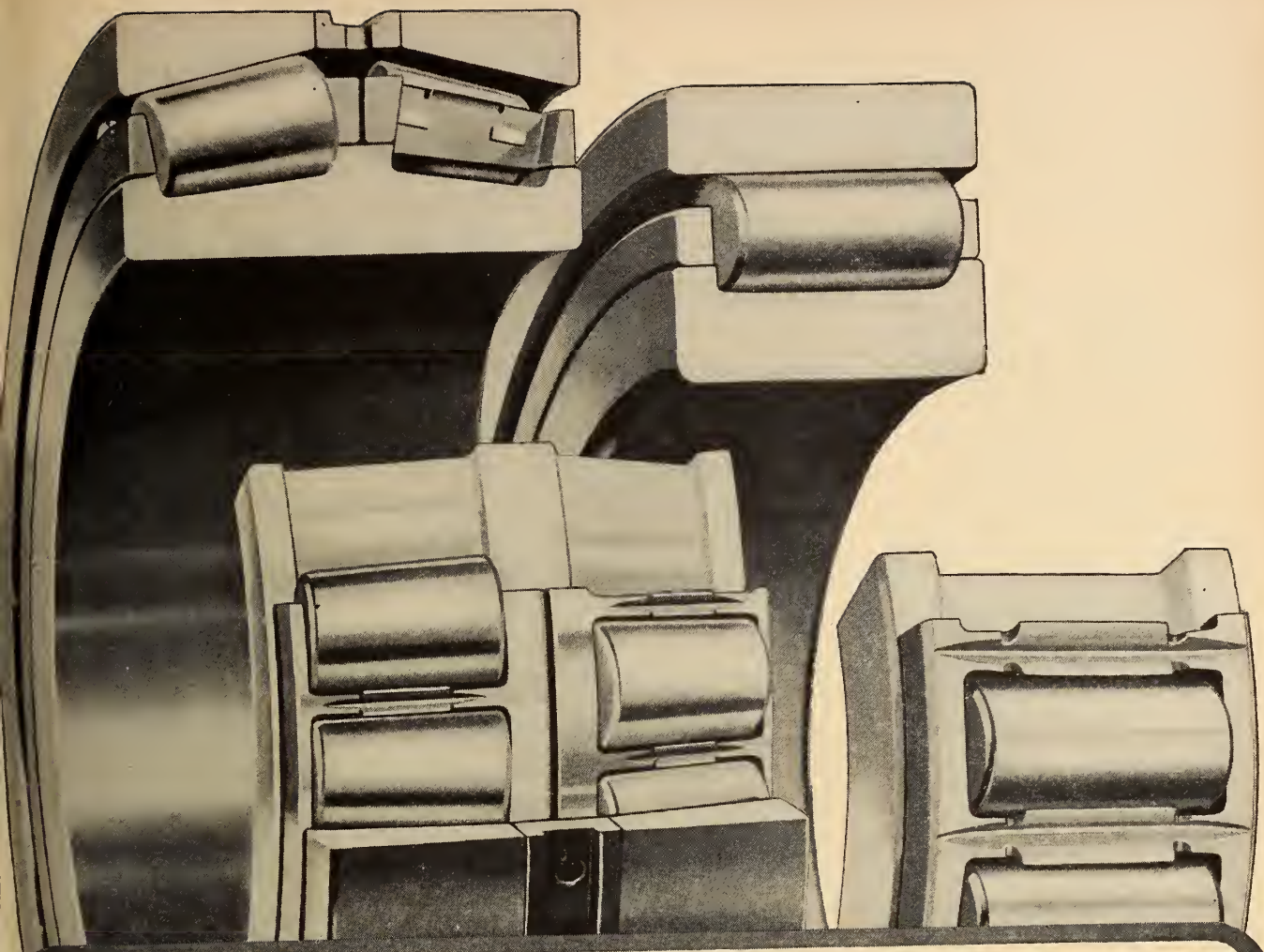
NAME.....

COMPANY.....

STREET.....

CITY.....PROV.....

TYPE OF INDUSTRY.....



TORRINGTON

TAPERED and CYLINDRICAL ROLLER BEARINGS

Give you these BIG ADVANTAGES

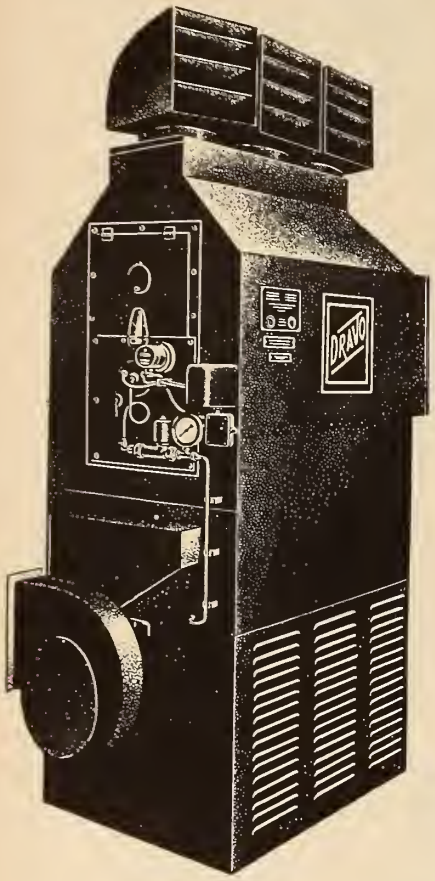
- **One-piece cast-bronze cages with machined pads in each roller pocket**—to assure accurate guiding of rollers.
- **Stabilized races**—to maintain accuracy of fit, improve bearing performance.
- **Individual roller retainment**—to assure adequate lubrication at roller, simplify inspection of race surfaces.
- **Precision tolerances and finishes on both rollers and races**—for minimum eccentricity and equal load distribution.
- **Controlled quality steels**—by use of electric furnace steels, through-hardening or case-hardening grades, and modern heat-treating methods—for increased bearing capacity and longer life.
- **Interchangeability**—in all types and sizes.

Backed by custom engineering to meet your load and speed requirements, these advantages add up to maximum performance for your bearing dollar. That's why it always pays to specify TORRINGTON!

THE TORRINGTON COMPANY, LIMITED
925 Millwood Road, Toronto 17, Ont., Canada
District Offices and Distributors in Principal cities of United States and Canada

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Cylindrical Roller • Needle • Ball • Needle Rollers



DRAVO HEATERS CONSERVE STEEL,

MONEY—FUEL—and MAN HOURS

The steel needed for a heating system *can* be slashed from 50% to 70% for the representative open-space industrial structure shown below . . . by using the direct-fired warm air heating method with Dravo "Counterflo" Heaters! This conservation of steel, vitally important today, adds another saving to the long list of economies in money, fuel and labor effected by this heating method.

The chart below gives the detailed comparative story. Every system is equivalent in Btu output. Steel requirements for the 13 methods have been carefully and conservatively calculated.

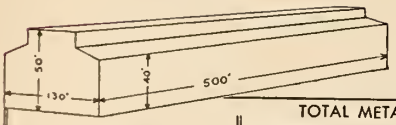
You will see that Dravo Heaters not only take LESS steel in each fuel classification . . . but that the HIGHEST steel requirement in a Dravo installation is *almost 50% less* than the LOWEST steel requirement in *any other* system!

Look at the contrast in *pipe* required! Jobs now held up by slow pipe deliveries can MOVE . . . if Dravo heaters are used!

Dravo "Counterflo" Heaters can expedite installation jobs for you! And the steel and pipe savings are just two of the many reasons why more and more "Counterflo" Heaters are being used in all types of structures.

DRAVO HEATERS HAVE EARNED HIGHEST INDUSTRIAL ACCEPTANCE BECAUSE THEY OFFER—

- **LOW FIRST COST... Users report 50% to 60% savings**
- **WORKING-ZONE WARMTH . . . Units heat 4,000 to 20,000 sq. ft.**
- **NO FUEL WORRIES . . . Burn oil or gas . . . readily converted**
- **AUTOMATICALLY CONTROLLED . . . On-off or modulating controls**
- **LOW OPERATING COST...80-85% efficiency**
- **EASY INSTALLATION . . . Fuel, electric and exhaust connections only**
- **LONG LIFE—LOW MAINTENANCE . . . Stainless Steel combustion chamber**
- **TESTED—APPROVED...CSA and/or UL seal**
- **AVAILABLE...Immediate delivery, no delays**



Each heating system compared below was sized to make up a calculated 12,000,000 Btu heat loss in this representative industrial building.

WRITE TODAY FOR BULLETIN No. 523

TOTAL METAL REQUIREMENTS FOR VARIOUS HEATING SYSTEMS WITH IDENTICAL 12,000,000 Btu LOAD

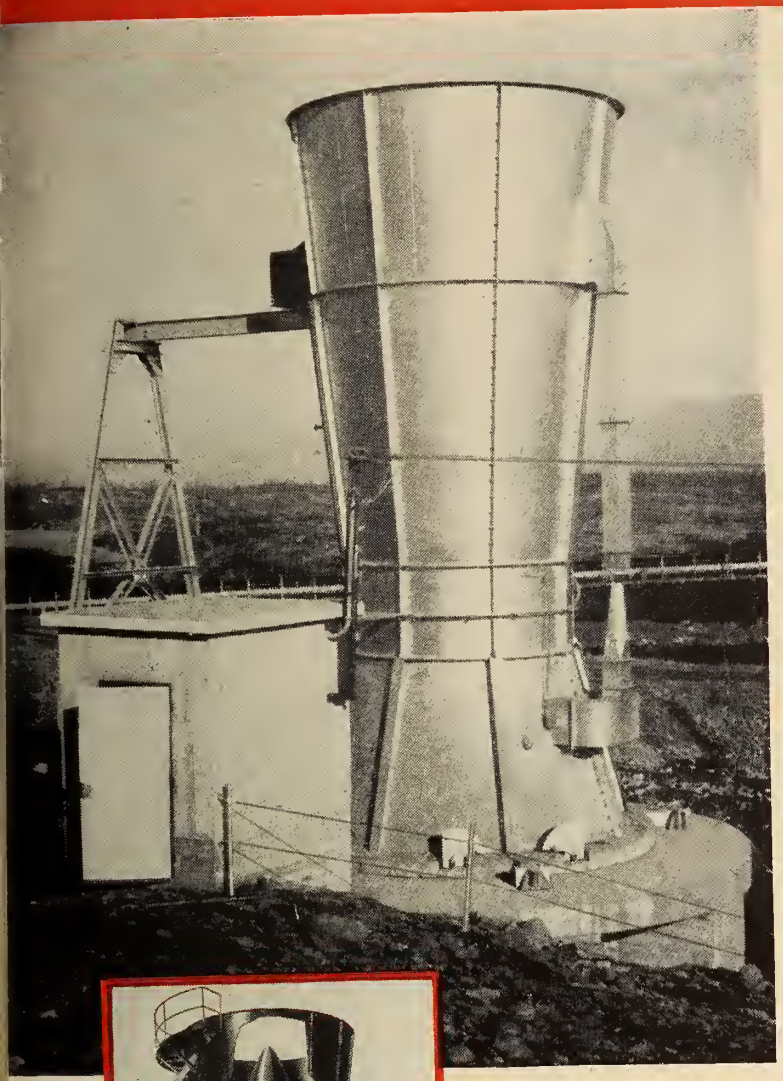
COMPONENT	GAS FIRED					OIL FIRED					COAL FIRED		
	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL BOILER	HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL BOILER	HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL BOILER	LOW PRESSURE CONVENTIONAL BOILER
BASIC HEAT GENERATORS	26,400	38,000	62,000	38,000	62,000	26,400	38,000	62,000	38,000	62,000	27,450	38,000	38,000
PIPING—Oil—Steam Boiler Room—Gas	9,096	15,490	15,490	35,308	35,308	4,352	15,790	15,790	35,608	35,608		14,990	34,808
TANKS—Oil—Blow-off Condensate		3,500	1,500	1,500	1,500	13,000	16,500	14,500	14,500	14,500		3,500	1,500
UNIT HEATERS Including Traps & Starters		21,240	21,240	21,240	21,240		21,240	21,240	21,240	21,240		21,240	21,240
STACKS & BREECHING	1,200	4,000	400	4,000	400	1,200	4,000	400	4,000	400	1,200	4,000	4,000
PUMPS—Fuel Oil Auxiliary Oil—Boiler Feed		1,000	1,000	1,000	1,000	400	1,400	1,000	1,400	1,000		1,000	1,000
STOKERS & FANS— Including Dust Collectors Fuel Oil Preheaters							2,000		2,000		23,850	15,000	15,000
STRUCTURAL STEEL Boiler House Foundation Reinforcing		7,000	2,000	7,000			7,000	2,000	7,000			7,000	7,000
TONS of STEEL REQUIRED	**DRAVO 18**	**45**	**52**	**54**	**61**	**DRAVO 23**	**53**	**58**	**62**	**67**	**DRAVO 26**	**52**	**61**

HEATING DIVISION

MARINE INDUSTRIES LIMITED

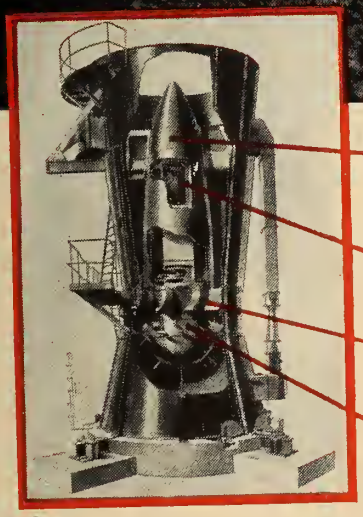
SOREL, QUEBEC

A new standard of ventilation for Canada's mines...



Aerex VERTICAL Mine Fan at INTERNATIONAL NICKEL

ONE OF THE world's largest Axial Flow fans, this 20-ton giant is Canada's first Vertical Mine Fan — designed and built by Aerex for INCO'S Creighton Mine, near Sudbury, Ontario. Fast becoming a familiar landmark in many parts of the world, the Aerex Vertical Mine Fan achieves highest efficiencies, quietness of operation and simplicity of installation. INCO's fan features a 124" impeller with 12 adjustable-pitch stainless steel blades, exhausts mine air at a rate of up to 300,000 cu. feet per minute!



1. Rear Fairing encloses motor and also provides motor ventilation.
2. Built in Monorail system permits removal of motor.
3. Vane section supports vertical motor.
4. Adjustable pitch fan rotor.

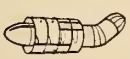
Aerex Mine Fans both Centrifugal and Axial, range in size from 12" diameter to the giants shown above.

Aerex motor driven high speed Axials for auxiliary mine ventilation will develop up to 7½" static pressure.

Aerex 12" and 16" compressed air fans will handle 2050 and 4340 CFM respectively, free delivery, and 1070 and 2270 CFM through 1600 ft. of duct.

Aerex Limited, 77 York Street, Toronto

Aerex LIMITED



HORIZONTAL MINE FANS

DUST FILTERS

AUXILIARY MINE FANS

COMPRESSED AIR FANS

Rolling out!

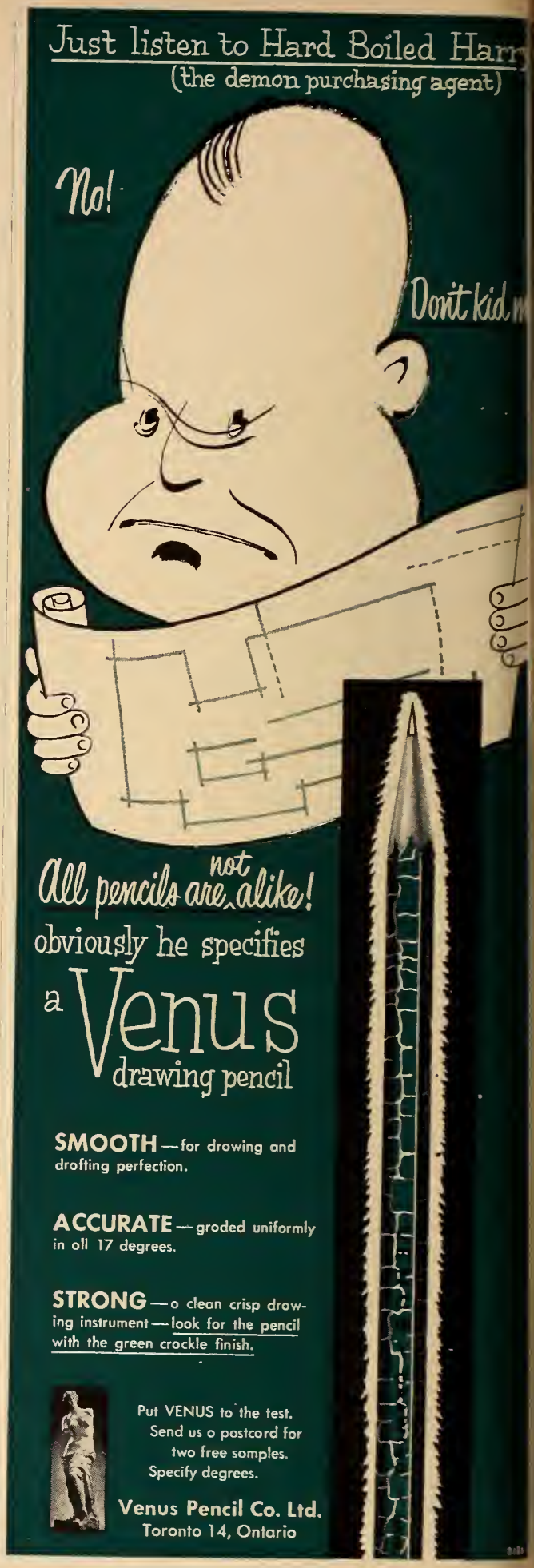
A very high percentage of the railway rolling stock, produced in Canada, rolls out from National Steel car, made to the most exacting standards. This output is only made possible by a combination of experienced management, skilled workmen, and an efficient and modern plant.

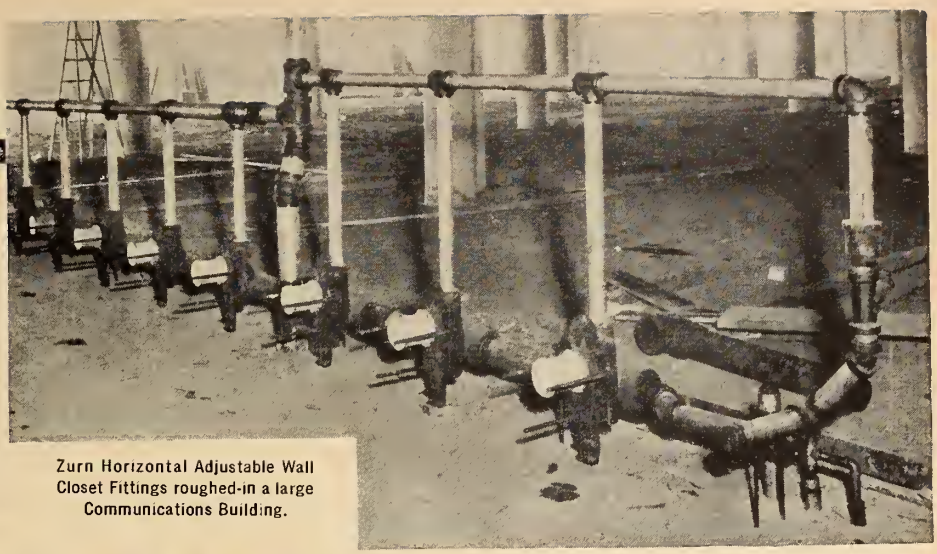
National Steel Car always welcomes the opportunity of placing definite recommendations, estimates and specifications before those interested in modern steel rolling stock and allied products.

NATIONAL STEEL CAR CORPORATION LIMITED

HEAD OFFICE: HAMILTON, ONTARIO • SALES OFFICE: MONTREAL, QUEBEC

BUILDERS OF TRANSPORT FOR CANADA





Zurn Horizontal Adjustable Wall Closet Fittings roughed-in a large Communications Building.

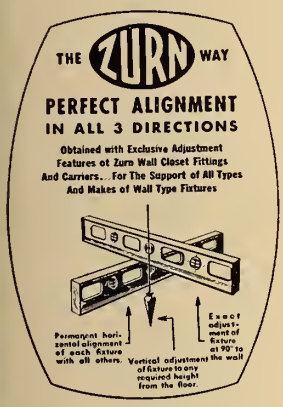
Wall closet fitting—horizontal, single type shown with connections for soil pipe.

Syphon jet closet carrier faceplate with universal adjustable fixture bolts and corrosion resistant adjustable coupling.

Exploded view of Zurn Wall Closet Fitting for syphon jet closet left-hand, horizontal, for soil pipe connections. Also available for threaded pipe connection.

ZURN systems*

usually reduce the over-all cost of fixture installations



*T. M. Reg. U. S. Pat. Off.

● The Zurn Way of installing wall-type fixtures practically eliminates the hazards commonly experienced and offers these plus features and advantages: Flexibility of Zurn Systems assures speed in assembly and accurate alignment in all three directions during installation; rigid watertight connections insure minimum final adjustments when installing wall-type toilets; bulk of assembly can be precut in shop; unique waterway allowing a 4" vertical adjustment does away with numbered fittings. Zurn Systems for any make of wall-type fixtures can be assembled into an almost limitless variety of installations. Installations of wall-type toilets have the horizontal drainage line, up to where it connects to the stack, installed above the floor, behind the toilets, behind the wall—no furring in or delays waiting for other crafts.

Zurn Systems are available for installing any type or make of wall-type toilet, urinal, lavatory, sink, and other wall-type fixtures. Write for free booklet entitled, "You Can Build It and Maintain It For Less A NEW WAY".

CANADIAN ZURN ENGINEERING LTD.

PLUMBING • MARINE • INDUSTRIAL • POWER TRANSMISSION

2052 ST. CATHERINE ST. W., MONTREAL, P. Q.

Sales Offices: Montreal, P. Q. • Toronto, Ontario • Vancouver, B. C. • Windsor, Ontario

ZURN **PLUMBING DIVISION PRODUCTS INCLUDE EVERYTHING FOR DRAINAGE SYSTEMS FROM ROOF TO BASEMENT**

One of several types of Zurn Carriers for wall-type urinals

Greaseptor

Area Floor Drain

Roof Drain with Internal Expansion Joint; High velocity drainage

Supremo Perfect Seal Floor Level Cleanout

Backwater Valve Non-fouling

CANADIAN ZURN ENGINEERING LTD.
Plumbing • Marine • Industrial
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Please send me the new Zurn Booklet, "You Can Build It (Cubic Foot of Building Space) For Less A New Way."

Name and Title .....

Company .....

Street .....

City and State .....

Please attach coupon to your business letterhead.

. . . Let Taylor

Perhaps we've been hiding our light under a bushel. Over a period of 20 years we have developed and perfected volumetric load measuring elements which have been utilized almost exclusively in the paper industry. They've been used, in indicating, recording and controlling form, to measure calender stack pressures, paper machine press section pressures, beater roll pressures, Jordan plug pressures, etc. There are many applications throughout industry where they can be used to measure tension on conveyor belts, thrust on bearings, forces applied by pneumatic or hydraulic cylinders, weight of solids or liquids in tanks, and force applied to testing apparatus.

The instrument comprises a measuring element, made of hardened alloy steel, connected to a Bourdon spring in an indicating, recording or controlling instrument by means of a mercury filled capillary tubing in lengths up to 200 ft. The measuring element is installed in the direct line of force, so as to be independent of friction or other factors which would affect accuracy of measurement. Most recent developments afford a wide variety of ranges, greater range suppression, greater over-range protection, and greater energy for positioning the pen or actuating a control mechanism.

While applications shown below all illustrate compression load measurement, tension loads also can be handled with a maximum load not to exceed 30,000 pounds.

There are many more logical applications for these highly accurate and sensitive instruments. *What is your problem.* Call your Taylor Field Engineer, or write Taylor Instrument Companies of Canada Limited, Toronto, Montreal, Winnipeg, Calgary, Vancouver.

. . .

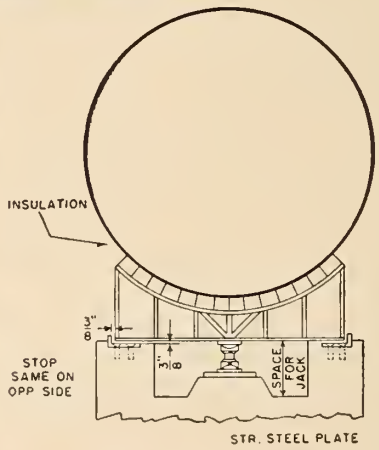
Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

Problem

To accurately measure the weight of chlorine in tanks.

Solution

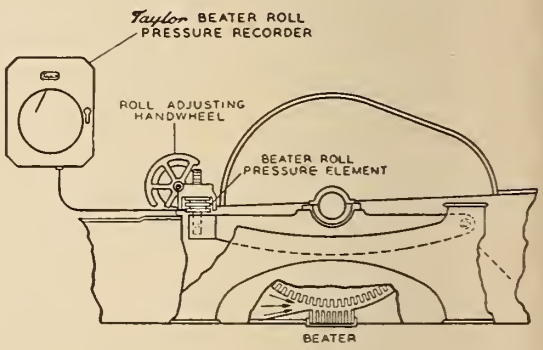


Spool type Load Measuring Element.

Characteristics

Range limits: 0-250,000 lbs. for compression loads, maximum load not to exceed 400,000 lbs. Applicable to horizontal or vertical tanks, containing corrosives or solids, making conventional level measuring devices impractical. Tension loads 0-30,000 lbs.

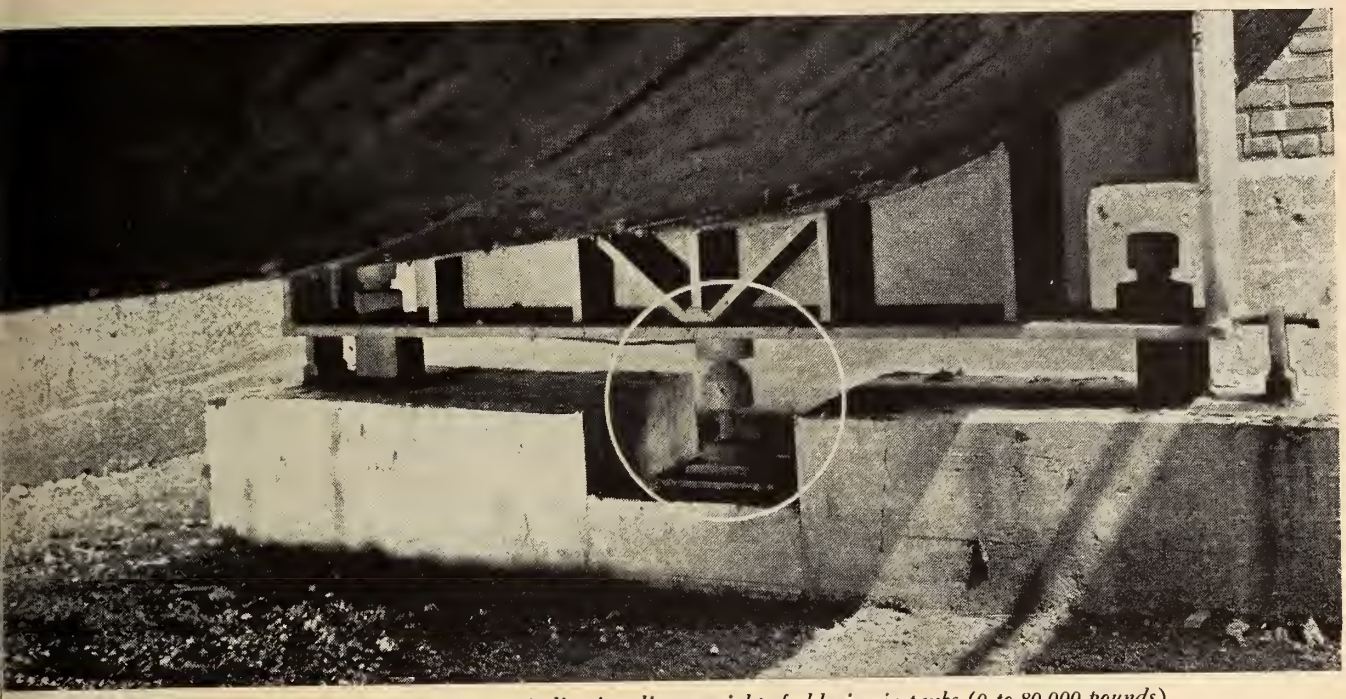
To accurately measure processing pressure in paper stock beater.



Ring type Load Measuring Element.

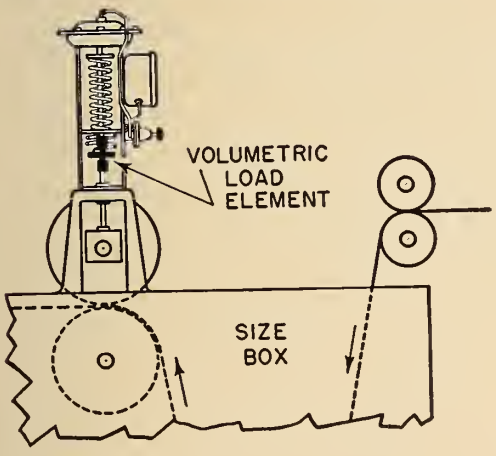
Range limits: 0-20,000 lbs., maximum load not to exceed 20,000 pounds—compression only. Similar to diaphragm type, but with hole through center of element for load-screw or shaft. Another application is the measurement and control of Jordan plug pressure.

carry your load



Spool type Volumetric Load Element indicating direct weight of chlorine in tanks (0 to 80,000 pounds) at Niagara Falls, N. Y., plant of Niagara Alkali Company

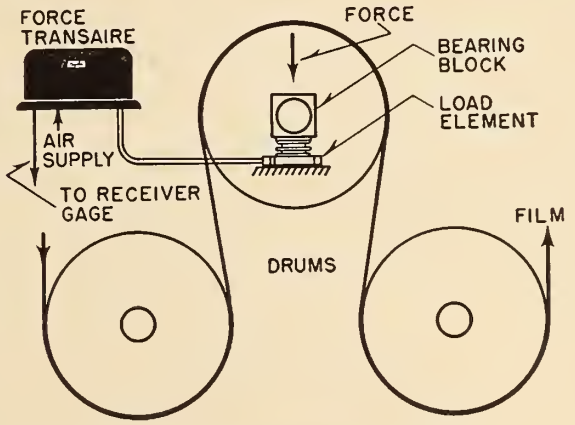
To accurately measure squeeze roll pressures on textile slashers.



Diaphragm type Load Measuring Element.

Range limits: 0-5,000 lbs. maximum load not to exceed 6250 lbs. Compound ranges, tension—0—compression also available. Applicable to measure roll or nip pressures in calender stacks, press section and many other finishing operations involving processing of material between rolls.

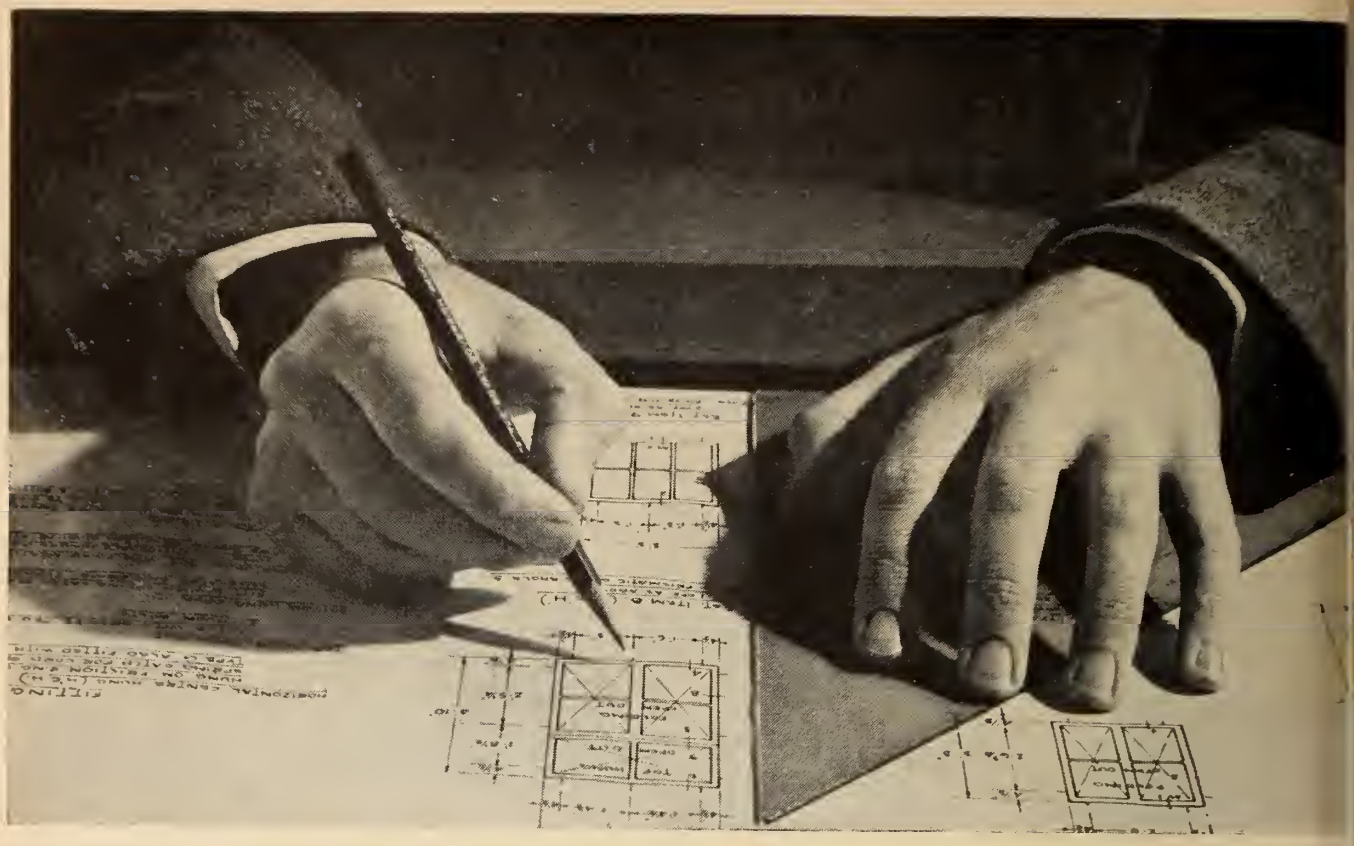
To measure film tension within very close limits as a measure of "gain" or percentage of stretch.



Volumetric Load Measuring Element.

Range limits: 0-300 lbs. in range spans as short as 30 lbs. Used in conjunction with a TRANSAIRE* Pressure Transmitter which gives an output pressure proportional to the force applied. Applicable to film, paper, yarn or similar tension measuring requirements.

*Reg. U. S. Pat. Off.



When Planning Your Windows...

Distinctive in appearance, rigid and strong without bulkiness, free forever from warping, twisting, swelling, Crittall and Fenestra windows are designed for a life-time of serviceability. They are made in modular units in a wide variety of styles, engineered to facilitate co-ordination with other wall materials. This standardization saves on-the-site expense, and also means fast delivery from a big stock in the quantity you want, when you want them. Low initial cost, low installation cost and low maintenance cost have earned for Crittall and Fenestra windows the approval of architects, builders and owners for a half century. Whether you require an entire wall of windows, a number of single units— or a special job in a hurry — they're as near as your phone. Call us about your *next* installation.

Hot Dip Galvanizing for Rust-Proof Windows available at extra cost

CANADIAN CRITTALL METAL WINDOW LTD.

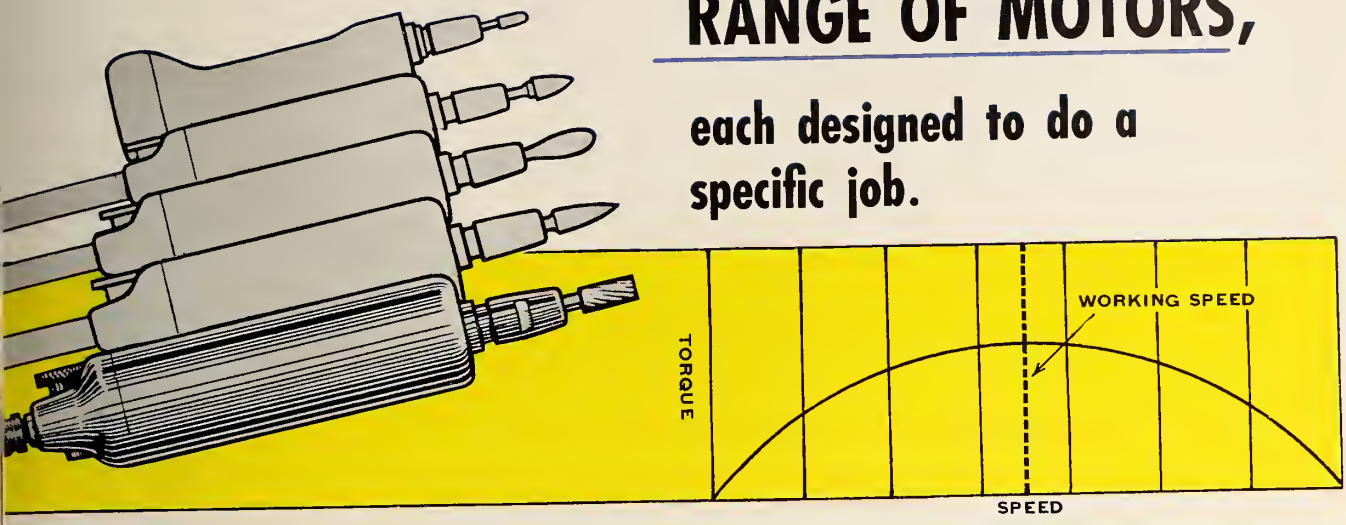
139 STEPHENSON AVE., TORONTO 13 — 2165 CLIFTON AVE., MONTREAL 28

Fenestra Industrial Windows in Steel **CRITTALL** Universal and Residential Windows in Steel and Aluminum

Air tool peak efficiency depends on the speed of the motor . . .

COPCO-ATLAS AIR TOOLS HAVE A WIDER RANGE OF MOTORS,

each designed to do a specific job.

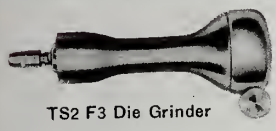


Copco-Atlas air tools feature: ball bearings throughout, polished aluminum housings, built-in pressure feed lubrication, special Swedish steels and alloys.

DRILLS:
- Powerful motors individually designed for each tool.
- Specially-designed pistol grip handles . . . give maximum thrust in direct line with drill.

Each tool has its own motor working at the peak of the speed-torque curve.

ROTARY FILES, DIE GRINDERS:
- Wide speed range — 650 to 50,000 rpm.
- $\frac{1}{8}$" and $\frac{1}{4}$" special collet chucks.
- Exhaust air cools bearings, discharges through chuck to clear cuttings.

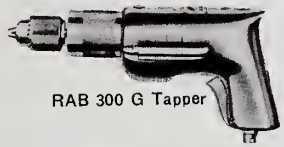

TS2 F3 Die Grinder

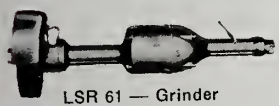
RRN11P
Light Rivetter

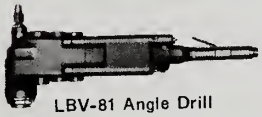
RAB 200 Drill

RAB 2F1 Rotary File

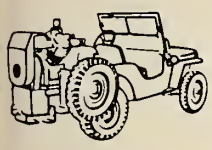
RS-3 Grinder


RAB 300 G Tapper


LSR 61 — Grinder


LBV-81 Angle Drill

RAB O Drill Rubber handle


60 and 75 cfm

Write, wire or phone any one of our branches for specifications on the complete range of Copco-Atlas air equipment. You'll find a quotation from Copco on interesting comparison. Delivery, service and performance guaranteed by Canadian Copco Ltd.

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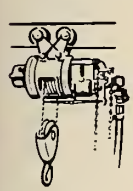
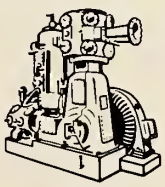

Air Hoists

236 cfm


330 to 3220 cfm

13 to 46.3 cfm

145 to 300 cfm

Contractor's Tools

the Record proves that TURQUOISE holds a Needle Point

We sharpened a long, fine drafting point on an Eagle 4H TURQUOISE pencil, snapped it off and used it as the needle in an old-fashioned phonograph.

The point held without crumbling under the weight of the arm and the vibrations of the groove, and played the full record with surprising clarity!

Here is conclusive proof that the 100% "Electronic" graphite in the TURQUOISE lead gives it a particle fineness and compactness that produce non-crumbling, amazingly wear-resisting needle points.

100% "Electronic" graphite also gives unmatched denseness and durability, with the superior smoothness, uniformity and reproduction quality every draftsman dreams of.

PROVE IT YOURSELF: Write for a sample TURQUOISE pencil in any grade you desire, and test it at your own drafting board. Please name your regular supplier and this magazine.

Made in Canada

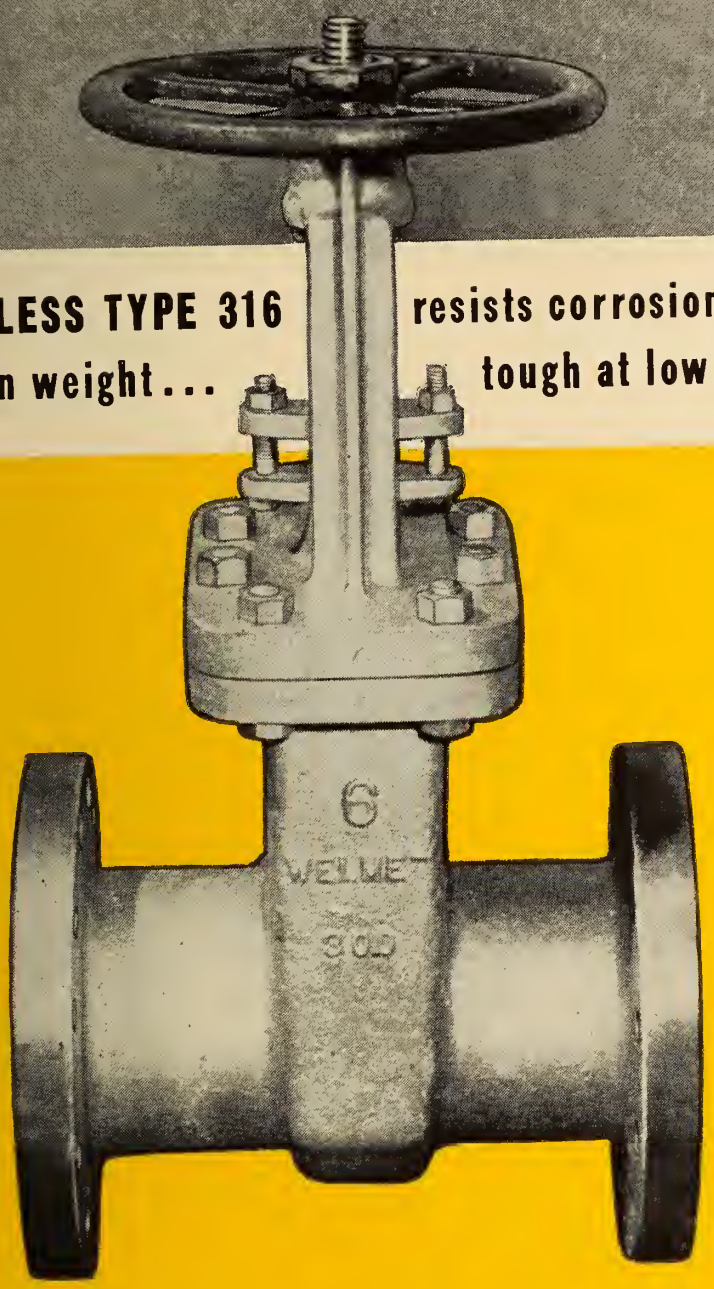
with 100% *"Electronic" Graphite

EAGLE PENCIL COMPANY OF CANADA, LIMITED
217 BAY STREET, TORONTO, CANADA

*®

NICKEL ALLOY STEEL VALVES

STAINLESS TYPE 316 resists corrosion . . . machines easily . . .
light in weight . . . tough at low temperatures



An enterprising Canadian steel foundry has pioneered in the development of light weight stainless steel valves.

The valve casting, of Stainless Type 316, has excellent resistance to corrosion, is relatively light and easy to handle. Price-wise, it is remarkably economical.

Use of this type valve should be considered in all operations where high resistance to corrosion attack is required.

INCO *proven* SERVICE

A fund of useful information on the selection, fabrication, treatment and performance of alloys containing nickel has been accumulated over the years. This data is yours for the asking—through INCO'S Development and Research consulting service.

EMBLEM OF INCO SERVICE NICKEL TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
25 KING ST. W., TORONTO, ONT.

What is the *BEST* method for pile encasement?

HERE'S THE PREPAKT ANSWER

the PROBLEM

. . . to encase the 12-inch steel H-piles supporting a Canadian pulp and paper mill. The beams rest on river bedrock and are normally immersed in 18-20 feet of water containing tannic acid wastes from the mill. Due to these conditions, the beams had been badly corroded, necessitating repair or replacement.

Corroded condition of H-piles prior to Prepakt repair operations.

the PREPAKT SOLUTION

. . . the use of Prepakt methods and materials permitted encasement of these piles without unwatering. After forms were constructed and hoop reinforcement positioned, coarse aggregate was preplaced in the forms. The voids were then pumped full with Intrusion mortar, displacing the water.

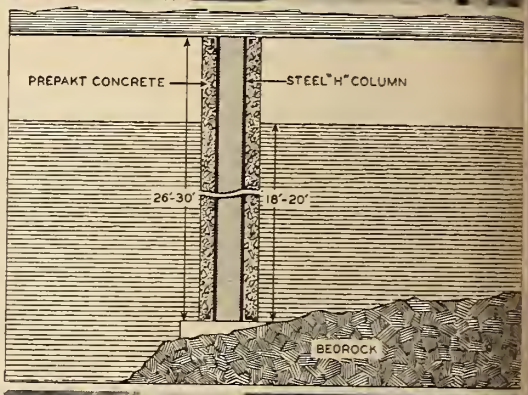


Diagram illustrates how piles were encased by Prepakt techniques.

the RESULT

. . . this Prepakt technique produced high-strength encasement structures permanently bonded to the columns. The dense, impermeable Prepakt Concrete resists the attack of acid wastes and has high weather resistance to cyclic freezing and thawing. Important economies were realized as no cofferdams were required, nor were plant operations interrupted.

After encasement with Prepakt Concrete, piles provide better-than-ever support.

This modern Prepakt technique for pile encasement is applicable to all types of piles — timber, concrete and steel. The outstanding advantages of this cost-cutting method make it the best on every count.

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Before any job is started, it gets a thorough appraisal—by the sales engineer who makes it his business to learn your exact requirements, by the production-wise plant engineer, by the experienced works foreman who will see the job through. Out of these preliminary conferences comes many a saving in *time and money* for the customer.

Quality products from the best, most modern equipment available. This includes high pressure die casting machines with automatic cycle— assuring maximum economy in production.

Service from a completely experienced sales force and work staff.

Looking for a better source for die castings, sand castings, machined parts or forgings? See the Wallaceburg people. Since 1905 they've had a reputation for giving customers *what* they want—*when* they want it!

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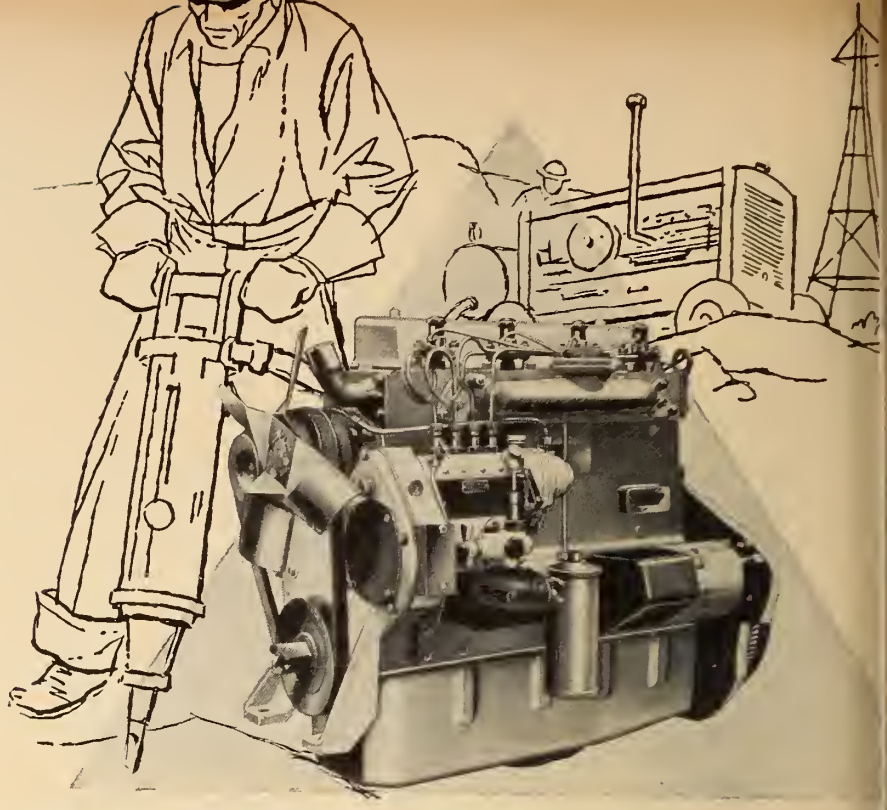
a
new
lightweight
diesel
engine
for all
industrial
applications



PERKINS L-4 4 CYLINDER DIESEL

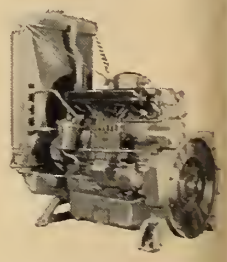
with
outputs up to
60 H.P.
and
speeds up to
2,000 R.P.M.

Designed specifically for industrial use, the Perkins L-4 is a versatile high-speed diesel engine—built to sell at a low price! You can use it for driving generating sets, pumps, compressed air equipment, welding sets and many other jobs. And, you can count on it to operate reliably and economically over long periods.

Sturdily constructed and compact, the L-4 offers you the advantages of accessibility and ease of maintenance. Its famous "Aeroflow" combustion system gives you more work per dollar . . . because you get lower fuel consumption . . . a smoother running engine . . . and instant cold starts.

For complete facts on the Perkins L-4 Diesel Engine, get in touch with us. And, if you require any engine to fit a special need, Perkins Service Engineers will gladly help you with your problem.

another **powerful** Perkins engine



P-6 Industrial Diesel.

Developing 32/85 H.P. at 1000/2400 R.P.M. Proven throughout the world in a wide variety of applications, the powerful P-6 has an outstanding record of trouble-free operation.

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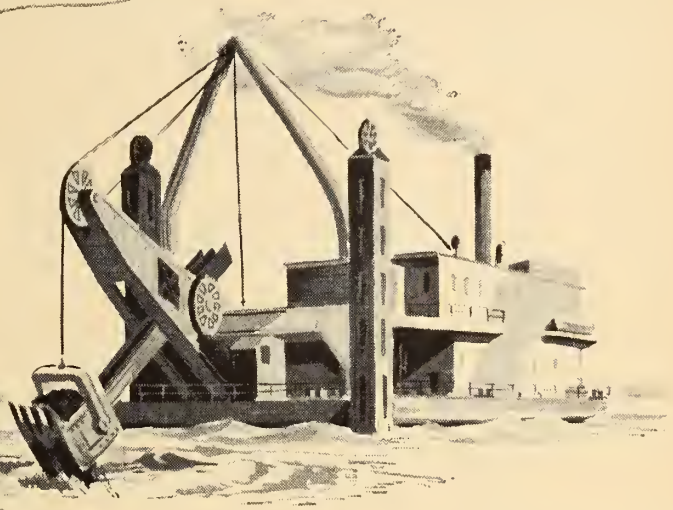

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SHIPBUILDING • SHIP REPAIRING • DREDGING • TRANSPORTATION

Moto-Bug

"THE POWER WHEELBARROW"

ABOVE: Moto-Bug with tilting flatbed platform 4' long, co-pacity 1200 lb.

Ailing production schedules and materials handling bottlenecks never cure themselves. You know what is required — you could write the specifications yourself. It must be a machine with the strength to carry your loads . . . the manoeuvrability to pick its way through the plant . . . the compactness dictated by aisle width and door openings . . . the versatility to perform varied tasks. Well — MOTO-BUG gives you all these, and at a price you will concede to be moderate.

All MOTO-BUG attachments are interchangeable.
All MOTO-BUGS are 33 inches or less in width.

LEFT: Fork-lift Moto-Bug with hydroulic pump; 1000 lb copocity, 5' lift.

BELOW: Moto-Bug with 12 cu ft tilting materials hopper eosily hondles load of costings.

SPECIFICATIONS

SPEED: 1½ to 4 MPH (forward & reverse)
ENGINE: 6 HP Wisconsin
GRADEABILITY: 20%
WEIGHT: 615 lb. with hopper
LENGTH: Varies, 5' 9" opprox.
RIDING STEP: Folding (optional)
TIRES: Pneumotic
Front: 16 x 500
Rear: 12 x 400

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who answers the call, "full speed ahead"?

When the engine room telegraph rings on many a Canadian Naval and merchant ship, turbines built by Inglis respond promptly. Throughout the country too, Inglis heavy machinery is powering the drive to industrial progress which all the world watches. For every basic industry—pulp and paper, mining, petroleum, chemical and manufacturing, the Inglis plant is busily producing big equipment. The call now is "Full speed ahead"—and Inglis is answering.

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STEAM POWER PLANTS PAPER MAKING MACHINES PRESSURE VESSELS
PUMPS COMPRESSORS MARINE STEAM TURBINES HEAVY MACHINERY
REFRIGERATION SYSTEMS

Associated in the English Electric Group with English Electric Company of Canada Limited

Look What A West Coast Shipyard Is Doing With...

SYLVAPLY WATERPROOF -GLUE PLYWOOD

Floating Drydock in operation at Vancouver's Burrard Shipyard and Engineering Works Ltd.

performance under pressure!

Old dockyard hands gasped at the idea of *plywood* ballast tanks . . . but Vancouver's pace-setting Burrard Shipyards had already investigated other salt and fresh water installations where Sylvaply had demonstrated superiority over traditional construction materials.

The giant buoyancy tanks which make up both sidewalls of the drydock in the photo are built with ¾-inch Sylvaply. The crossply construction of Douglas Fir waterproof-glue plywood provides the necessary strength to withstand tremendous pressures.

Wood planking previously used for these tanks required many hours of costly labor to caulk the joins between each board. Sylvaply's big, rugged 4 x 10 foot panels reduced joins to a minimum. Ideally dimensioned for pressure treating with creosote, complete penetration is possible with plywood. Cuttings taken after treating demonstrated that the Sylvaply panels could be cut, sawn and bored without exposing any area not completely creosote protected.

Today, after a rigorous testing period which included repeated submersion and exposure to sun, Burrard reports "complete success, with no sign of water seepage anywhere." The Shipyard is also happy about the considerably lower construction cost with Sylvaply.

Dollar-wise men of Canadian industry have solved construction and fabrication problems with Sylvaply. For information which may help you solve your particular problem correspond with Technical Section, MacMillan & Bloedel Ltd., P.O. Box 355, Vancouver 1, B. C.

Canada's Busiest Building Material.

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KINGSTON sits for its portrait!

Ontario city uses dependable topographic maps for all-round planning

Kingston, an Ontario community with a population of about 34,000, now has an official municipal portrait. CANADIAN AERO SERVICE, LTD. was commissioned to map the city last year.

At a cost of only $15,000. we delivered complete topographic maps of the entire city. Kingston's city planners now have complete, up-to-date map facts for planning and engineering of industrial and residential development . . . for streets, highways and sewer systems, and for all the complex problems of city growth.

Modern CANADIAN AERO mapping can produce accurate contour maps or photo-maps for your city at a great saving in time and tax dollars. Our engineers bring a broad experience to your mapping problem. Write us today.

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OUR AFFILIATE IS SPARTAN AIR SERVICES, LIMITED.

Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

W. R. Elliot.—Walter R. Elliot has been named chief design engineer of Sheldons Engineering Limited. Mr. Elliot has joined the Company after serving for nine years as research engineer of the Buffalo Forge Company of Buffalo, New York. Previous to that appointment he was professor of engineering at the University of Missouri.

W. R. Elliot

●

New Company. — A newly established company, Consolidated Fire & Safety Equipment Ltd., P.O. Box 125, Westmount, Quebec, is distributing the following equipment:
Randolph CO_2 extinguishers and systems. General Fireguard Dry Chemical —soda & acid—foam—carbon tetrachloride, etc. Mine Safety Appliances masks —respirators and general safety lines. Safety-walk non slip products. Safety goggles—welding helmets, etc. E. & J. resuscitators. Fire hose—hose cabinets—hose racks—foam—foam nozzles, etc.
The manager of the Company is George E. Riley.

●

G. F. Sterne Appointment. — G. F. Sterne and Sons Limited, Brantford, Ontario, have been appointed exclusive Canadian distributors for the industrial water conditioning products of Elgin Softener Corporation, Elgin, Illinois. The Elgin Company has been manufacturing water conditioning equipment for over 45 years.

●

"Gilsulate" Distributor. — Insul-Mastic and Building Products Limited, Vancouver, has been appointed distributor for the natural plastic material mined at Bonanza, Utah, and developed as an Insulator by American Gilsonite Co. of Salt Lake City. The product will be distributed under the name "Gilsulate". It is a thermal insulator intended for use by the building industry.

●

Barber-Greene Expansion. — Barber-Greene Canada Ltd. has just completed a new plant and offices at the Don Mills development near Toronto. This Company is a subsidiary of Barber-Greene Company of Aurora, Illinois. President of Barber-Greene Canada Ltd. is Walter B. Holder, and the newly appointed secretary and sales manager is Anthony S. Greene.

●

Defence Production Change. — N. R. Chappell has been appointed director of the Washington office of the Department of Defence Production. He succeeds S. D. Pierce, who has been appointed Canadian Ambassador to Brazil.

●

K. A. Durrell.—Kevan A. Durrell has been appointed factory representative in Montreal of Perfex Controls Limited.

●

A. J. LeBlanc. — Arthur J. LeBlanc, M.B.E., has been appointed assistant to the president of Toronto Iron Works Limited and Central Bridge Company Limited. The president of the Company is G. E. Ellsworth.

●

Stelco Appointment. — John D. Allan has been named sales manager, construction materials division, the Steel Company of Canada, Limited. He succeeds R. H. Macdonald who is now manager of the Company's heavy bolt division.

J. D. Allan

●

L. W. Neumark.—Leo W. Neumark has joined the Tremco Manufacturing Company of Cleveland, Ohio and Toronto, Ontario, as vice-president in charge of marketing. In his new post Mr. Neumark will coordinate sales activities of several divisions. The Toronto plant of the Company is located at 220 Wicksteed Avenue, Leaside, Ontario.

●

STEEL SHAPES...

that shape the Future

In Canada's rapidly expanding economy, steel warehouses serve an essential function by supplying steel shapes of all kinds for a multitude of industries. We, in Dominion Bridge, are proud of the fact that we maintain the only *national* warehouse service, serving thousands of customers from steel stocks at nine strategic centres from coast to coast. Under present day conditions, this "on the spot" service means a great deal in meeting urgent requirements.

WAREHOUSE DIVISION
DOMINION BRIDGE
COMPANY LIMITED

Dominion Bridge Company warehouses at:
MONTREAL, OTTAWA, TORONTO, WINNIPEG, EDMONTON, CALGARY, VANCOUVER.
Assoc. Company Warehouses at: AMHERST, SAULT STE. MARIE.
*Other Divisions: Structural, Platework, Boiler, Mechanical.

ANACONDA HAS THE ANSWER TO *Your* METAL PROBLEM*

Formbrite

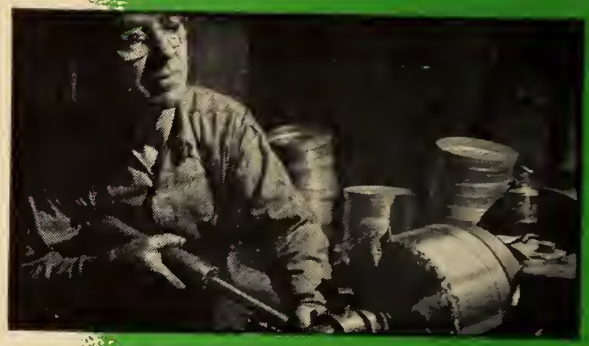
cuts polishing costs of General Steel Wares Electric Kettles

General Steel Wares Limited, an all-Canadian Company established over 100 years ago, manufactures over 4000 metal housewares articles. One of them, an electric kettle, is made from Formbrite, an excellent metal developed by Anaconda for press room products.

Formbrite has definite advantages over ordinary brass. The exceptionally fine grain substantially reduces buffing time (an important cost factor). It is stronger, has a harder, more scratch-resistant surface—yet is so ductile that it can be readily formed, drawn or spun. Then, too, Formbrite is no more expensive than standard drawing brass.

Many Canadian industries, like General Steel Wares, to whom Anaconda supplies Formbrite in increasing quantities, report big savings in polishing operations.

Shown above is the first draw of 'Formbrite' (Anaconda drawing brass) to form the General Steel Wares electric kettle.



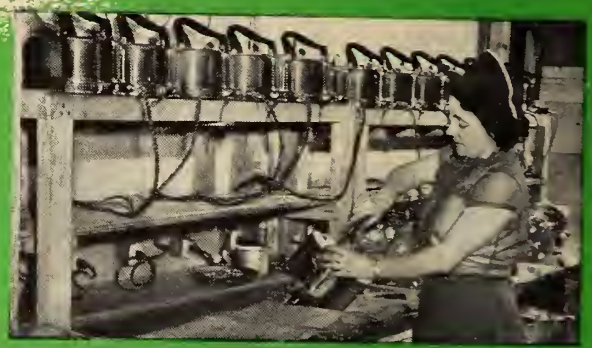
Kettles are first drawn, trimmed and spun. They are then buffed. Formbrite, because of its exceptionally fine grain has been found to cut polishing costs.

After holes have been punched for lips and handles, kettles are plated. Installation of electric assembly is seen above.

*

ANACONDA HAS THE ANSWER

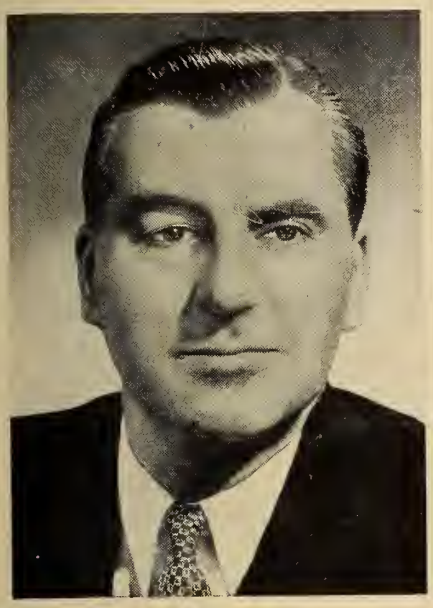
The specialized knowledge and experience of our Technical Department is at your service. If you have a metal problem—Anaconda can give you the answer. Do not hesitate to get in touch with us. Anaconda American Brass Limited, Main Office and Plant, New Toronto, Ontario; Montreal Office, 939 Dominion Square Building.



As seen here kettles are tested, approved and final outer bottom is installed. They are then packed and ready for shipment.

ANACONDA—*First* IN COPPER, BRASS AND BRONZE

Canadian Vickers President.—Ormonde Herbert Barrett, O.B.E., E.D., has been elected president of Canadian Vickers Limited. He succeeds J. Edouard Labelle, who is now chairman of the board.



O. H. Barrett

●

G. T. Berner.—G. T. Berner has been named general sales manager of Anaconda American Brass. Mr. Berner was formerly sales manager of the company which position he has held since 1944. He will make his headquarters in the offices of Anaconda American Brass Limited, New Toronto, Ontario.

G. T. Berner

●

K. J. Dewhirst.—K. J. Dewhirst has been appointed manager of the sales department of the B. F. Sturtevant Co. of Canada.

●

Ontario Hydro Scholarships.—Winners of nine Ontario Hydro Engineering Scholarships were announced on August 21st by Robert H. Saunders, chairman of the Hydro. Total value of the scholarships is $2,300. A Toronto student, J. F. Phenix, won the third-year scholarship

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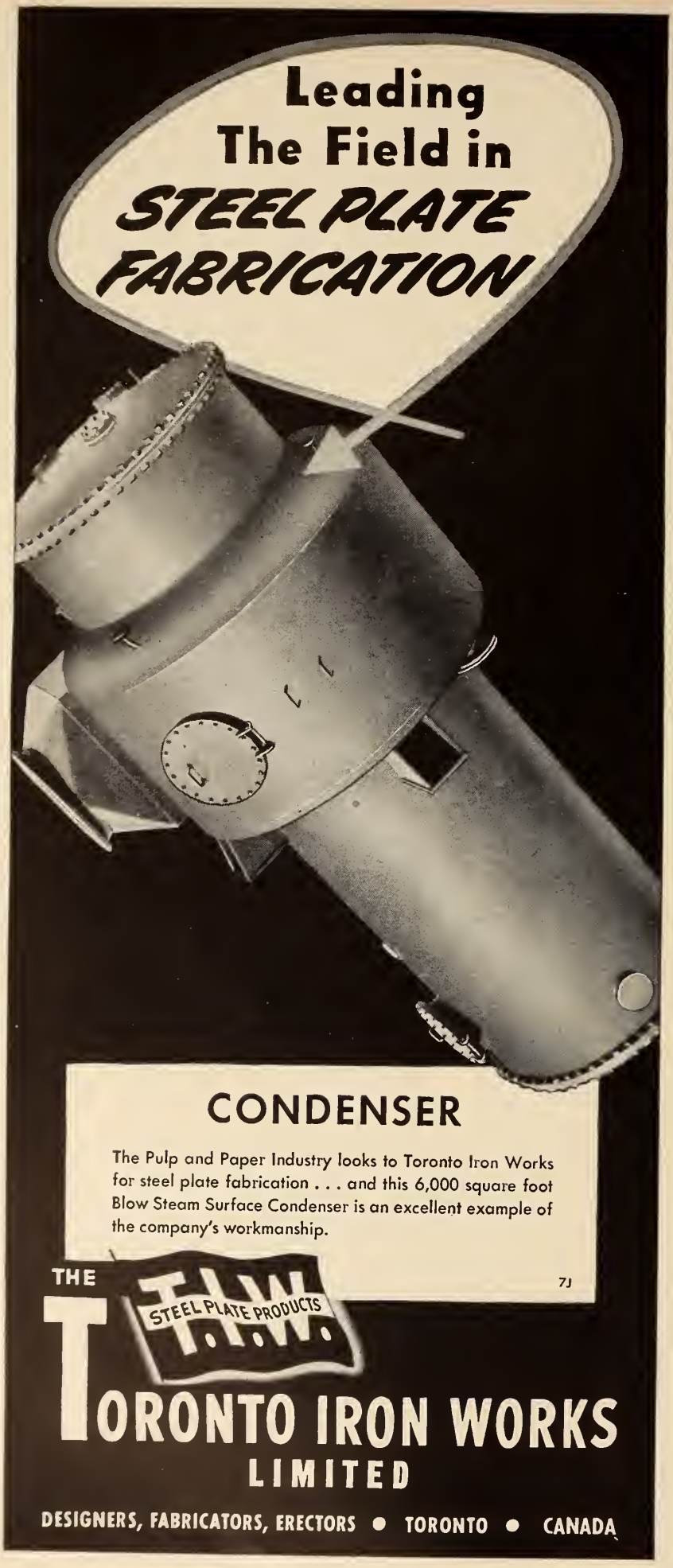
ONTARIO: Laurie & Lamb, (Stationary), 284 King St. West, Toronto
Sheridan Equip't Co. Ltd. (Portable), 33 Laird Drive, Toronto
MANITOBA & SASKATCHEWAN: Medland Machinery, 576 Wall Street, Winnipeg
BRITISH COLUMBIA: B. C. Equipment Co., Ltd., 551 Howe Street, Vancouver

5305



in electrical engineering at the University of Toronto. Winner of the second year award for engineering and business was G. W. Torrance, Burlington, Ontario. Another Toronto student, A. F. Walden, won the first-year award in chemical engineering. All scholarships offered at Queen's University were for work in applied science. The first, second and third year honors were won respectively, by: R. D. Tillotson, Leamington, Ontario, I. M. Duck, Kamloops, B.C., and G. R. Yungblut, Auburn, Ontario.

Cadet G. R. Fanjoy, S.E.I.C., won the third year electrical engineering scholarship at R.M.C., Kingston. At the Ryerson Institute of Technology D. J. Haxton of Oshawa was awarded the scholarship open to students in the mechanical and industrial course. William Toivonen was named winner of the Hydro Scholarship in applied science at the Lakehead Technical Institute.

●

Provincial Engineering Expansion.—Provincial Engineering Limited, Niagara Falls, Ontario, have announced that they are considerably broadening their activities with the formation of a new transmission tower division. This will give Provincial three divisions—manufacturing, making all types of cranes and hoists; construction, equipped to provide a complete mechanical construction and equipment installation service; transmission tower division.

D. A. Barnum has been appointed manager of the new division. He was recently with the Canadian Bridge Company, Walkerville, Ontario.

The new tower division will specialize in the design, detail, fabrication, and erection of galvanized steel transmission towers and sub-stations.

●

F. J. Edwards (Canada) Ltd.—To promote sales and supervise distribution and service of "Besco" machinery throughout Canada, F. J. Edwards Ltd., of London, England, have formed a new company—F. J. Edwards (Canada) Ltd. Offices and showrooms will be located at 16 Watsons Drive, Etobicoke, Toronto 18.

The president of the Canadian company is H. A. Johnson, managing director of the British company. Vice-president is G. M. Hayward, who is technical and export director of the British company. The resident managing director in charge of activities in Canada is John L. Hall.

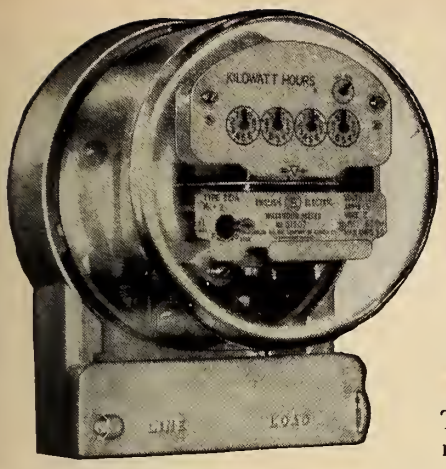
●

Norene S. Pye.—Norene S. Pye of Toronto, is the first woman chemical engineer to join the engineering department of Canadian Industries Limited. She is a recent graduate of the University of Toronto, and will be engaged in the design of equipment similar to that installed in the newly constructed nylon intermediates plant at Maitland, Ontario.

●

C. W. Nessell.—C. W. Nessell, of Minneapolis-Honeywell Regulator Co. Ltd., who is an authority on warm air heating, will conduct a series of meetings in October on behalf of the National Warm Air and Air Conditioning Association in Ontario and Quebec.

The first meeting will be held in Windsor, Ontario, on October 14th. He will speak in London, Ontario, on Octo-



longer bearing life

Here's why

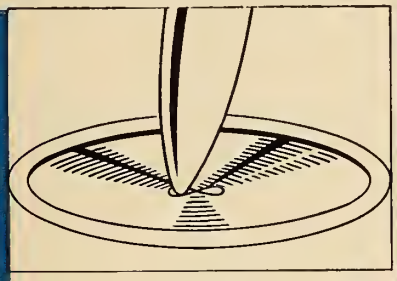
The wear in meter bearings is caused by vibration, side thrust and normal rotation.

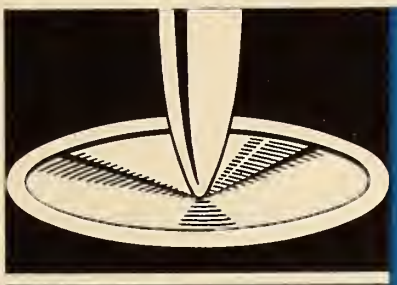
The voltage coil flux which acts continuously night and day, whether the meter is measuring load or not, produces in the disc a 120 cycle vibration and a 60 cycle vibration. These vibrations are at right angles and cause the lower pivot to describe a figure "8" path on the jewel. During a year the pivot in an ordinary meter travels about 40 miles in this manner while the pressure on its point may exceed 70 tons per square inch—a formidable combination for wear.

The life of the bearings of the new English Electric meters has been increased enormously by:

1. Providing two pairs of double pole permanent magnets arranged so as to—
   (*a*) Cancel out most of the vibration and thus reduce the annual pivot travel to less than 6 miles.
   (*b*) Halve the side thrust.
2. Reducing the speed of rotation which reduces the rotational wear and also reduces the total pivot travel.

BOTTOM PIVOT AND JEWEL in an ordinary meter using this combination of driving electromagnet and braking permanent magnet system. Driving force and braking force produce side thrust equal to their sum.





BOTTOM PIVOT AND JEWEL in English Electric type B21 meter with balanced double brake magnets and electromagnet system. As the two braking forces act in opposite directions their effects on side thrust cancel, minimizing the total side thrust and parasitic forces.

PERMANENCE OF CALIBRATION is ensured by the use of one-piece laminations and high coercive force brake magnets.

PA5321B

EXCEPTIONAL ACCURACY over a wide load range is obtained by low speed of operation; high degree of linearity in the electromagnet design; and high ratio of permanent magnet damping to A.C. damping flux.

'ENGLISH ELECTRIC'

WATTHOUR METERS

Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

English Electric Company of Canada Limited *Head Office and Factory: St. Catharines, Ontario*

ber 15th, Hamilton October 16th, Toronto, October 19th and 20th, Kingston October 21st, Ottawa October 22nd and Montreal October 23rd.

Communicate with the Company at Leaside, Ontario, for details as to the times and places of the meetings.

●

Allis-Chalmers Appointments. — M. C. Lowe, president of Canadian Allis-Chalmers Limited, has announced the appointment of Wally Wright, manager of the firm's Ontario district sales office, Toronto, as director of purchasing at head office, Lachine, Que. Mr. Wright is succeeded by Frank Bowden, manager of the eastern district sales office, Montreal. Mr. Bowden's place has been filled by Ken Dodd, manager of the Vancouver district sales office, who has been replaced by Jack Slingsby, sales engineer of the Ontario district sales office. Gordon E. Irving, sales engineer of the Calgary district sales office, has been appointed manager of that branch, and Hugh McCreadie, sales engineer with the Ontario district sales office, has been transferred to Calgary in the same capacity. All appointments were effective August 1, with the exception of Mr. Irving's, which took effect on July 1.

●

Nickel Appointments.—Ralph D. Parker has been elected president of Canadian Nickel Company Ltd., Inco's subsidiary which conducts its exploration and prospecting programme.

R. W. Wright

F. J. Bowden

K. L. Dodd

J. G. Slingsby

G. E. Irving

H. McCreadie

NEW Bulletin Tells

9 WAYS TO REDUCE YOUR REFRACTORY WASTE

in Kilns and Dryers

Here is a new, special bulletin giving you nine ways in which Plibrico materials, methods and engineering cut refractory costs in dust chambers, tail rings, firing hoods, clinker coolers, flues, breechings waste-heat boilers, stacks.

It covers *the* Plibrico way of eliminating troublesome joints in linings, preventing bulging and collapse, cutting maintenance costs, reducing refractory stocks, resisting abrasion, meeting special problems, providing skilled installation with undivided responsibility.

Write or call us for your copy.

Plibrico (Canada) Limited

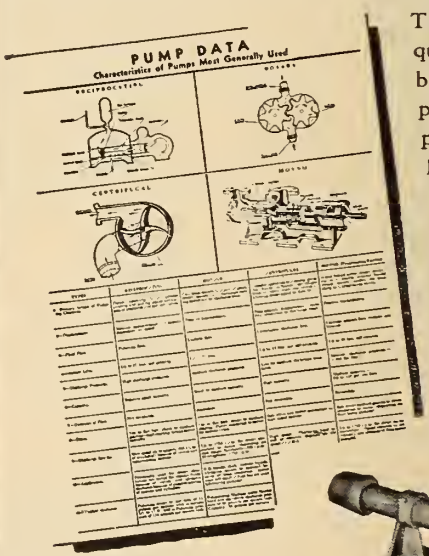
POST OFFICE BOX 10, NEW TORONTO 14, ONTARIO

PLIBRICO SALES & SERVICE IN PRINCIPAL CITIES

REFRACTORY PRODUCTS • ENGINEERING • CONSTRUCTION

DO YOU KNOW PUMPS?

THIS DATA SHEET DESCRIBES THE ACTION AND USES OF THE MAIN PUMP TYPES . . .



This free leaflet shows quickly the type of pump best suited to your application. The four main pump types are analyzed and described briefly but completely. You'll see how the versatile Moyno outperforms all other types. It pumps anything that will flow through a pipe, without pulsation turbulence or aeration.

The Efficient

R & M MOYNO

Send for Bulletins MP101/E93 and 30B/E93

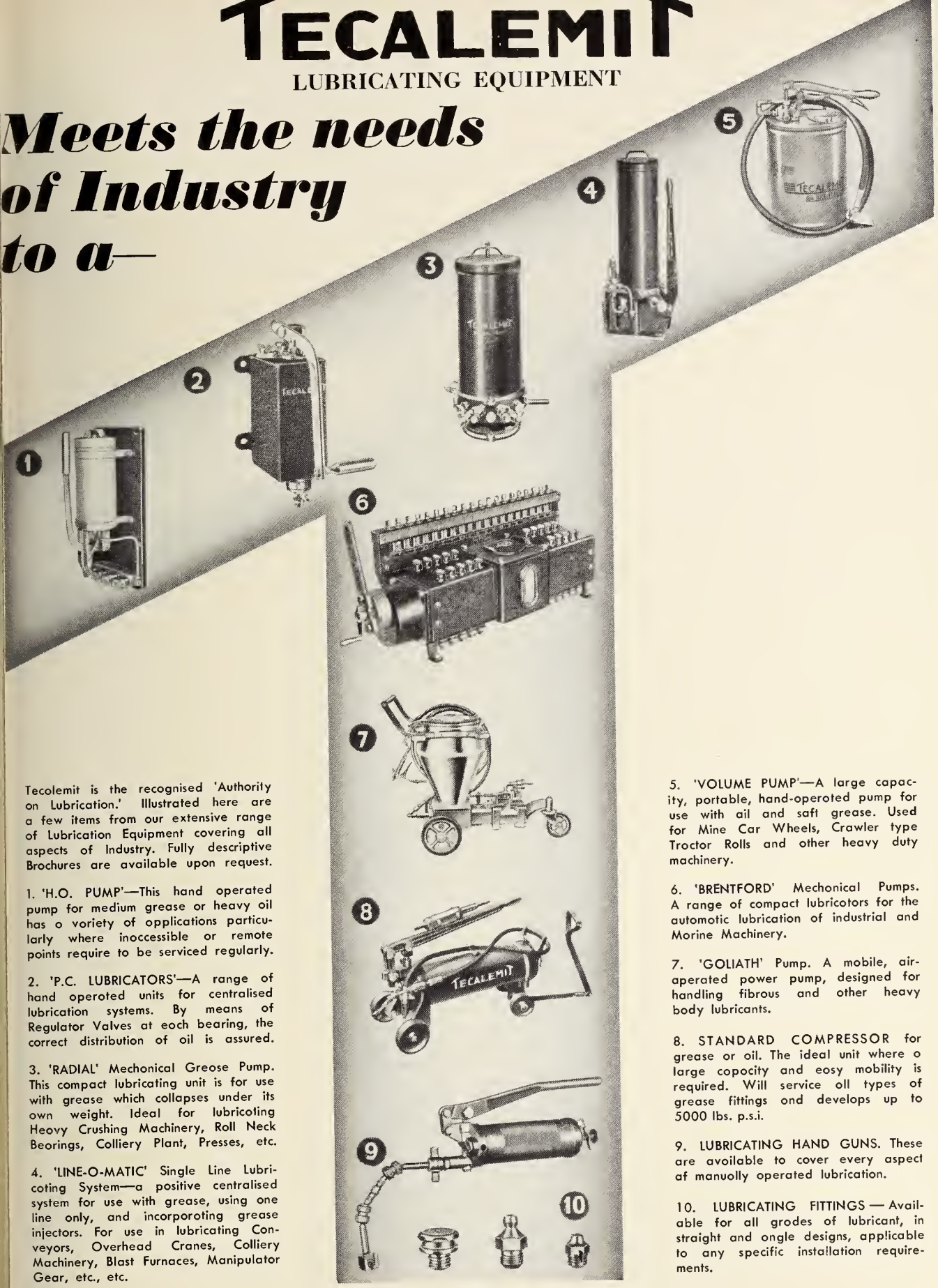
THE ROBBINS & MYERS CO.
OF CANADA LIMITED
TORONTO BRANTFORD, CANADA MONTREAL

ELECTRIC MOTORS • PROPELLAIR INDUSTRIAL FANS • MOYNO PUMPS • DESK FANS • HOISTS AND CRANES

TECALEMIT

LUBRICATING EQUIPMENT

Meets the needs of Industry to a—



Tecolemit is the recognised 'Authority on Lubrication.' Illustrated here are a few items from our extensive range of Lubrication Equipment covering all aspects of Industry. Fully descriptive Brochures are available upon request.

1. 'H.O. PUMP'—This hand operated pump for medium grease or heavy oil has o voriety of opplications particularly where inoccessible or remote points require to be serviced regularly.

2. 'P.C. LUBRICATORS'—A range of hand operoted units for centralised lubrication systems. By means of Regulator Valves at eoch bearing, the correct distribution of oil is assured.

3. 'RADIAL' Mechonical Greose Pump. This compact lubricating unit is for use with grease which collapses under its own weight. Ideal for lubricoting Heovy Crushing Machinery, Roll Neck Beorings, Colliery Plant, Presses, etc.

4. 'LINE-O-MATIC' Single Line Lubricoting System—a positive centralised system for use with grease, using one line only, and incorporoting grease injectors. For use in lubricating Conveyors, Overhead Cranes, Colliery Machinery, Blast Furnaces, Manipulator Gear, etc., etc.

5. 'VOLUME PUMP'—A large capacity, portable, hand-operoted pump for use with ail and saft grease. Used for Mine Car Wheels, Crawler type Troctor Rolls and other heavy duty machinery.

6. 'BRENTFORD' Mechonical Pumps. A range of compact lubricotors for the automotic lubrication of industrial and Morine Machinery.

7. 'GOLIATH' Pump. A mobile, air-aperated power pump, designed for handling fibrous and other heavy body lubricants.

8. STANDARD COMPRESSOR for grease or oil. The ideal unit where o large copocity and eosy mobility is required. Will service oll types of grease fittings ond develops up to 5000 lbs. p.s.i.

9. LUBRICATING HAND GUNS. These are avoilable to cover every aspect af manuolly operated lubrication.

10. LUBRICATING FITTINGS — Available for all grodes of lubricant, in straight and ongle designs, applicable to any specific installation requirements.

TECALEMIT

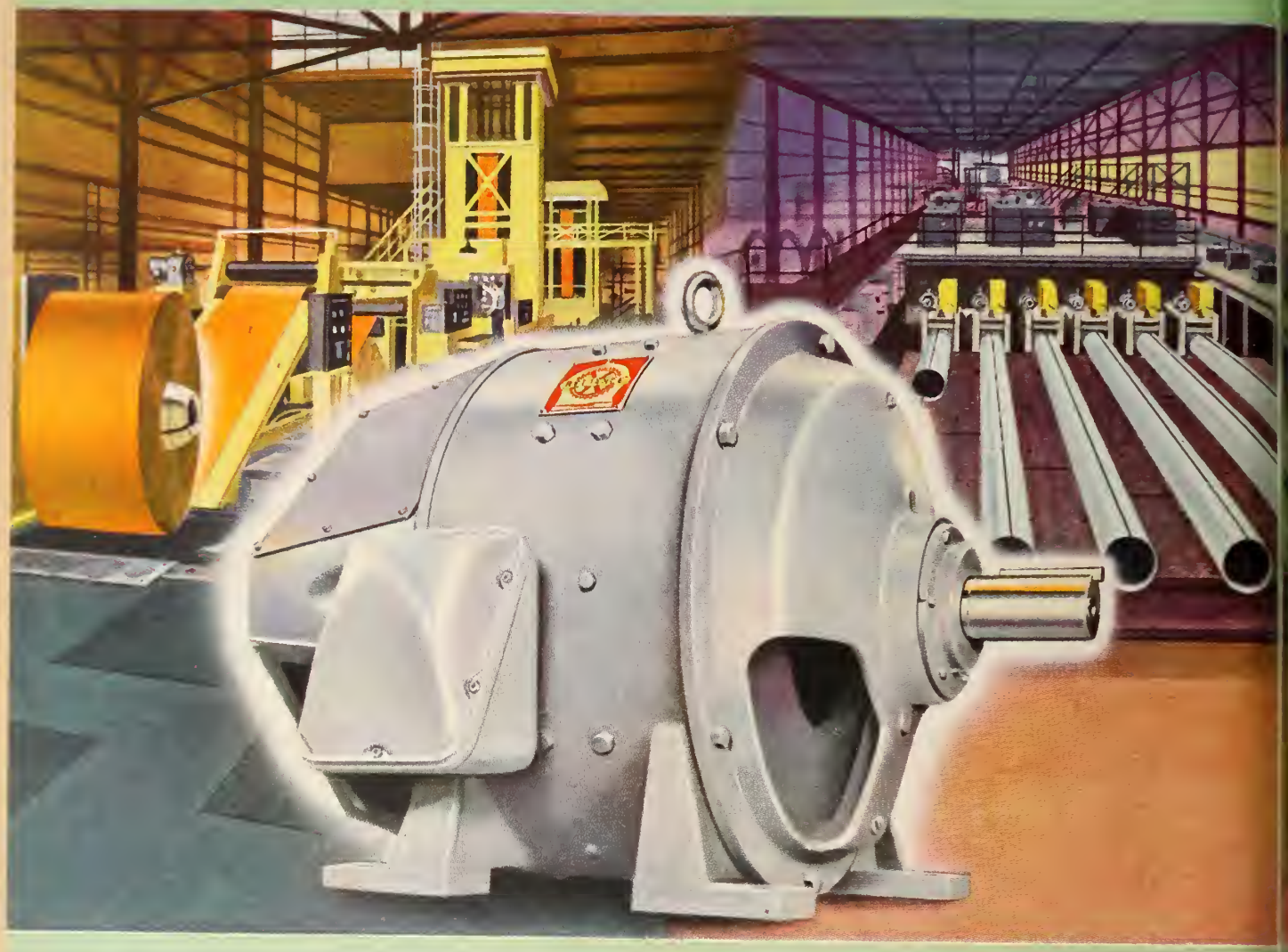
The Authority on Lubrication

431 KING ST. W., TORONTO

Also Available Through
Thampson-Gordon Ltd., Hamiltan
Moore Bros. Machinery Co. Ltd., Montreal

Alsa Available Through
The Federal Belting & Asbestos Co. Ltd.
Toronto, Vancouver

For tough power jobs..



RELIANCE

TYPE 'T' HEAVY DUTY

D-C. MOTORS

3/4 TO 1000 HORSEPOWER

"The Toughest Motors Ever Built"

ınd precise speed control

This sturdy, versatile DRIVE MOTOR meets all your requirements for

- UNLIMITED SPEED CHANGES
- CONTROLLED ACCELERATION AND DECELERATION
- JOGGING, INCHING, CREEPING
- SMOOTH STARTING, QUICK STOPPING

Early Reliance developments in drive motors gave industry wider ranges of speed adjustments than any motors previously available. And Reliance has specialized ever since in drive motors combining heavy duty construction for the toughest power jobs with precise speed control to meet your most exacting requirements. Use Reliance Type 'T' Heavy Duty Drive Motors on the most grueling applications and your experience will reveal why long-time users have called them "*The Toughest Motors Ever Built*". Get dependable motor response to all-electric control in a Reliance-engineered drive and you have the means of achieving and maintaining maximum production from any machine.

WRITE for D-c. Motor Bulletin C-2001 and Bulletin D-2311 which highlights the role of Reliance adjustable-speed drive motors in single and multi-motor drive systems.

HOW RELIANCE ENGINEERING adapts the motor to your specific power needs...

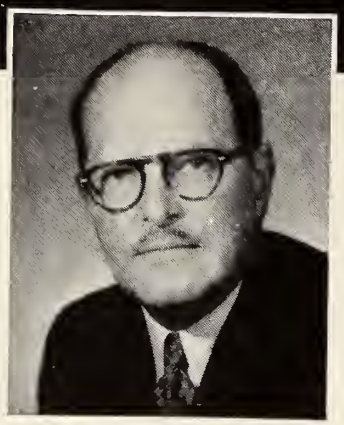
Reliance adjustable-speed drive motors are engineered to respond instantly and accurately to the signals of associated controls and regulators in any motor-drive system. Co-ordinating mechanical design, horsepower and speed range of the motor with other components in a drive is the specialized job of Reliance Application Engineers. Their application experience and practical production knowledge give you whatever operating flexibility is required to produce more goods at less cost.

RELIANCE ELECTRIC & ENGINEERING (CANADA) LIMITED

VANCOUVER • ST. CATHARINES • HAMILTON • WELLAND • TORONTO • MONTREAL • TRURO, N. S.

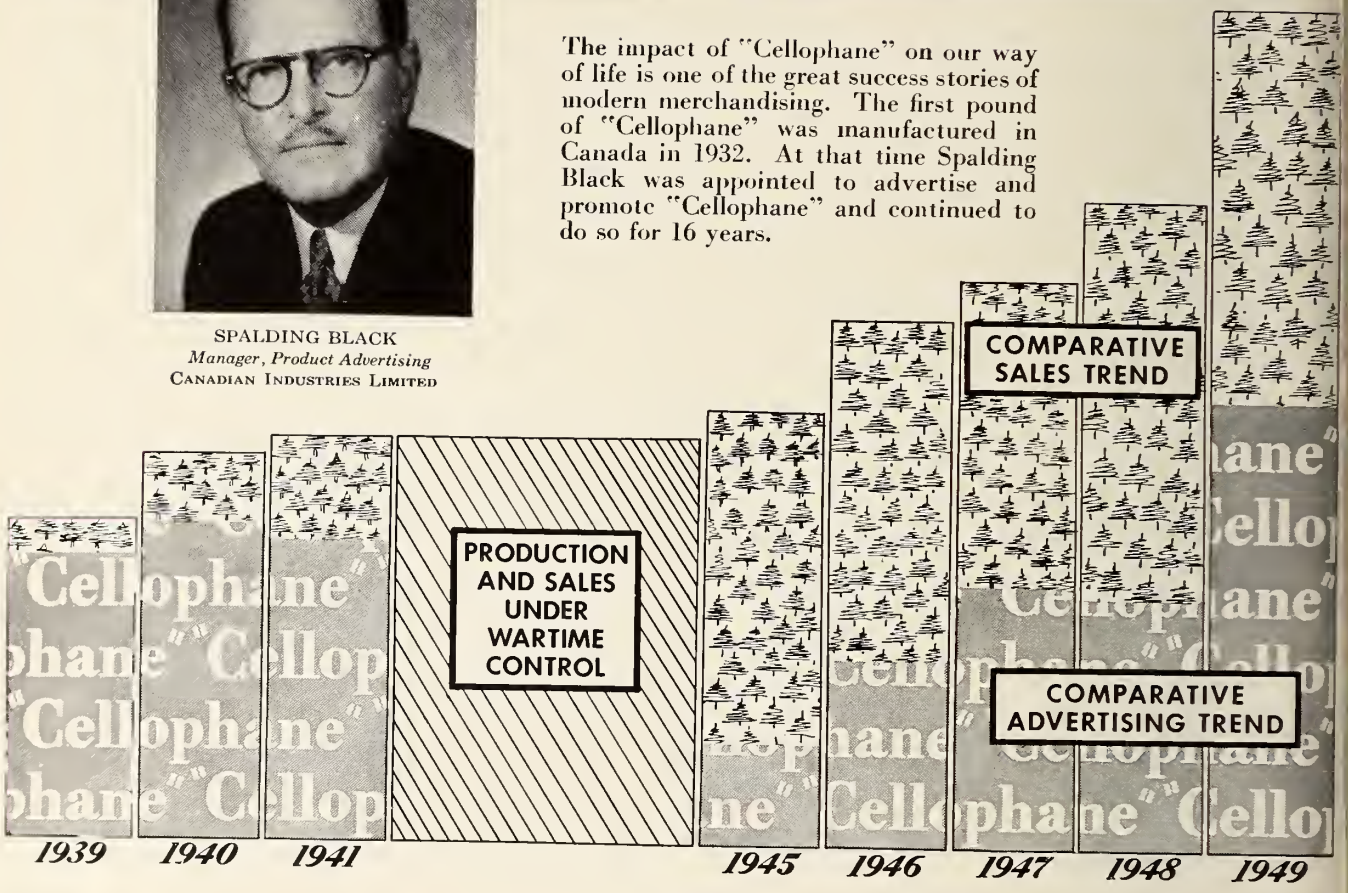
TRANSFORMERS — A-C. AND D-C. MOTORS — RELIANCE V*S DRIVES

"Cellophane" Division of C-I-L has used Business Papers continuously since 1933



SPALDING BLACK
Manager, Product Advertising
CANADIAN INDUSTRIES LIMITED

The impact of "Cellophane" on our way of life is one of the great success stories of modern merchandising. The first pound of "Cellophane" was manufactured in Canada in 1932. At that time Spalding Black was appointed to advertise and promote "Cellophane" and continued to do so for 16 years.



Here's what Mr. Black says:—

"Each year we have used all the business papers that reach fields where 'Cellophane' is used or where potential markets exist. Practically all forms of advertising were used at different times for different purposes, but one of the essential elements of contact to our customers and prospects has been, and is, our continuous campaign in the business and trade press."

Since 1933 "Cellophane" Division of Canadian Industries Limited has used Business Paper advertising continuously, as an essential element in its promotion of the use of "Cellophane".

The success of this advertising policy is shown by the graph above.

The B.N.A. includes merchandising, industrial, service, and management publications, serving every branch of business and industry. One or more of them covers YOUR prospects, economically and effectively.

The emblem that identifies BNA *business papers of character*

BUSINESS NEWSPAPERS ASSOCIATION
OF CANADA
137 Wellington St. W., Toronto, Ont. Telephone: WA 5462

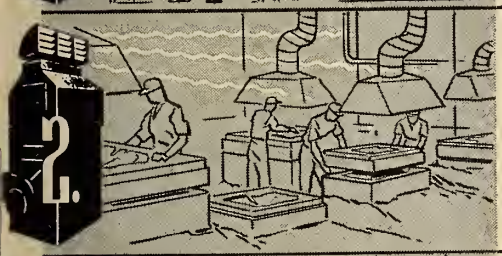
HERE ARE 5 ways

A DRAVO *Counterflo* HEATER* CAN WORK FOR YOU!

*DIRECT-FIRED

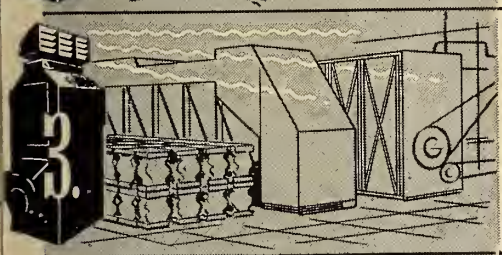
COMFORT HEATING *(commercial and industrial)*

Dravo Heaters have a 150-foot air throw and recirculate warm air at the working level, giving maximum comfort with minimum roof heat loss. No expensive pipe covering, radiators or ducts required. Quick warm-up; automatic on-off or modulating controls.



TEMPERING MAKE-UP AIR

Where dust-filled or fume-filled air must be removed from a building by exhausters, this air can be replaced and tempered by Dravo Heaters. Equal pressure is maintained . . . working conditions are kept comfortable.

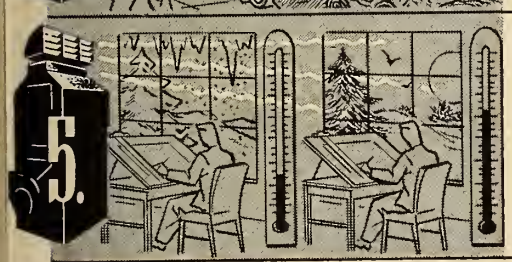


HEAT CURING

Dravo Heaters can be used independently or in combination with other equipment for process curing concrete, plastics, paper, fibre containers, rubber and many other products. Automatic temperature controls keep air flow at desired temperature.

PROCESS DRYING

Moisture content of air can be controlled or removed entirely by using fresh or recirculated air. Immediate response to temperature controller demand makes it ideal for drying paint, farm crops, wood products, rugs (after cleaning) and many other processes.



YEAR-'ROUND VENTILATION

In addition to comfort heating, Dravo Heaters provide fresh-air ventilation in warm weather and can be easily tied in with air-conditioning systems.

DRAVO HEATER *Plus* VALUES . . .

- Low initial cost . . . users report 30% to 60% savings on installation.
- Direct-fired . . . low fuel consumption . . . burn gas or oil . . . readily converted.
- Long service life, low maintenance . . . stainless steel combustion chamber eliminates refractory lining.
- Easily moved to any location to fit your requirements.
- Flexibility . . . can be mounted horizontally or vertically on floor, walls or ceiling.
- Available in sizes from 400,000 to 2,000,000 Btu/hr.

WRITE FOR MORE INFORMATION. It's worth your while to look into Dravo *Counterflo* Heaters for any of these five functions shown above. You'll be glad you did.

DRAVO

HEATING DIVISION

MARINE INDUSTRIES LIMITED

SOREL, QUEBEC

J. Roy Gordon, vice-president and general manager of Canadian operations of the International Nickel Company of Canada Limited has been elected a director of the Company.

●

Shawinigan Changes.—Eugene A. Gareau, superintendent of the Rapide Blanc and Trenche power developments of The Shawinigan Water and Power Company for the past four years, has been transferred to the field headquarters of the Company's generation and transmission department at Shawinigan Falls. He will serve as assistant to the divisional engineer, R. J. Hirsch.

Mr. Gareau has been succeeded by David F. Foster, who has been stationed at Rapide Blanc since 1949.

●

Westinghouse Reorganization.—Changes in the organization of the Canadian Westinghouse Supply Company have been announced by R. L. Brown, vice-president and general manager.

The changes are—R. J. Burgess, formerly sales promotion manager of the Canadian Westinghouse Company's appliance division, has been appointed sales manager of the Supply Company's appliance division. He replaces G. I. Harrison who goes to Canadian Westinghouse as manager, major appliances.

DEXION *is scientific*

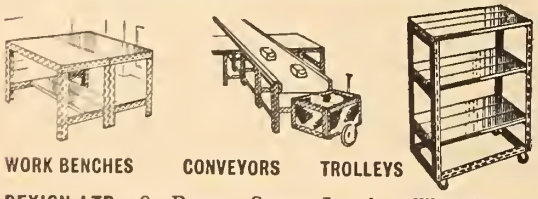
Dexion, the constructional unit of the age, is a product of scientific research. Precision-made from the best quality mild steel, phosphate treated against rust and stove enamelled, it comes to you — complete with nuts and bolts — ready for instant use.

NO MEASURING
NO DRAWING
NO DRILLING
NO PAINTING
NO SKILLED LABOR
NO RUSTING
NO WASTE
NO WELDING
NO DELAYS

DEXION *returns your money with interest*

With Dexion, you can build much of the equipment you need with immediate savings in cost, time and manpower. Dexion structures can be tailor-made to *your* requirements. They can be dismantled and used again and again in countless different ways. Once you use Dexion you will wonder how you ever did without it!

DEXION *has unlimited versatility*



WORK BENCHES CONVEYORS TROLLEYS

WRITE OR PHONE NOW
for illustrated literature CH2, or, better still, order a trial supply and see for yourself.

ONTARIO
Dugald Cameron Associates Ltd., Malton
Tel: Toronto Cherry 1-4311

QUEBEC
Francis Hughes & Associates Inc.
926 University Tower Building. Montreal
Tel: Un 6-7348

MANITOBA & SASK.
Mumford Medland Ltd.
576 Wall Street, Winnipeg
Tel: 37187/80

ALBERTA
Northern Asbestos & Building Supplies Ltd.
P.O. Box 578, Edmonton
Tel: 73536

B.C.
F.T.S. Ltd.
856 Dunsmuir Street, Vancouver
Tel: Pacific 9946

DEXION LTD. 189 Regent Street, London, W.1, England

Dexion Angle is protected by British Patent No. 620,696, Canadian No. 455,256, and world patents.

DEXION SAVES LABOR SPACE & MONEY!

T.A.5427

Eric Hall, formerly with Westinghou Electric Supply Company in the Unit States, has been appointed Ontario r gional manager with headquarters Toronto. F. J. Taylor has been tran ferred from the Alberta region to T ronto where he will serve as sales pr motion supervisor in the specialti division.

●

P. G. Kingsmill.—P. G. Kingsmill h been appointed apparatus sales engine for Canadian General Electric Compar in western Ontario. Mr. Kingsmill w contact utility and industrial custome in the Niagara Peninsula. He will mak his headquarters at the Company's a paratus sales office at 355 Main St. Eas Hamilton, Ontario.

●

W. Digby Worthy.—W. Digby Worth of the computation centre of the En lish Electric Company Limited, has r cently been travelling in Canada a the United States on a Fellowship fro St. John's and Christ Colleges, Can bridge.

Mr. Worthy has been studying Amer can and Canadian computation practi and equipment, and also has been i vestigating the needs for the services the computation centre by the Engli Electric Company of Canada Limite and the John Inglis Co. Limited.

●

Walter Smallwood.—Walter Smallwoo has been appointed factory sales repr sentative for Canada, except Britis Columbia, of the refrigeration divisio of Curtis Manufacturing Company, S Louis, Missouri. He will have office and warehouse at 187 King St. Eas Toronto.

●

R. R. Keay.—Robert R. Keay has bee named a vice-president and chairma of a new managing committee appoint ed to direct operations of Deeks Mc Bride Limited, Vancouver.

●

C.G.E. Appointments. — Departmen managers in Canadian General Electri Company's marketing services divisio have been named by C. A. Morrison vice-president.

The division provides marketing ad vice, appraisal, assistance and service t all company segments, specializing i marketing research, product planning sales, advertising and sales promotion product service, marketing personne development, public relations and gov ernment relations.

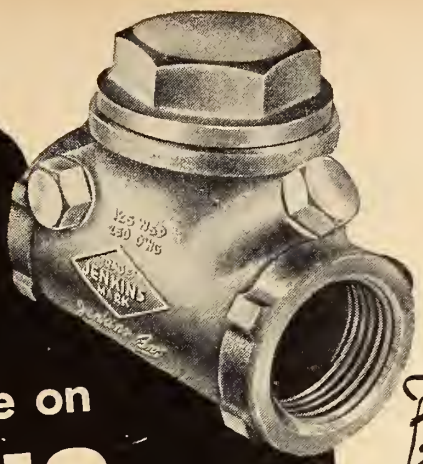
Department managers are: J. N Milne, marketing research; H. H. Rim mer, advertising and sales promotion C. J. Slattery, marketing personne development; D. O. Steadman, publi relations.

●

Josam Changes. — Josam Canada Lim ited has expanded its activities and now has a new building at 130 Bermondsey Road, Toronto. The plant and office now comprise over 10,000 square fee of modern building area. The following appointments have been made: W. C Fletcher, manager in charge of sales D. B. McColm, assistant manager i charge of sales engineering; J. E. Kelly office manager.

●

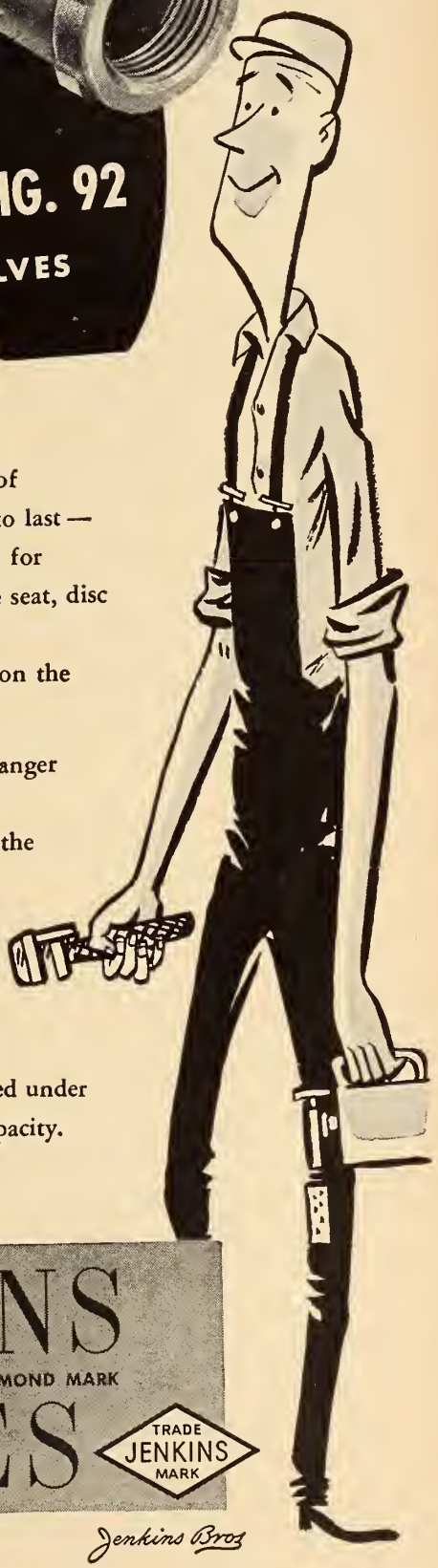
(*Continued on page 1256*)



Engineers and Steamfitters see eye to eye on

JENKINS FIG. 92

BRONZE SWING CHECK VALVES



Constructed for extra strength and endurance of high-tensile Bronze, this Jenkins Valve is built to last — and last! The Jenkins Fig. 92 valve is designed for easy maintenance as well as efficient service. The seat, disc and hanger are set at an angle of 40 degrees to the vertical for firm and positive valve closure on the lightest return pressure.

For renewal or inspection the entire disc-and-hanger assembly can be lifted through the top of the valve by unscrewing the cap and withdrawing the hanger pin.

Jenkins Fig. 92 is machined to close tolerances for firm closure when installed in vertical or horizontal pipe lines. Ribbed pipe ends of substantial proportions provide a sure wrench grip, and each valve is factory-tested under hydrostatic pressures far in excess of its rated capacity.

Sold Through Leading Industrial Distributors

JENKINS BROS. LIMITED
617 St. Remi Street, Montreal

Sales Offices:
Toronto, Winnipeg, Edmonton, Vancouver

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
TRADE JENKINS MARK

Jenkins Bros

Mechanize 3 out of 5 sigma* hand

You can mechanize a lot of your manual sigma* welding applications with DOMINION OXYGEN'S new, lightweight SWM-3 machine. One man handles this easily portable machine—it weighs only 40 lbs.—and it's flexible. It can be mounted on a wall, a post, a carriage, or on a tractor-type machine, depending on the work at hand . . . And best of all, this machine can "think"—through DOMINION OXYGEN'S electronic voltage control.

Arc voltage control is a DOMINION OXYGEN development for machine sigma welding. Set up out of the way, the voltage control instantaneously speeds up or slows down wire feed speed as required by changing arc conditions. The result is that you get smooth, uniform welds through proper control of welding variables.

DOMINION OXYGEN'S ELECTRONIC VOLTAGE CONTROL

How many of *your* welding problems are due to a fluctuating voltage? How many? Well, you can eliminate them *all* with DOMINION OXYGEN'S electronic voltage control. It holds welding voltage substantially constant at any preset value within the welding range. It responds to increases or decreases in arc voltage by speeding up or slowing down the wire feed motor. This action is practically instantaneous and constant arc voltage results.

The voltage control unit is mounted either locally or remote from the machine. Set up near the welding generator or transformer, it makes the welding head (rod drive and wire reel section) small and compact—easy to handle.

One Knob Control

After making several basic adjustments that set the SWM-3 for a specific job, the machine practically works by itself. Just throw the switch to start welding. It's as easy as that. One simple knob is all you turn.

Quick, Easy Starts

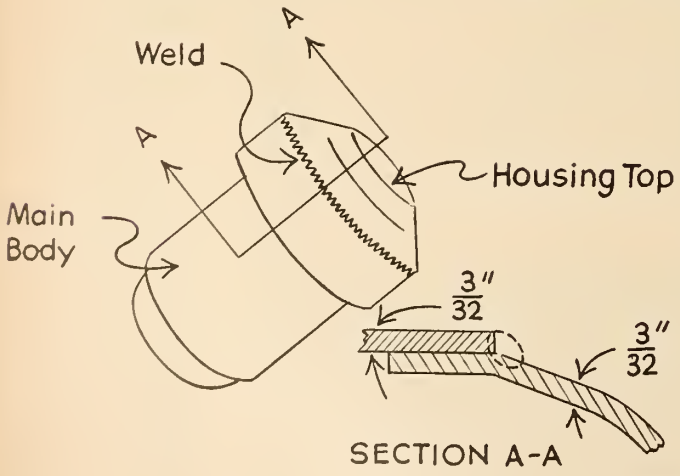
Use the retract starter built into the voltage control . . . turn on the wire feed switch, and the retract starter automatically causes the wire to:

1. feed down until it touches the work,
2. retract from the work, drawing an arc, and
3. start feeding down again, maintaining the preset welding arc voltage.

Ample Power

Because of a high operating voltage built right into the control, the wire feed motor gets ample power for smooth, efficient operation.

A Typical Application

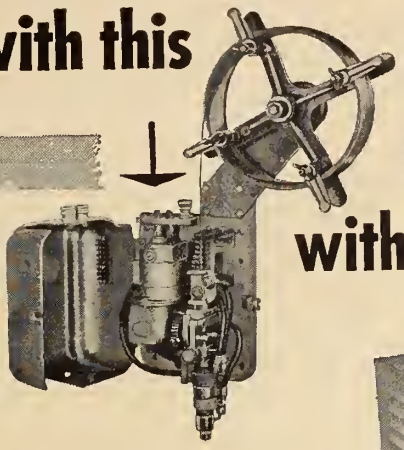


DOMINION OXYGEN'S SWM-3 welds most metals fabricated commercially—aluminum alloys, stainless steel, carbon steel, deoxidized copper, Everdur, and aluminum bronze. Butt, lap, fillet, or corner welds are made in these metals from 16 gauge thickness upward.

This steel compressor housing is now being fabricated with DOMINION OXYGEN'S new SWM-3 machine for sigma welding. Lap welds in the $\frac{3}{32}$-in. material are made at 55 in. per minute. Current is 380 amp. dcrp, using $\frac{3}{32}$-in. welding wire.

* Initial letters of *S*hielded *I*nert *G*as *M*etal *A*rc. "Sigma" is easier to say.

welding jobs with this little machine with the big brain



HERE'S ALL YOU NEED RIGHT AT THE WORK

Welding Head

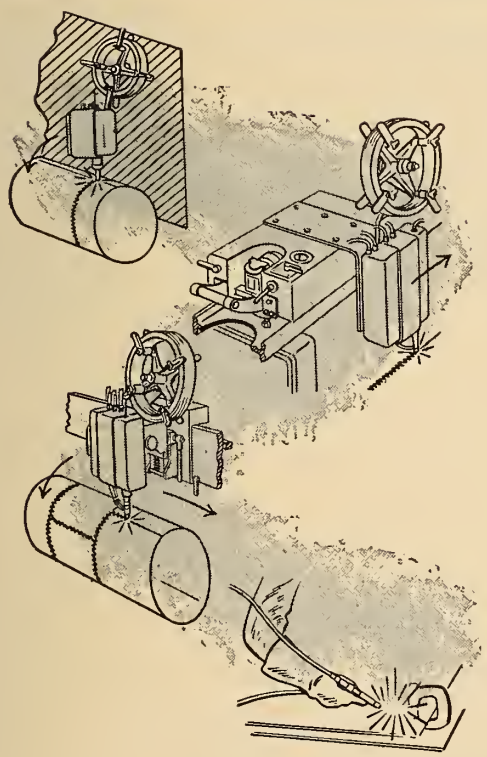
Net Weight . . . . . 40 lbs.

It houses . . . . . wire drive, wire-straightening device, water-cooled cup, wire guide tube and holder

It handles . . . . . 1/32, 3/64, 1/16, 3/32, welding wires

DOMINION OXYGEN'S *dependable electronic voltage control unit.*

DOMINION OXYGEN'S SWM-3 IS FLEXIBLE



USE IT IN A STATIONARY POSITION

Set up the welding head on a wall, post, or vertical bracket . . . Move the work to be welded beneath it. You can use the SWM-3 for many jobs in this position—it will handle four different sizes of welding wire.

GIVE IT MOTION

Mount the welding head on the OXWELD CM-37 tractor-type machine carriage . . . The SWM-3 will make longitudinal welds in cylinders, or butt, lap, and fillet welds in aluminum and stainless or carbon steels.

COMBINE BOTH SETUPS

It's just as easy to mount the SWM-3 on the OXWELD OM-48 side beam carriage: Use it for making longitudinal welds in any part. Stop the unit, revolve the work, and you can make circumferential welds in the same part—*without changing the setup.*

OR, USE IT MANUALLY

By adding an adaptor, you can use the SWM-3 with your sigma hand welding torch. It becomes a flexible drive unit to help you handle all of your other jobs that do not lend themselves to mechanization.

Ask DOMINION OXYGEN to tell you more about the SWM-3 . . . There's a good chance that it will help you do one of your present welding jobs better, easier, faster, and cheaper. Telephone or write the nearest DOMINION OXYGEN office today.

DOMINION OXYGEN COMPANY LIMITED

DOC

Montreal Toronto Winnipeg Vancouver

Plants, Warehouses and Distributors Throughout Canada

"DOC," and "Oxweld" are trade marks of Dominion Oxygen Company Limited.

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1252*)

J. N. Helfat.—Jere N. Helfat has been appointed staff assistant to the vice-president and general manager of Reliance Electric & Engineering (Canada) Limited. In his new capacity Mr. Helfat will be directly concerned with improved plant procedures and Company long range growth goals.

●

E. A. Boadway. — J. W. Humphrey, president, the Philip Carey Mfg. Co. has announced the appointment of E. A. Boadway as vice-president and general manager of both the Quebec Asbestos Corporation Ltd. and the Philip Carey Co. Ltd., Lennoxville, Quebec.

●

J. P. Ogilvie. — Dr. John P. Ogilvie, associate professor of Metallurgy at McGill University for the past five years, and formerly assistant professor there, has joined the stainless steel and alloys division of Shawinigan Chemicals Limited, Montreal.

Dr. Ogilvie will be in direct charge of technical sales development through the study of new techniques and applications of stainless steel and alloys. He will work under the supervision of C. K. Lockwood, vice-president.

●

New Equipment and Developments

Patented Framing Material. — "Steel-Frame", patented framing material developed by a Canadian engineer, will be manufactured and distributed in Canada exclusively by Taymouth Industries Limited, New Toronto.

Taymouth will commence exclusive Canadian production and merchandising of "Steel-Frame" this month at a new plant near Toronto, under agreement with Erie Machine Products Ltd. of Windsor, Ontario. The president of Erie Machine Products Ltd., Ralph Smith, developed the Steel-Frame system during the past year. United States manufacture and distribution, under the trade name Mult-A-Frame, will be handled by the Ainsworth Manufacturing Corporation of Detroit.

●

Fast Kraft Machine.—The fastest Kraft Paper-making machine in Canada is being built for St. Lawrence Corporation Limited for their Red Rock, Ont., mill by John Inglis Co. Limited, Toronto. The production capacity of the unit is 600 tons per day. When complete, it will be the first machine in Canada containing the special features of high pressure cast iron dryers throughout and Puseyjones "Rapi-Drape" wire changing device. It is a Fourdrinier Machine designed for making Kraft liner boards over a wide range of speeds (400 to 2,000 ft. per minute) and is being built to the designs of The Pusey and Jones Corporation of Wilmington, Delaware.

The Fourdrinier part will be suitable for a wire 240 inches wide and 130 ft. long. Dryers are designed for a working pressure of 125 pounds per square inch and laid out to accommodate a "Breaker Stack", or intermediate smoothing press within the dryer section.

Two stacks of Calenders will be installed, with three intermediate dryers between them. A Pope reel of latest design, using constant pressure loading by pneumatic cylinder, follows the second calender. Inglis engineers have adapted these designs to suit the special requirements of the Red Rock Mill.

●

Oil In Israel.—It was reported in the press on June 17th that two Canadian oil companies may be the first to tap the 2,000,000 acres of potential oil lands in Israel recently concessioned by the Israel Government to seven Canadian, American and European companies.

Sir Robert Watson-Watt, M.E.I.C., president of the new Continental Oil Company of Calgary, Alberta, announced that exclusive drilling contracts have been awarded to Pontiac Petroleums Ltd., of Calgary, to explore and develop the 800,000 acres granted his company in Israel.

●

New Motor Control.—A completely new alternating current motor control for ratings up to 100 horsepower is now available from the Canadian Westinghouse Company. The new control is the Company's "Life-Linestarter", and basic design changes include a single moving element, balanced on a knife edge fulcrum. A strong spring kicks out the armature and provides positive action, as well as preventing accidental operation under impact.

The design of the new starter is such that it may be completely dismantled from the front, using only a screwdriver. Installation and servicing are simple. The design is similar throughout to NEMA sizes 0 to 4 with standard accessories available for special applications. Complete details may be obtained by writing to the Company at Hamilton, Ontario.

●

Saskatchewan Power. — The net kilowatt hours generated in all power plants operated by the Saskatchewan Power Corporation increased by nearly 20% during the first six months of 1953 as compared with the same period of 1952.

●

T.V. in B.C.—The Canadian Broadcasting Corporation has selected Vancouver as the site of its fourth television station, and has ordered complete transmitter, studio and mobile broadcasting equipment from Marconi's Wireless Telegraph Co. Ltd., through Canadian Marconi Company, both members of the English Electric Group.

Vancouver is to have a 5-kilowatt vision transmitter, a 3-kilowatt sound transmitter, with combining unit and ancillary equipment. These were shipped to Canada, in August, and the station will be ready to go on the air by the end of the year.

●

Plastic Pipe Couplings.—The Victaulic Company of Canada Limited, 406 Hopewell Ave., Toronto 10, Ontario, has announced that to meet the wide demand among flexible plastic pipe users for a simple, positive, method of joining, a method of adapting this type of pipe for Victaulic Couplings has been devised. This is done by means of a short insert, made of plastic, which serves as a stiffener to support and maintain the plastic pipe ends in roundness. Standard Victaulic Pipe Couplings are then installed over the pipe ends to provide simple, secure, leaktight connections. The Company will be pleased to supply complete details as to procedures, etc.

●

Street Lighting System.—Canadian Line Materials Limited has announced a new street lighting system, called Uni-Ballast. It operates series-connected mercury vapor lamps without individual ballasts. Uni-Ballast was designed to fill the need for a system yielding high power factor, high efficiency, and good regulator load factor.

●

Transmission Lines.—Work is now in progress on three transmission lines between Waneta Power Plant project and Trail plant of Consolidated Mining and Smelting Company. Eleven miles separate the two plants. The lines and a switching station at Trail will cost $1,900,000. They will distribute all the power from the Waneta plant which initially will have a rated turbine capacity of 210,000 h.p.

●

High Speed Regulator.—Successful field tests at the Hydro-Electric Power Commission of Ontario's Otto Holden generating station have been announced on an entirely new high speed regulating system for large synchronous machines. The tests were conducted on a 27,000 kva, 94.7 r.p.m. generator by engineers from the Commission and from the Canadian Westinghouse Company, which supplied the regulator.

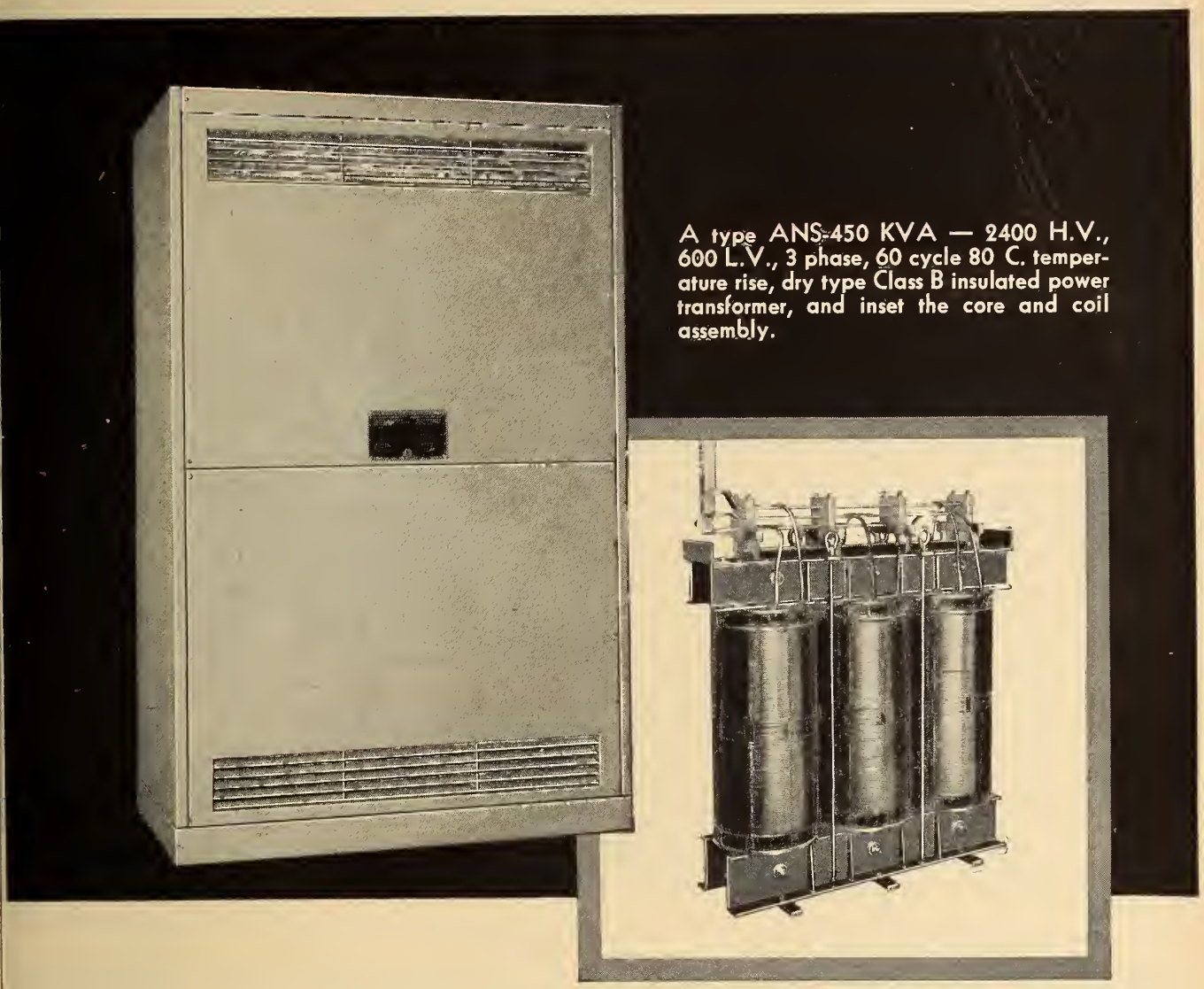
The new magnetic amplifier regulator Type WMA, was developed to overcome the shortcomings of existing regulating systems of vibrating, rheostatic, or rotating types. The tests revealed exceedingly fast response. No pilot exciter is needed on the generator shaft. The main exciter is self-excited to provide normal base excitation for the a-c generator. A power magnetic amplifier in the regular cubicle puts energy into either the boost or the buck field, to raise or lower the excitation voltage to the value required for maintaining a fixed machine terminal voltage. The power magnetic amplifier is controlled by an input magnetic amplifier. This unit magnifies any signal error resulting from comparison, within itself, of generator terminal voltage and a reference quantity. A 420 cycle permanent magnet generator, driven by a squirrel cage induction motor and equipped with a flywheel, is located in the bottom of the regulator cubicle. This generator supplies power to the reference circuit and to the power magnetic amplifier.

Stabilization of the Otto Holden regulator proved very easy and the tests revealed that the response was exceptionally fast. Complete details may be obtained from Canadian Westinghouse Company, Limited, Hamilton, Ont.

●

(*Continued on page 1260*)

AIR COOLED TRANSFORMERS



A type ANS-450 KVA — 2400 H.V., 600 L.V., 3 phase, 60 cycle 80 C. temperature rise, dry type Class B insulated power transformer, and inset the core and coil assembly.

These English Electric air-cooled transformers are specially designed to meet the modern trend towards localized indoor distribution centres. They are available up to 15 KV and may be installed as individual units or incorporated into indoor unit substations.

'ENGLISH ELECTRIC'

Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

English Electric Company of Canada Limited — Head Office and Factory: St. Catharines, Ontario

PA5315

"OLD BRIDGES like these... are a DANGER to heavy traffic!"

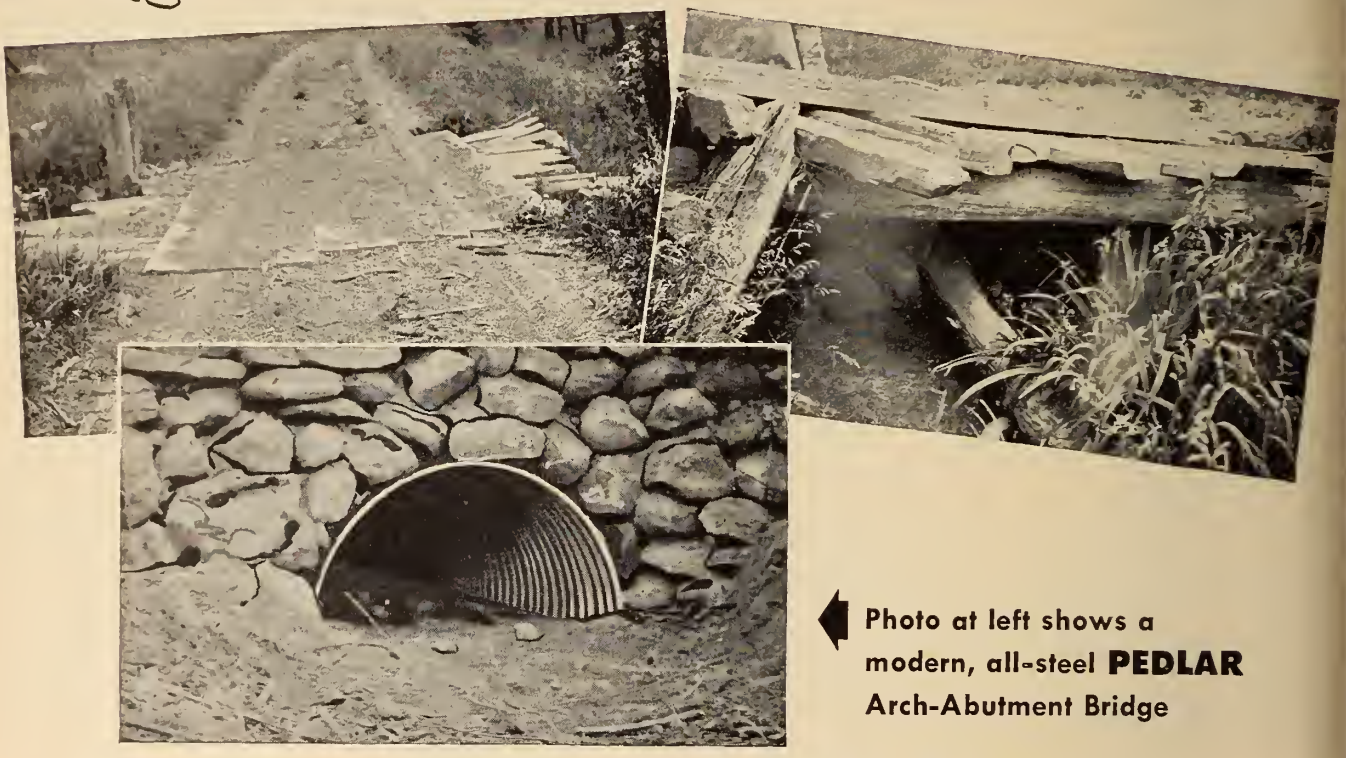


Photo at left shows a modern, all-steel **PEDLAR** Arch-Abutment Bridge

Make them Safe with a PEDLAR *Installation*

Economical! Permanent!

Installation can be completed same day as work started!

No Concrete!

No Maintenance!

Custom-Built for Every Job!

Make your roads safe! Protect your municipality against damage suits by replacing worn-out wooden bridges with PEDLAR'S Arch-Abutment, the all-steel structure that remains secure against floods and washouts. Wide bottom carries water away, quickly. Arch-Abutment stands up under severe winter conditions and heaviest traffic. Let PEDLAR'S solve your bridge problems.

Write for full information and prices

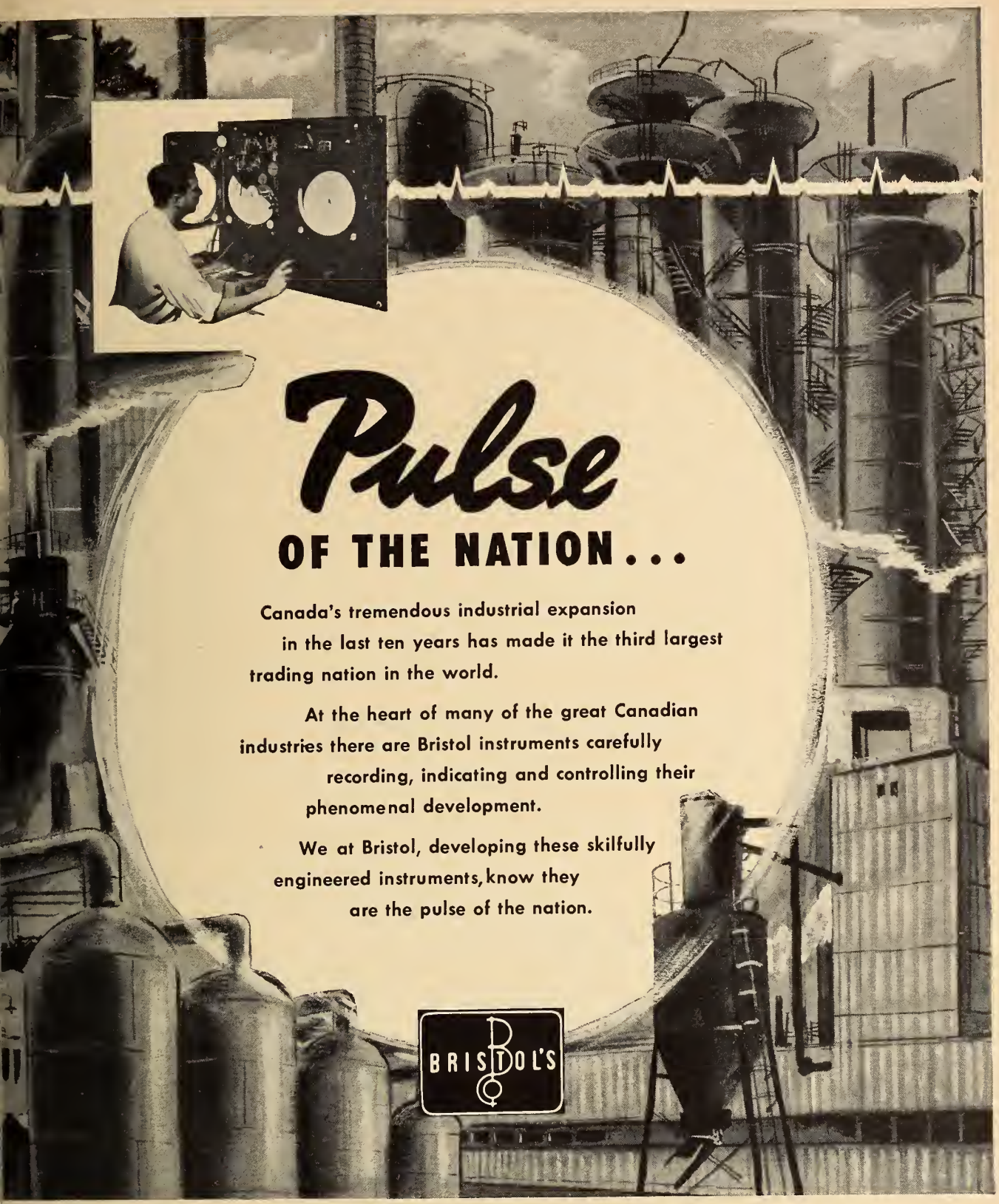
THE PEDLAR PEOPLE LIMITED

549-A SIMCOE ST. SOUTH, OSHAWA, ONTARIO

MONTREAL OTTAWA TORONTO WINNIPEG EDMONTON CALGARY VANCOUVER

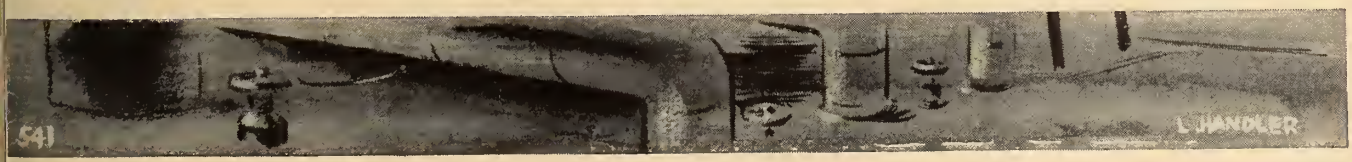
The P Limited PEDLAR'S METAL-BUILT PRODUCTS 1861

C-303



THE BRISTOL COMPANY OF CANADA LIMITED

Makers of Precision Instruments in Canada for over 20 years



BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1256*)

Concrete Enamel.—A new alkali-proof concrete enamel for use on interior floors and walls of basement and other masonry surfaces subject to dampness and alkaline action, has been developed by the paint and varnish division of Canadian Industries Limited.

Consisting, primarily, of a synthetic rubber base, the enamel is said to be highly resistant to alkali, with superior abrasion resistance and excellent resistance to the chemical action of soap and acids. The manufacturers point out that the new enamel will not stand up under hydrostatic pressure and no claims are made for its use to waterproof basements.

Good ventilation is required when the new enamel is being applied and two coats are suggested for concrete floors Spreading rate for a single coat is approximately 500 to 600 square feet per gallon. The paint is available in tile green, tile red and tile grey.

The new product may be applied over old paint if the latter is hard and adhering perfectly to the surface of the concrete.

●

Safety Record. — Canadian Johns-Manville's plant at Asbestos, Quebec, has won continent-wide recognition as one of the most safety conscious industrial plants in North America by placing first in two contests sponsored by international organizations.

●

Improved Gauge Dial.—A new Convex Scale Jerguson Truscale Remote Reading Gage is announced by Jerguson Gage & Valve Co. The new convex scale permits full 180° visibility. It has been designed so that readings of liquid level can be instantly taken from the front, or either side, without distortion. Scale markings are directly on the convex face. Indicator goes clear around the convex surface. The Company's representatives in Canada are Peacock Brothers Limited, Box 6070, Montreal.

●

New Gradall Control.—A remote control drive system for the carrier unit of Gradall, Warner & Swasey's multi-purpose earthmoving and construction machine, has been announced by the company. The purpose of the new control is to give Gradall a complete one-man operation, if desired by the user. The integrated remote control system is available as an optional accessory factory installation. For complete details write to the Warner & Swasey Company, 5701 Carnegie Avenue, Cleveland 3, Ohio.

●

Exide Battery Improvement. — Exide Batteries of Canada Limited announce the "Power Tube" positive plate of their Exide-Ironclad battery. These batteries have been widely used in motive power service during the past 43 years, and are now being manufactured, in their entirety, at Exide's new industrial plant on Warden Avenue, Toronto.

Describing the advantages of the Exide-Ironclad "Power Tube" positive, J. E. Eells, executive vice-president said "ever since the earliest days of storage battery research-engineering, retention of positive plate material in the grid structure has been a subject of great concern. Internal shock, which is caused by the mechanical vibration of rough work, tends to dislodge active material from the grid structure of the positive plate, thus shortening battery life. Continuous research led to the development, in 1940, of the Exide "Power Tube", a positive plate different in construction to all others and specially designed to withstand internal shock. To date, it is the most effective retainer of active material yet demonstrated in heavy duty service."

These slotted power tubes contain the active material. So fine are the slots that while permitting the easy access of electrolyte, they retard the washing out of active material, hold it despite the repeated charge-discharge cycles and excessive vibration placed on batteries during heavy service. The first Ironclad batteries from the new Canadian plant will be delivered in September.

●

New Atlas Asbestos Product. — Atlas Asbestos Company, of Montreal, has announced the marketing of a new product designed to fill a great need in the building trades. It is the new Atlas product "Colorflex", an asbestos-cement sheet that is flexible and available in three colors, red, yellow and green. The color is not a surface color, it goes right through the sheet. "Colorflex" is recommended for such applications as walls, dados, ceilings, counter fronts, garage lining, stair enclosures, etc. It is inexpensive, tough and strong. It is easy to saw and nail. It is not laminated. Sheet sizes are 48" x 96" and ⅛" thick.

●

New Hercules Motor.—Hercules Motors Corporation, Canton, Ohio, is now producing a turbo-supercharged version of their 6 cylinder diesel engine model DFXE. The new engine designated DFXE-TS, has a 5⅝" bore, 6" stroke and 895 cubic inch piston displacement. The DFXE-TS develops 845 lbs. ft. torque at 1800 r.p.m. and 318 hp. at 2000 r.p.m.

●

Price Reduction. As a result of improved manufacturing techniques, substantial price reductions for G.E. light-beam-type vibration indicators and recording vibrometers have been announced by Canadian General Electric Company.

For complete details on the new prices communicate with the Company at 212 King Street West, Toronto.

●

Conveyor Belt Repairs.—A new, quick method for making temporary repairs to covers and edges of conveyor belts, with a minimum of lost time, has just been announced by the B. F. Goodrich Rubber Co. of Canada, Ltd.

A new material which is air-curing, named "Quik-Lock" is used for the purpose. It is designed to protect the exposed fabric of belts, sealing out damaging moisture. Repairs to all types of conveyor and elevator belts may be made by untrained personnel with a minimum of equipment. The new material, exclusive in Canada with B. F. Goodrich, can be applied to all rubber, neoprene or hycar belts. Complete instructions and suggestions concerning the use of the materials are obtainable from the industrial product sales department of B. F. Goodrich Rubber Co. of Canada, Ltd.

●

Rubber Tired Serapers.—A new line of open-top, tractor drawn, rubber-tired scrapers ranging in capacity from 10.5 to 28.5 cubic yards is announced by LeTourneau - Westinghouse Company, Peoria, Illinois. These scrapers are designed to fit any tractor-scraper job and are available in four sizes. For complete details write to LeTourneau-Westinghouse Company, Peoria, Illinois.

●

Sullivan Mill.—Last month the Sullivan Concentrator at Kimberley, B.C. marked its thirtieth year of operation. It is the largest mill in Western Canada and accounts for over 30% of British Columbia's total milling capacity.

●

International Tool Exposition.—Brooklyn, New York, will be the site of the first International Machine Tool Exposition which opens there on October 5th. The Exposition is designed to fill the need for a permanent centre for the display of American and foreign machine tools.

●

Reducing Valve.—Kent-Norlantic Limited, Horner Avenue, Toronto 14, announce the "MIL" pressure reducing valve for steam, air and gas. The valve is available in ½", ¾" and 1" sizes, and the maximum working pressure is 200 pounds per square inch. Communicate with the Company for further information.

●

Electricity Generators.—Two new gasoline-driven electric plants, rated at 10,000 and 15,000 watts a-c have been added to the water-cooled line of engine-generators manufactured by D. W. Onan & Sons Inc., Minneapolis, Minnesota.

Designated as the "HQ" model, they are powered by continental 4-cylinder, water-cooled engines and were designed to provide economical electric power for both primary and standby applications. Details may be obtained from the Company.

●

High Temperature Protection.—A new quick-drying material that can be sprayed like paint on metal making the treated surface capable of withstanding temperatures as high as 5,000 degrees Fahrenheit has been developed by the B. F. Goodrich Company.

Named "Pyrolock", a one-sixteenth inch coating of the new insulation protects metal for as long as ten seconds against flame temperatures hotter than the melting point of the metal.

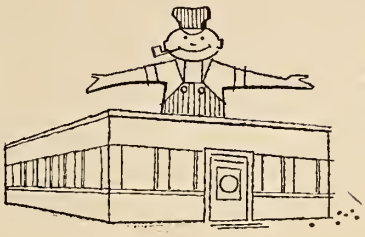
The Company describes the product as "a water base inorganic material unique in the field of thermal insulation".

The material was developed at the request of the United States Defense Department for use in the rocket and guided missile field. Laboratory tests conducted over a two year period indicate that the new material resists higher temperature for longer periods than any other preparation available for use in that field.

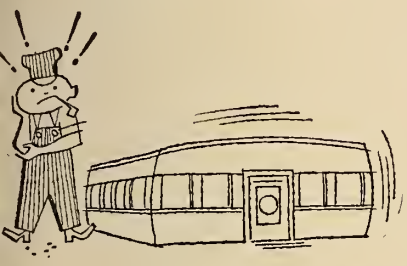
(*Continued on page 1264*)

WE KEEP GROWING OUT OF OUR PLANTS!

n 1947 the future of the company ooked most promising. Sales of Bailey Meters and Controls for steam power lants and industrial processes were ncreasing rapidly.

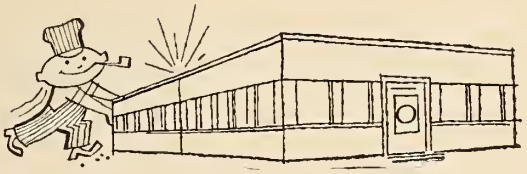


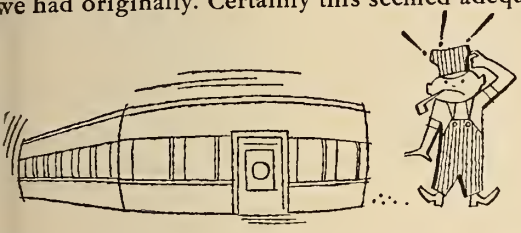
As a result, we built a brand new plant and offices, allowing, as we thought, plenty of space to look after our needs for a good many years.



But only a year or so after the new plant was completed, we found that despite optimistic planning, we had actually been too conservative. Every last foot of space was in use. Business was still growing.

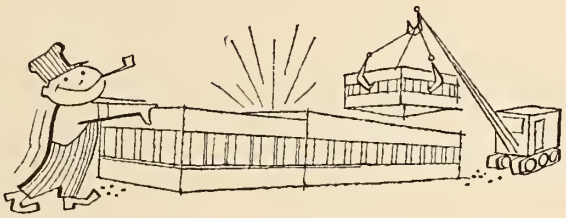
So we put the builders to work again. They added another section o our building in 1951, giving us *fifty per cent more floor space than* we had originally. Certainly this seemed adequate.





Yet it was not. In eighteen months the demand for Bailey Meters and Controls was once more catching up with our facilities for designing, building, selling, and servicing.

The next year we expanded again. A great new section was added to the rear of the plant. This alone gave us some sixty percent more space than before. A second storey was built in front. These latest extensions, completed in 1953, almost double all our previous facilities. But as we intend to continue to expand whenever necessary to fill your requirements promptly, we are sure this program is still *to be continued.'*



Bailey Meter Company Limited

HEAD OFFICE: 1980 CLAREMONT AVE., MONTREAL

ENGINEERS AT YOUR SERVICE FROM COAST TO COAST

BM-33

Advantages of
NEOPRENE

Neoprene is a man-made product which resembles natural rubber but is far more resistant to heat, flexing, abrasion, butting, chipping . . . and to the action of gasoline, oils, grease, many acids and other chemicals, sunlight and ozone.

• High abrasion resistance, long service life at high temperatures and in the presence of oils, make neoprene conveyor belts economical wherever conditions are toughest. One belt in Nova Scotia, carrying hot oil-treated coke has been in service for several years, operating twenty-four hours a day, 365 days a year

NEOPRENE *Conveyor Belts*

GIVE LONGER LIFE WITH FEWER SHUT-DOWNS

- **Longer life means lower belt costs.**
- **Fewer shut-downs mean greater production and higher profits.**
- **Under severe production conditions, the initial cost of the belt is quickly recovered.**
- **If your conveyor belts carry greasy, oily or moderately hot materials, it will pay you to investigate neoprene.**

Thousands of other resilient products in every phase of industry owe their improved performance and longer service to the unique properties of neoprene. Your rubber goods manufacturer or supplier will be glad to tell you about the neoprene products he supplies. Write for your free subscription to "Neoprene Notebook". Each issue describes new applications of neoprene to build new products, improve old products, or reduce maintenance costs.

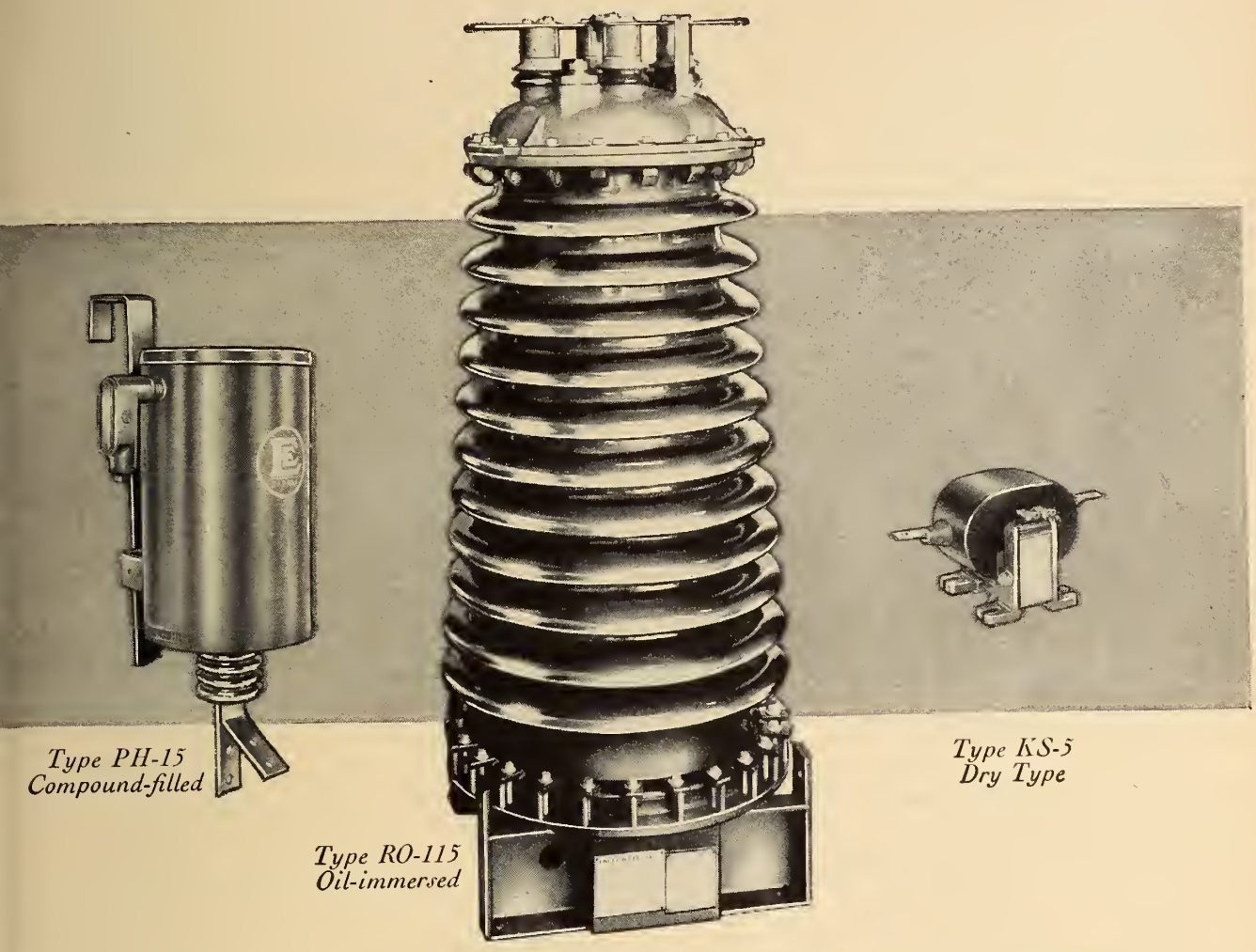
CANADIAN INDUSTRIES LIMITED

CHEMICALS DEPARTMENT • MONTREAL

C·I·L Chemicals
SERVING CANADIANS THROUGH CHEMISTRY

CH-53-33

Indoor and Outdoor
INSTRUMENT TRANSFORMERS
for metering, relaying and general use in all voltage classes



Type PH-15
Compound-filled

Type RO-115
Oil-immersed

Type KS-5
Dry Type

- **High Accuracy**
- **High Thermal Limits**
- **Robust Construction**
- **High Mechanical Limits**
- **Stable Characteristics**
- **Trouble-Free Service**

Designed and manufactured in Canada to ASA test requirements. English Electric also manufacture a complete range of outdoor and indoor potential transformers and combined metering units. Full details are available from any district office.

'ENGLISH ELECTRIC'

Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

English Electric Company of Canada Limited — Head Office and Factory: St. Catharines, Ontario

PA5317

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1260*)

It is claimed that Pyrolock is non-toxic, non-flammable, non-explosive and will adhere directly to clean metal surfaces without sand-blasting or use of priming surface preparations. Write to B. F. Goodrich Rubber Co. of Canada, Ltd., Kitchener, Ontario, for complete technical data.

●

Electrolytic Capacitators.—To meet the demands of Canada's ever expanding television and radio industry, Johnson Matthey & Mallory Limited, Toronto, have built an extension to their plant to permit increased production of Mallory Electrolytic capacitors.

●

Chain Belt in Canada. — Chain Belt Company of Milwaukee has announced the acquisition of facilities in Canada for the manufacture of certain of its product lines. It has purchased the controlling interest in Crothers Engineering, Ltd., Toronto. The Canadian concern has a three year old plant on a ten acre tract in the industrial outskirts of Toronto. Manufacturing facilities include a well equipped machine shop and structural steel fabricating shop. The new company will be operated as Canadian Chain Belt, Limited.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Bros Road Machinery.—A new picture folder describing the Bros line of road machinery has just been released by Wm. Bros Boiler & Mfg. Company.

The folder illustrates and describes Bros Pneumatic tire rollers and giant 50-ton "Roll-O-Pactors", drum-type tampers. "Bituminizer" distributors, "Spray-matic" spray bars, portable steam generators and asphalt circulators.

You can obtain a copy by writing road machinery division, Wm. Bros Boiler & Mfg. Co., Minneapolis 14, Minnesota. Ask for Folder No. RE-113.

●

Link-Belt Gear Drives. — Helical gear drives, their advantages, fields of application and correct selection, are discussed in a new, illustrated 16-page book No. 2451, just released by Link-Belt Limited. Full-page cross-sectional views showing in detail the design and construction features of both the double and triple reduction types. Installation photographs picture typical installation.

All factors governing correct selection are described in detail.

Link-Belt helical gear drives are made in a range of sizes for capacities from fractional to over 100 horsepower and ratios up to approximately 300 to 1. The book will be sent to any interested reader on request. Write to Link-Belt Limited, P.O. Box 173, Station "H" Toronto 13.

●

M-H Bulletin.—New 16-page Catalogue No. 8950 describes, illustrates and provides specifications for a wide variety of accessories for pneumatic control applications. Included are air pressure regulators, air filters, pneumatic relays, control by-pass panels, pneumatic switches, valve positioners, and other highly functional equipment. Data on control piping systems and the computing of air capacities are also included. For copies write to Minneapolis-Honeywell Regulator Company, Limited, Leaside, Toronto, Ont.

●

"Terne Topics". — Just published, the latest issue of "Terne Topics", company trade publication devoted to Terne Metal roofing, features a story on two new machines designed to reduce the time and labour required for installing "Terne" roofs.

These are the hand-operated pan former, which cuts the time for turning up the edges of a 50-foot roll of Terne Metal from half an hour to one minute; and the electrically-operated seamer, which ensures straight, uniform seams. The latter is not yet in full production.

A four-page insert uses line drawings to describe methods of constructing and installing valleys and gutters of Terne Metal.

Copies of "Terne Topics" may be obtained by writing to Follansbee Steel Corporation, Pittsburgh 30, Pa.

●

Electrical Fittings.—Buchanan Electrical Products Corporation, Hillside, New Jersey, have just released catalogue No. 53 in which is described their complete line of solderless wire connectors and specialized electrical fittings. The publication is well produced and contains 16 pages of informative material. To obtain copies communicate with the Company at the address given above.

●

Ion Exchangers.—While ion exchange is not a new process, it is finding many new uses and is rapidly attracting attention in all phases of industry. Engineers and chemists are using cation and anion exchangers in hundreds of applications where previously available techniques were inadequate. They are being utilized for the removal of impurities from solution; concentration of electrolytes in solution; addition of specific ions to solution; separation of electrolytes in solution; catalysis and in special medical applications.

To summarize the properties of most of their ion exchangers and indicate some of their uses, a 12-page bulletin (No. 2508) has been prepared by the Permutit Company of Canada Limited, 6975 Jeanne Mance street, Montreal, P.Q.

The bulletin details a general history of ion exchange engineering, gives data on the proper selection of ion exchangers and lists general applications in the treatment of water and special problems associated with the recovery of valuable metals from solutions, streptomycin purification, sugar refining, separation of rare earths, treatment of waters, etc.

●

(*Continued on page 1268*)

DIRECTORY

See page 1163

for particulars re our new 1953 Membership Directory

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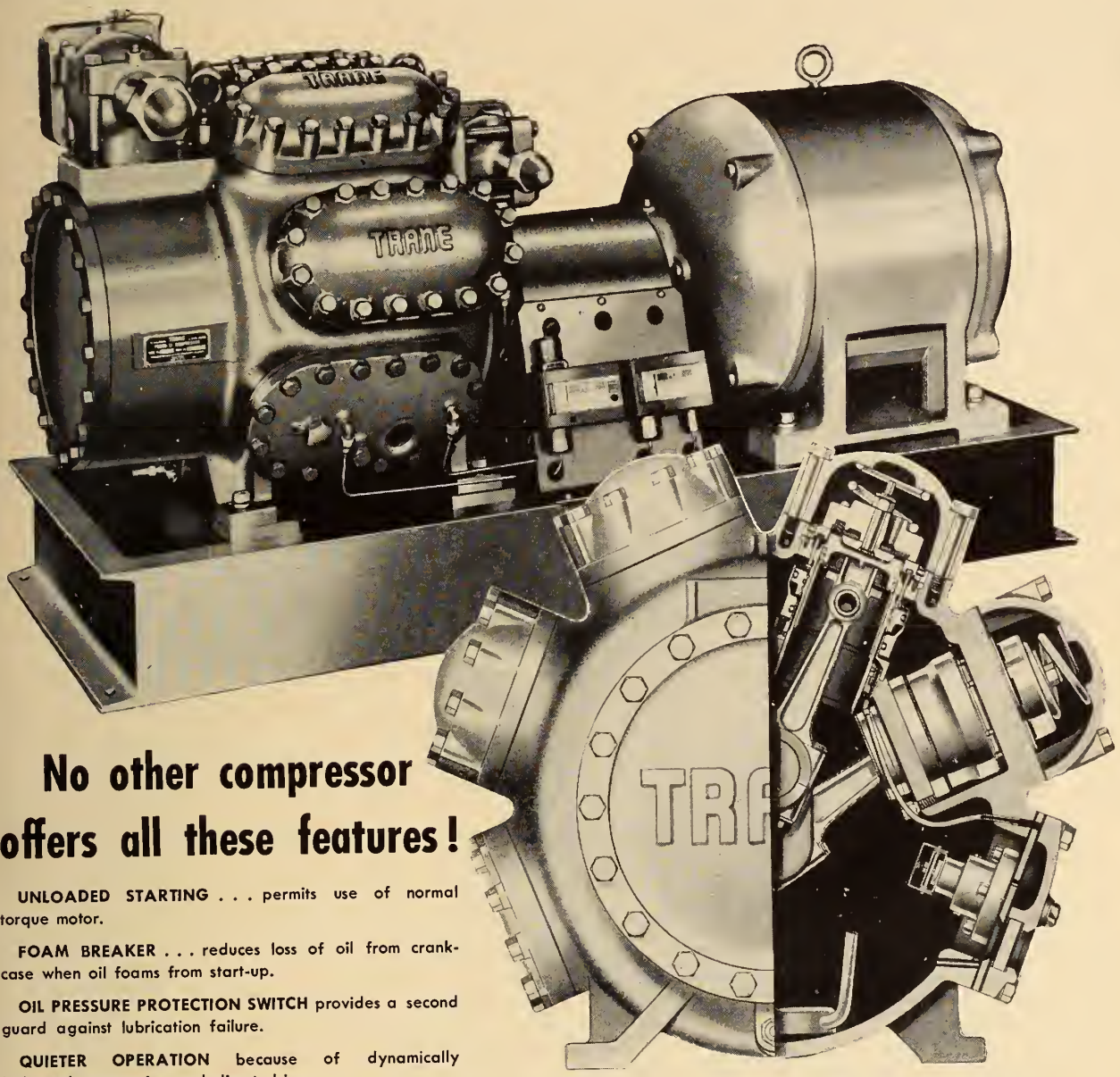

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1264*)

Lubricating Equipment. — Farval Corporation, 3249 East 80th Street, Cleveland 4, Ohio, have just published a new bulletin No. 26 which describes Centralized Lubrication equipment.

This 20-page illustrated booklet has been produced to provide easy scrutiny of the various units of the Farval system, so that those most suited to specific requirements may be selected.

To obtain copies communicate with the Company at the address given above.

●

"Humidity Engineer".—A new issue of "The Humidity Engineer", containing timely and practical articles on applications of humidity conditioning has just been released by Surface Combustion Corporation, Toledo, Ohio.

Marine condensation, resulting cargo damage and the new marine-type air conditioning system installed on the Mariner class ships to eliminate condensation are covered in the first article. This problem is of wide interest because it is similar to that encountered in water works filtration plants, breweries and sugar storage bins.

A second article covers the moisture problems encountered in the various steps of lithographic platemaking and explains the system of humidity control used by the Strobridge Lithographing Company of Cincinnati.

Auto Specialities Manufacturing Company of Hartford, Michigan, claims that their air conditioning system has kept absenteeism at less than 1%. How this resulted and the added benefits of the system are explained in a third article.

Copies may be obtained by writing to the Editor, Humidity Engineer, Surface Combustion Corporation, Toledo, Ohio.

●

Industrial Fasteners. — Industrial Fasteners Institute Incorporated, 3648 Euclid Avenue, Cleveland 15, Ohio, offers Journal readers copies of a well-produced, four-coloured bulletin entitled "Fasteners". This publication, now in its ninth volume, deals with trends in the application of industrial fasteners in the expanding use of heat-treated high-strength bolts. This is a well produced publication and requests for copies will insure receipt of No. 1 of volume 9 and all succeeding issues.

●

Bristol Potentiometers. — Bristol Electronic Dynamaster Recording Potentiometers are now available in the form of Time-Temperature Program Controllers, according to an announcement by The Bristol Company of Canada Ltd.

These new program controllers regulate temperature according to a predetermined schedule of changing values. Any desired program, such as heating, soaking, and cooling cycle can be accurately maintained. Complete specifications are given in a twelve-page bulletin No. P1255. Write to the Bristol Company of Canada, Ltd., 71-79 Duchess Street, Toronto.

●

Brown Boveri Review. — The Brown Boveri Review is the title of an excellent technical publication which is available in Canada through Brown Boveri (Canada) Limited. The address of the company is 1015 Beaver Hall Hill, Montreal.

To be placed on the mailing list for regular receipt of this publication, communicate with the Company.

●

"The Taylor Forge".—Taylor Forge & Pipe Works, P.O. Box 485, Chicago 90, Illinois, offer copies of a new magazine entitled "The Taylor Forge."

This publication is designed to appeal to engineers.

To be placed on the mailing list for regular receipt of this publication, communicate with the Company.

●

Minneapolis-Honeywell Publications.— Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ontario, offer the following new technical literature: Bulletin I.D.S.10.0-13, which describes the ½-second Electronik recorder. A new, four page, specification sheet No. 116 which describes and illustrates Pyro-vane, Pulse-pyr-ovane and Protect-o-vane automatic controllers. Four page specification sheet No. 84 which describes and illustrates Radiamatic compensated radiation detectors. Bulletin I.D.S. 9.1-14, which describes Electronik time deviation recorder. Four page bulletin "No. 1540" which describes Electronik inductance bridge receiver.

Communicate with the Company for these publications.

●

Wales-Strippit Catalogue. — Wales-Strippit of Canada Limited, 344 Sherman Ave. North, Hamilton, Ont., offer copies of their catalogue 10-AA which describes the Wales sheet metal fabricator for punching, notching and nibbling up to 165 strokes a minute.

●

Permutit Bulletin.—Permutit's Package Water Conditions Plant, an extremely versatile and self-contained unit, designed to chlorinate, coagulate, clarify, filter, neutralize, de-alkalize and soften raw water supplies is described and illustrated in a new eight page bulletin No. 3869. Prepared by The Permutit Company, New York 36, it lists the component parts of the complete water conditioner, details the principles of operation, gives ratings, capacities and sizes and illustrates typical installations. Copies may be obtained from Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal 15, Quebec.

●

Allis-Chalmers Shakeouts. — Canadian Allis-Chalmers, Ltd., Box 37, Montreal, Quebec, offer copies of their bulletin No. 07B6365B, in which is described Foundromatic shakeouts in types and sizes to meet the foundry's particular requirements. The bulletin contains 20 pages.

The units covered include those from 3,000 to 8,000 and from 8,000 to 300,000 pounds capacity. The larger units have simplified two-bearing construction, effective side loading protection, and a specifically designed pivoted motor base for effectively maintaining proper belt tension.

Tabulated dimensions of the larger spring mounted and smaller rubber mounted shakeouts are listed along with shakeout electrical equipment requirements and shakeout shipping weights.

●

Paint Colour Guide. — As a guide to trustees, principals, teachers and maintenance staff, a specifications manual for colour conditioning of school interiors has been prepared by the paint and varnish division of Canadian Industries Ltd. The specifications, accompanied by colour chips, are based on scientific colour principles which take into consideration such factors as light reflection, seeing conditions, glare and colour psychology. Engineers who have been dealing with schools find this publication most useful. Copies may be obtained by writing to Canadian Industries, Ltd., Paint and Varnish Division, Box 10, Montreal, Que. Ask for "School Color Guide".

●

Fluorescent Street Lighting.—Canadian General Electric Co. Ltd., 212 King St. West, Toronto, have just issued a new bulletin on Fluorescent Street Lighting. It is a new two colour booklet which describes the latest developments in fluorescent street lighting. It is well illustrated, contains eight pages of information on application, description, dimensions, etc. Ask for Bulletin GEC-963.

●

New Garlock Bulletin.—A new eight-page bulletin describing many of the silicone rubber products made by the Garlock Packing Company has just been issued. The products described include diaphragms, gasketing, sheet packing, oil seals, rings, insulation tape, rod and valve stem packings, and molded shapes for many industrial uses. Copies of this bulletin, Garlock Silicone Products Bulletin Ad-147, may be obtained from The Garlock Packing Company of Canada Ltd., 750 Bay St., Toronto.

●

Newly Designed Fan. — The Canadian Blower & Forge Co. Ltd., Kitchener, Ontario, have issued a new bulletin No. 3865, which presents their new design "A" Breezo and "NV" Fan.

In the letter which accompanied the copy of the bulletin sent the editor, it is stated "This fan is an advancement in the design of our line of Breezo units which have given reliable and efficient service for years. It has been developed after extensive tests based on experience from building and testing propeller and axial flow fans." To obtain copies write to the Company at the address given above.

●

Demand Metering Manual. — Canadian General Electric Co. Ltd., 212 King St. West, Toronto, have issued a new 48-page manual on demand metering, probably the most comprehensive booklet on this subject ever released in Canada.

The publication describes, in detail, the theory, economics, operation and application of demand meters. It provides a summary of the principles and problems of demand metering, a reference for helping in specific demand-measuring application and a clear, simple textbook for students and trainees. To obtain copies write to the Company and ask for GET-2327.

●

Reconstruction of the NRX Reactor at Chalk River

by

J. L. Gray, M.E.I.C.

General Manager,
Atomic Energy of Canada Limited,
Chalk River, Ontario.

A paper presented before the Hamilton Branch of The Engineering Institute of Canada, September, 1953.

In this paper the author lifts the curtain surrounding Canada's Atomic Energy Plant at Chalk River, to explain the original reactor and the nature of its breakdown which occurred in December, 1952. A detailed description is given of how the old reactor was dismantled, and its "calandria" removed and disposed of, and the reconstruction of an improved and more powerful reactor.

The dismantling and reconstruction of the NRX nuclear reactor at Chalk River, Ontario, which broke down on December 12, 1952, has presented some unique engineering problems for the staff of Atomic Energy of Canada Limited. So far as is known, this is the first time a nuclear reactor (or "pile" in an earlier terminology) of high power rating has been completely dismantled after several years of operation, and much valuable information is being obtained during the process.

The personnel of all divisions of the Company have taken an active and interested part in the program. Although the operation of the reactor is the direct responsibility of the Operations Division of Industrial Operations, the Research and Development divisions have participated extensively in various phases.

At the time of the accident they were particularly active in assessing the damage and scheduling the initial program. Special electronic and photographic instruments have been developed for specific purposes. The cause of the trouble was thoroughly investigated by a combined group, which has resulted in some modifications to control equipment and operating procedures. Special mention should be made of the co-operation of Radiation Hazards Control Branch who have taken on a greatly increased load of work and responsibility.

The actual restoration program is, however, the responsibility of the Industrial Operations Divisions of the Company. The Operations Division operates various plants such as the nuclear reactors (in addition to NRX there is the low power ZEEP, the first reactor to operate outside the United States; and the NRU

The NRX reactor building (large brick building) at Chalk River. In the background is the Ottawa River

reactor which is now under construction), the chemical extraction and the isotope production plants. This division is also responsible for process development associated with these plants.

The Services Division carries out design and shop work for plant operations and for the research program, maintains all buildings and equipment, and constructs new buildings when it is deemed inadvisable to use the services of an outside contractor. The normal organization of these two divisions was shelved, and a special grouping of their personnel set up, designed specifically to handle the NRX restoration.

Strict limitations on the methods used to dismantle the reactor were imposed by the high levels of radiation from the radioactivity contaminated structure and equipment. In some cases it was not possible to look directly into the region where specially designed tools were operating. To ensure that they did not inhale radioactive dust or other active material dislodged from contaminated surfaces, machinists, pipefitters and all other personnel in the area had to wear gas masks which gave them limited vision and tired them relatively quickly. Protective clothing was uncomfortably warm and restricted movement to some extent.

The supply of manpower was a major problem. The project has never had an injury by overexposure to radiation, and the planning of the reactor restoration included a decision to keep well within the strict safety limits which have been an outstanding feature of the Chalk River Project. A skilled workman might receive his weekly

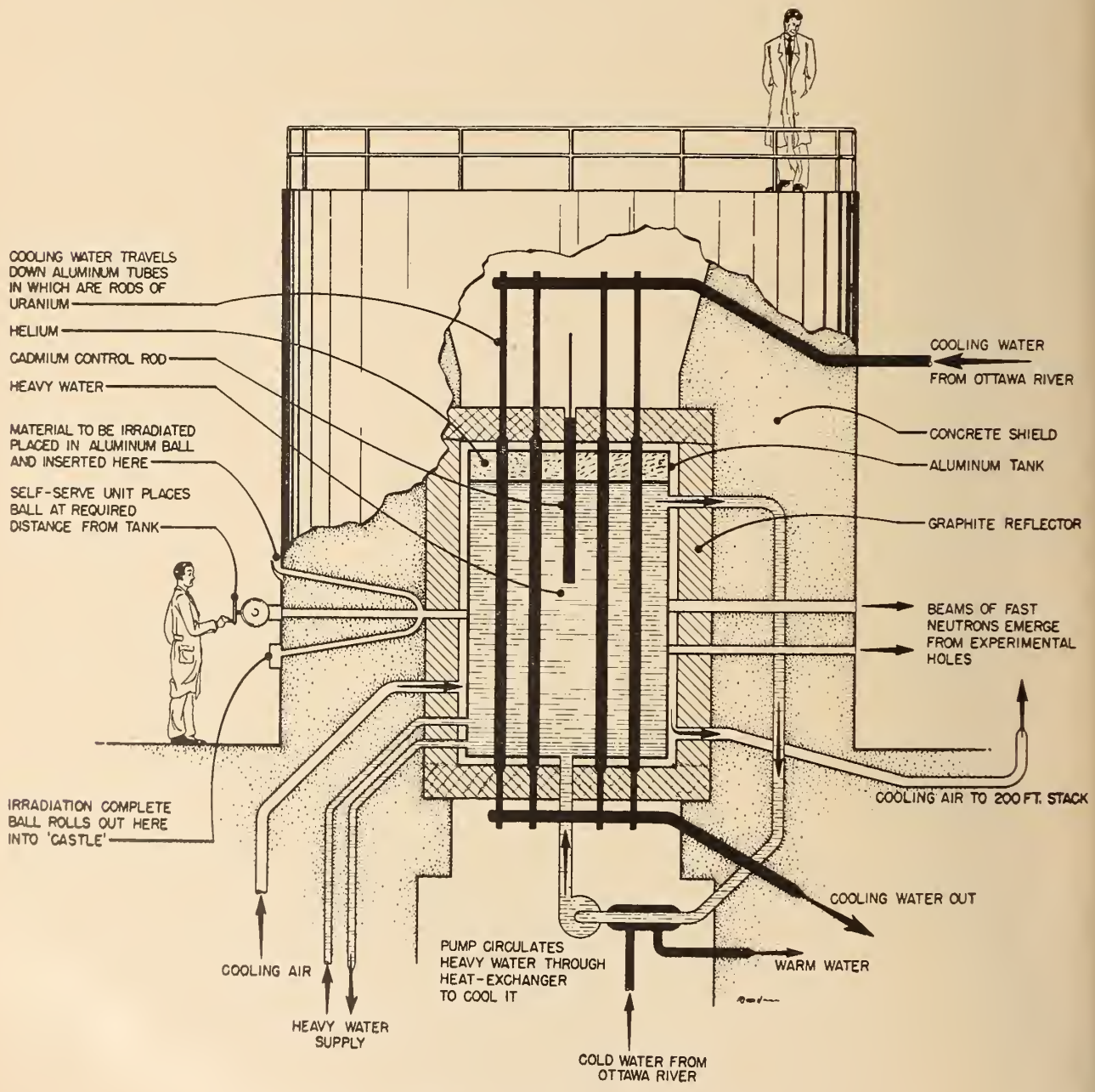


Fig. 1. Schematic diagram of the NRX reactor.

llowance of radiation (300 milli-oentgens)[1] within an hour, and hus a much larger crew of workers vas needed than would be required n the repair of any other equally omplicated industrial machine.

In a few instances a workman ould remain within the radiation ield for only a very few minutes. Careful planning was required to void the necessity of using a pro-ibitively large number of men. In ome instances it was necessary to llow individuals to take a thirteen veeks' dosage (3.9 r) in a matter of day or two. This, of course, neant that they were barred from he radioactive area for a period f 13 weeks.

Skilled tradesmen were conserved, vherever possible, by using other nen for such operations that did ot definitely require trade quali-ications. For example, No. 1 Radia-ion Detection Unit of the Canadian Army handled much of the decon-amination that had to be carried ut before machinists and other radesmen could go to work.

[1] The roentgen (designated by the symbol r) s defined as the quantity of X or gamma adiation such that the associated corpuscular mission per 0.001293 gram of air produces, n air, ions carrying 1 electrostatic unit of uantity of electricity of either sign.

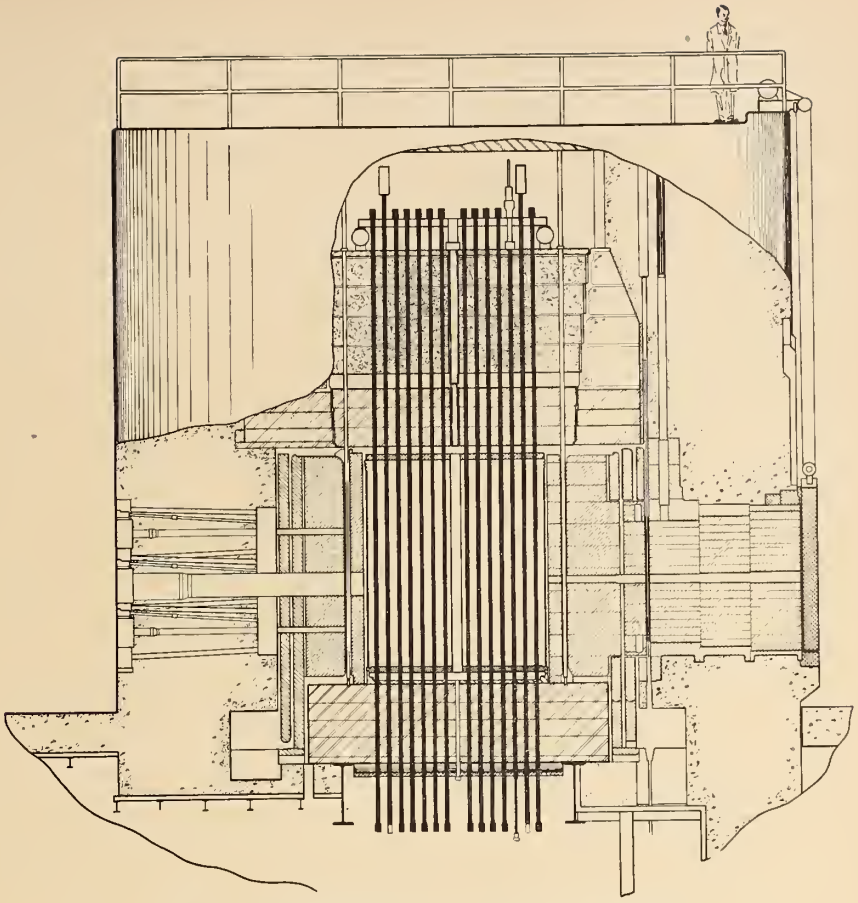


Fig. 2. The NRX reactor. Simple cross-section.

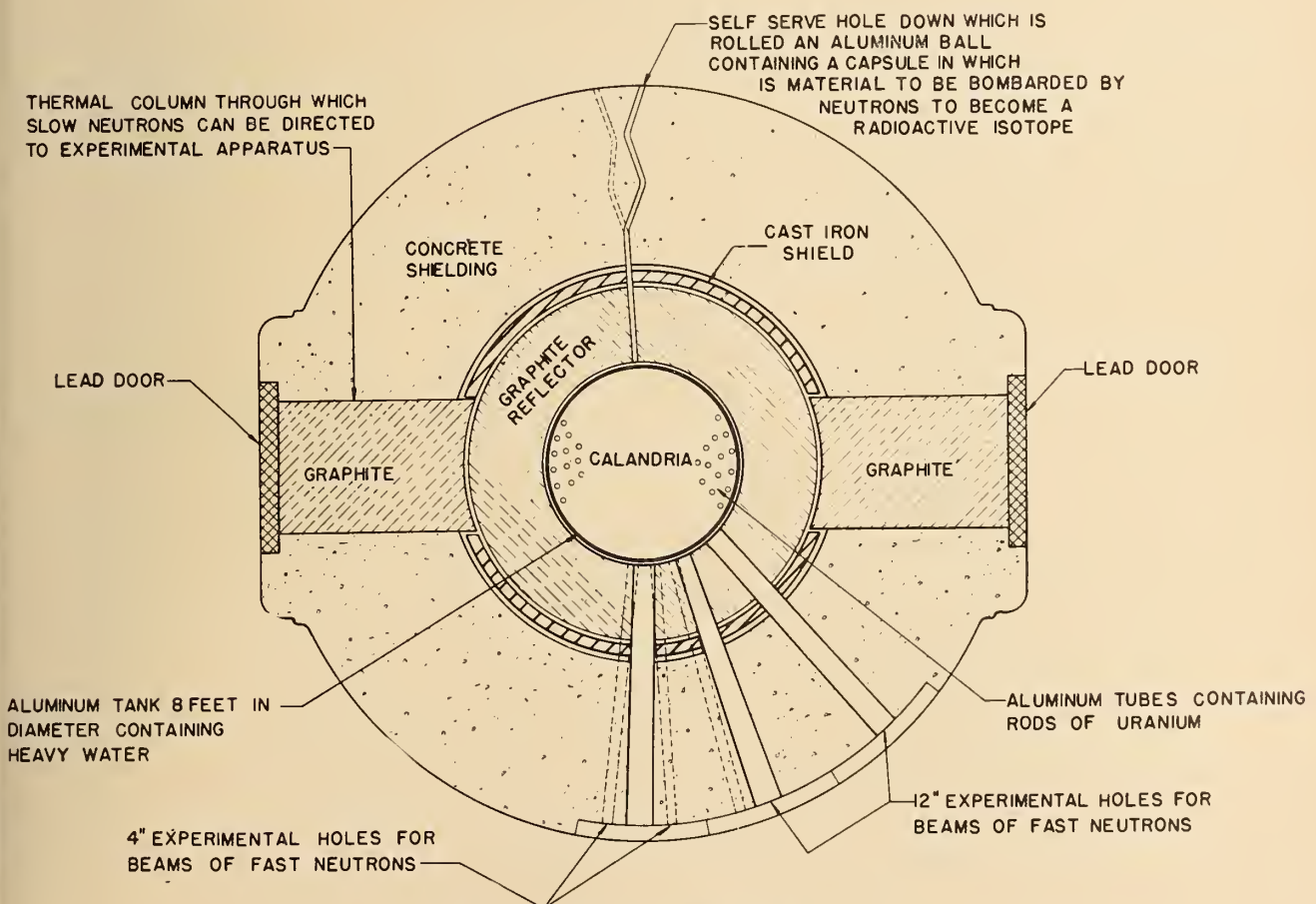


Fig. 3. Plan view of NRX reactor.

The R.C.N. and R.C.A.F. contributed personnel to the Army R.D. Unit, and without their assistance the time scale would have been extended considerably. It is interesting to note that, in some operations, use was made of volunteers from various branches of the project who are rarely exposed to radiation. Carpenters, clerks, accountants, janitors, and others donned gas masks and protective clothing, and carried out various tasks under the direction of the supervisory staff of Industrial Operations.

These people were carefully briefed, sometimes on mock-up panels, before they went into various parts of the reactor area to remove equipment or carry out decontamination. As a safety precaution, they were at times watched by a television camera with a display in the reactor control room.

The U.S.A.E.C., in co-operation with the U.S. Navy, and particularly the U.S. Naval Radiological Defence Laboratory, were extremely helpful in the early months of dismantling and decontamination. This work provided an opportunity to train personnel in the problems of handling highly contaminated material and equipment.

They generously contributed a steady flow of tradesmen, many with specialized knowledge of radioactivity. They also contributed special equipment, such as the TV set, and were most co-operative in discussing the problems. This was one field where their exchange of information was practically unrestricted.

The Breakdown

The breakdown of the NRX reactor occurred while experiments were being conducted at low power;

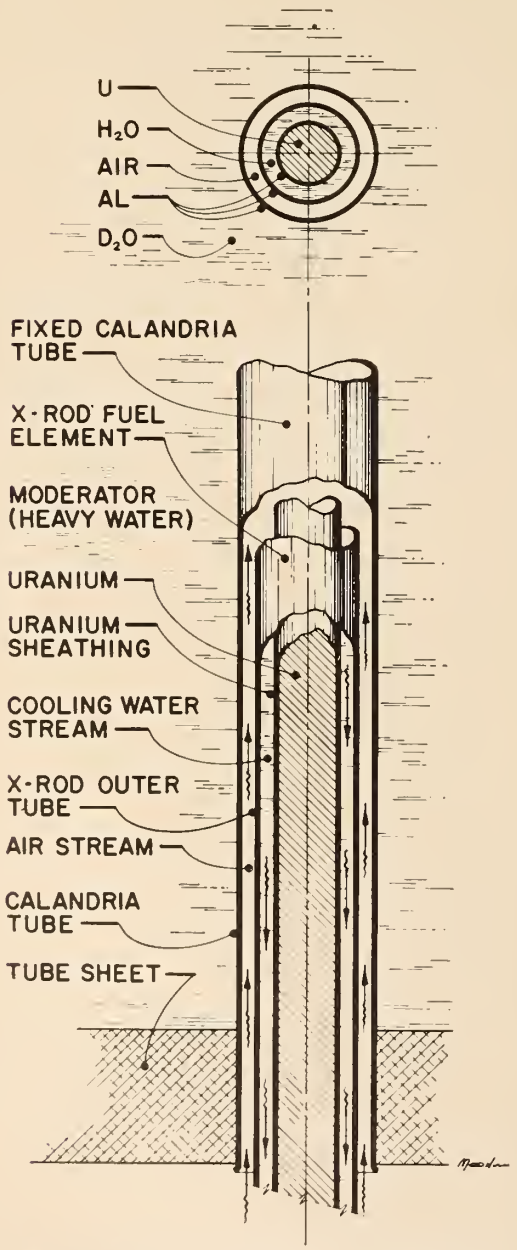


Fig. 4. Schematic diagram of X-rod assembly in calandria tube.

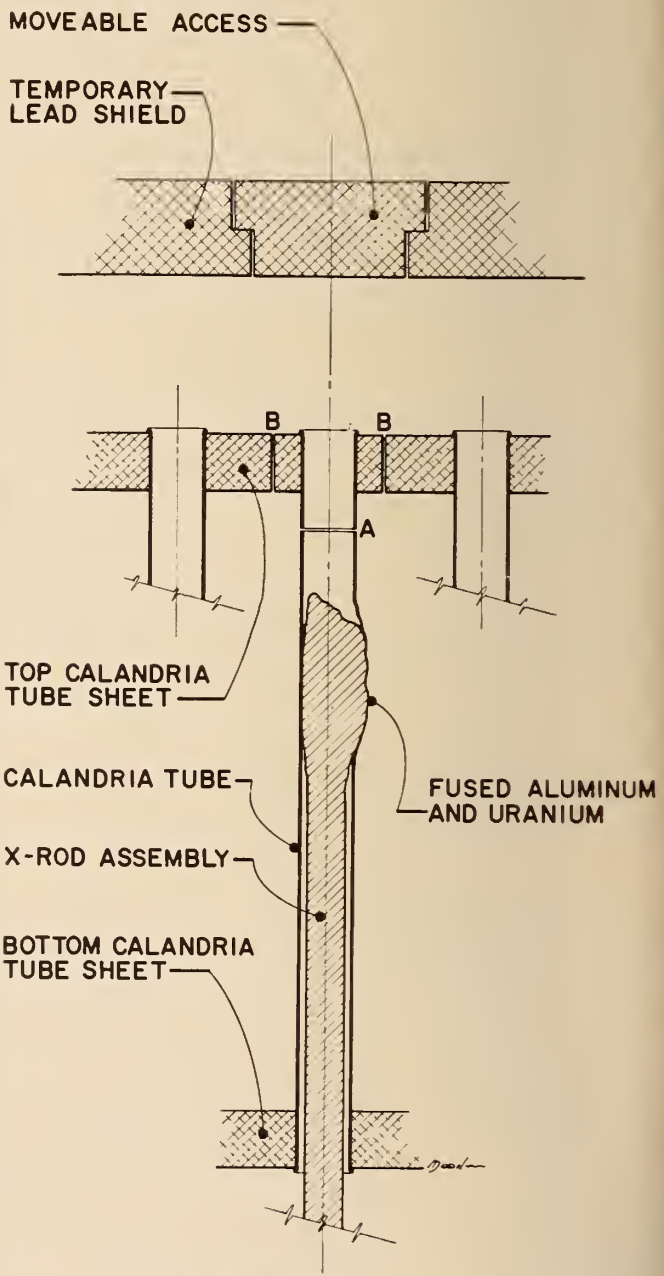


Fig. 5. Schematic diagram showing method of removing ruptured X-rod and calandria tube.

approximately 10 per cent of the uranium rods had a reduced flow of cooling water. These experiments were similar to those which had been carried out successfully many times before. Owing to a complex chain of events, a mechanical failure in the shut-down system occurred and a power surge resulted.

"Power" in a reactor is a direct measure of the number of uranium atoms splitting per second and appears as heat. The NRX reactor normally operates at 30 megawatts, and the surge amounted to an integrated power of about 30 megawatt minutes, with a peak of about 100 megawatts. This surge overheated the uranium rods having reduced cooling. Some of the uranium fuel and aluminum in the rod assemblies melted, and sheathing on the uranium rods ruptured. Highly radioactive fission products entered the cooling water.

The cooling water is normally piped to huge delay tanks, to allow short-lived radioactivity of the water (resulting from neutron bombardment) to die away before it is returned to the Ottawa River. The flow to the delay tanks ceased with the rupturing of the X-rods and the contaminated water poured into the reactor basement.

To prevent rapid oxidation of the highly active uranium rods, which might result in a uranium fire, cooling water had to be kept running through the reactor even after the power surge was brought under control and the reactor shut down. About 10,000 curies of fission products (for comparison, some 1,500 curies of radium have been produced in the world to date) were washed into the reactor basement in 1,000,000 gallons of water.

Before work could begin on the removal of fused and ruptured tubes and rods in the reactor, the contaminated water had to be removed from the basement. It was pumped to a large delay tank. A special burial pit was prepared within the 10,000 acres controlled by the Project. Then, within 9 working days, a 6,000-foot, 4-inch pipeline, suitably insulated against freezing in mid-winter temperatures, was constructed from this delay tank to the burial pit. The contaminated water was then pumped to the pit where the fission products have been safely retained in the sand.

When the power surge occurred, radioactive material also entered the cooling air which is sucked through the reactor and discharged up a 200-ft. stack. This short-lived radioactivity fell upon the plant area.

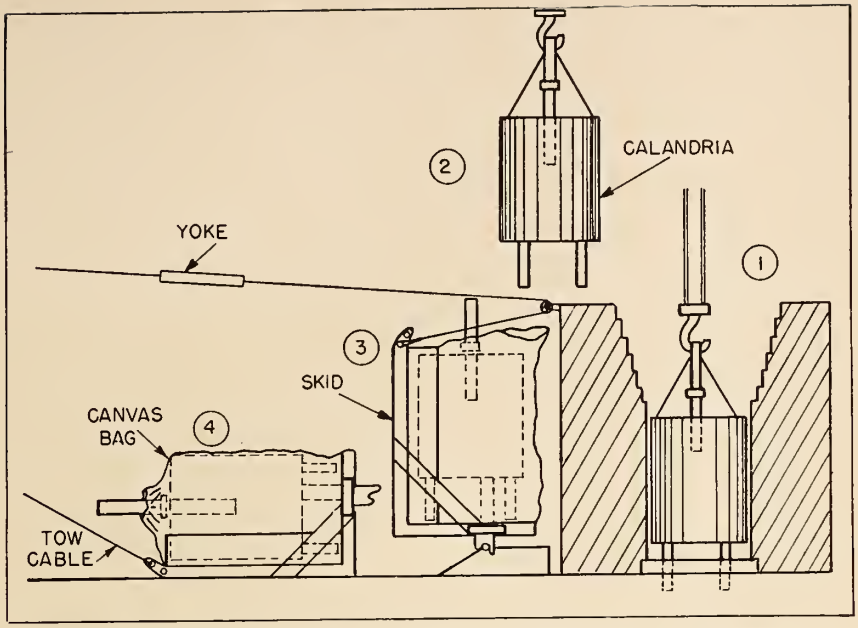


Fig. 6. Showing method used to remove calandria from NRX reactor.

While this radioactivity was harmless as far as the plant staff was concerned, it could upset experiments and monitoring control in several laboratories if it were tracked about the project. The plant evacuation signal was, therefore, sounded and all the project staff, except a few key personnel, left the plant in accordance with an established evacuation procedure.

The Reactor Structure

The complexity of the problem of dismantling the reactor can be realized only if one has a clear picture of at least the main features of the reactor structure. Some of the difficulties faced cannot be discussed, for this would require describing parts of the reactor which are classified as security information.

When the nucleus of a uranium-235 atom is struck by a neutron, it fissions or splits into two fission fragments. These are nuclei of radioactive isotopes of a number of atomic elements. At the time of this splitting, there is an emission of two to three neutrons that are used to maintain the chain reaction.

The kinetic energy of these fission fragments is transferred into heat that builds up temperatures very rapidly, unless controlled by some cooling mechanism. The fission products are also highly radioactive, emitting a variety of alpha, beta and gamma rays. The highly penetrating gamma ray is, of course, the most difficult one to handle, although extreme care must be taken with all forms of radioactivity.

From these events we can trace many of the reasons for the particular construction of the reactor, which is shown in two elementary schematic diagrams. Figure 1 indicates the main features of the structure and flow systems, while Fig. 2, which is a more realistic cross-section than Fig. 1, indicates the actual construction of the NRX reactor and gives a better idea of its complexity.

The heart of the reactor is an aluminum tank, called a "calandria", about 8 ft. in diameter and 10 ft. high. This tank is much like a fire-tube boiler. Into these tubes are inserted 176 aluminum tubes which contain rods of uranium fuel. For simplicity of designation these assemblies are termed "X-rods" which are shown diagrammatically in Fig. 4.

If the neutrons given off by a splitting atom of uranium are to split other atoms of uranium—thus setting up a chain reaction—these uncharged particles must be slowed down from a speed of about 10,000 miles per second to about one mile per second. This is done by a "moderator", which in the case of the NRX reactor is heavy water in the calandria.

To protect the uranium from direct contact with the cooling water, and to contain the highly radioactive fission products formed when the uranium fissions, the uranium rods are sheathed in aluminum. This metal was chosen

because it absorbs fewer neutrons (which are needed to maintain the chain reaction and to bombard materials to form radioactive isotopes.)

It can also withstand neutron bombardment (which changes the structural properties of materials) better than other readily available metals. The fission process gives off so much heat that the uranium and its aluminum sheathing would soon melt if it were not cooled. Therefore, the uranium rods are placed inside an aluminum tube, leaving an annulus through which cooling water from the Ottawa River is run continuously (Fig. 4).

The heavy water in the calandria is protected from light water contamination by the calandria tubes. The X-rod assembly just described slides into the calandria tube and does not come in contact with the heavy water. After a specified period of operation depending upon their position and the operating conditions, the X-rods are removed from the calandria tubes and sent to an extraction plant for the recovery of the depleted uranium and for the extraction of fission products and plutonium.

As the water running through the X-rods does not remove all the heat generated in the reactor, further provision was made for cooling by allowing air to pass between the X-rod assembly and the calandria tube, and by the addition of a heat exchanger in the moderator or heavy water circuit. The reactor structure around the calandria is cooled by air, which is sucked through it by huge fans and then discharged up a 200-ft. stack. Suction rather than compression is used, so that no stray radioactive material can leak from the reactor into the reactor building.

A certain number of neutrons escape from the calandria, but a large percentage of these is reflected back by an air-cooled graphite cylinder (Fig. 3) around the calandria. Columns of graphite lead from this cylinder to the outer edge of the reactor structure to provide neutrons for experimental purposes. Huge lead and cadmium doors at the end of these columns limit escape of neutrons and gamma radiation into the reactor building.

The graphite does not reflect back all the neutrons. Furthermore, highly penetrating gamma rays are given off when neutrons are absorbed. Thus, further shielding had to be provided to protect operators and scientists working around the reactor. This consists of a cast iron cylinder with air cooling around the graphite, and then an 8-ft. thick concrete cylinder outside the iron.

The shielding on the top and bottom of the reactor is best seen in Fig. 2. Immediately above the calandria are three water-cooled thermal shields. They are essentially circular "sandwiches" of steel and water. Each is about a foot thick and weighs 15 tons. Above these are four circular shields consisting of concrete poured into steel frames. They are slightly over a foot thick and weigh from 17 to 19 tons.

Beneath the calandria are three water-cooled circular steel shields—"sandwiches" much like the upper thermal shields—and below these is a lead and masonite bottom shield.

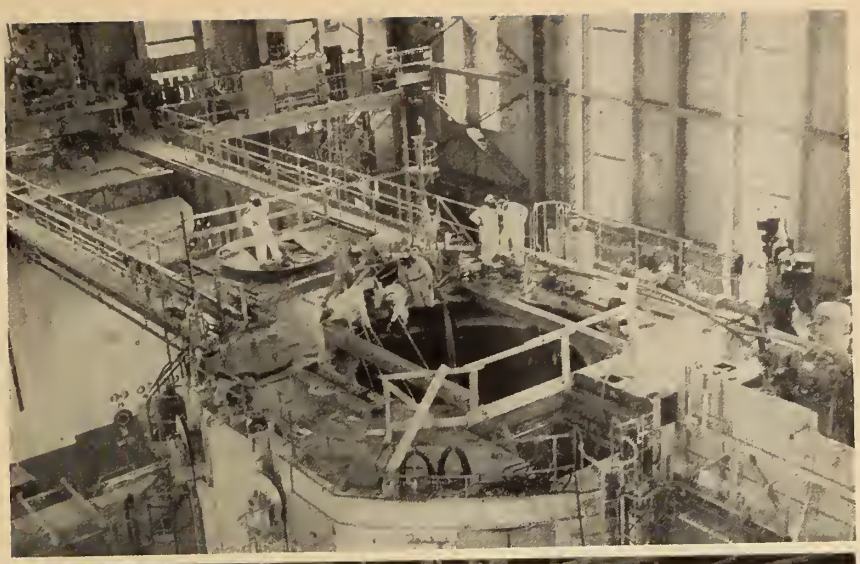
Dismantling

A considerable amount of decontamination had to be carried out before the dismantling could begin—particularly in the reactor basement, but space does not allow a full description of this work. It will be mentioned briefly under "Reconstruction".

After complex electrical connections and piping had been removed, all the undamaged X-rods were withdrawn from the reactor. This left a number of damaged X-rods in the reactor, the full extent of their damage not known, as only very limited views by a boroscope had proved possible. An attempt now made to pull out the defective rods resulted in their breaking off either just above the top tube sheet of the calandria due to a restriction in the lower shield or within the tank due to binding in the calandria tube.

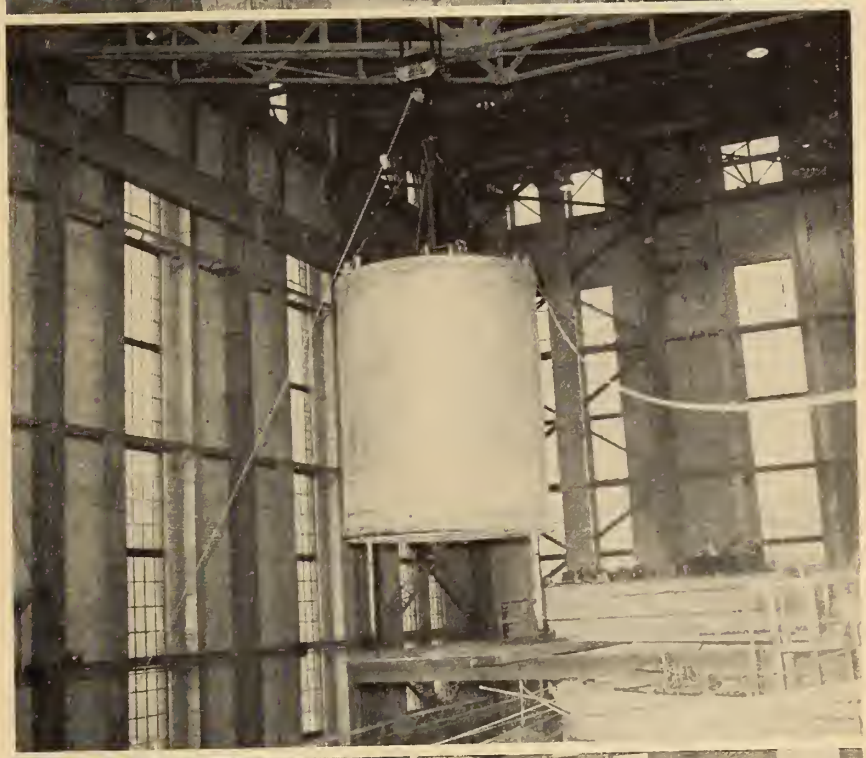
Personnel of the Industrial Operations Division inspecting a grabbing tool (projecting from a lead-shielded steel flask) after an attempt to pull an aluminum tube containing a uranium rod from the calandria.

A team of 70 men practised the calandria removal procedure thoroughly on a model of the reactor. Here George Ryan, crane operator, lifts a wooden model of the calandria out of the reactor structure, while other members of the crew look on.



Wearing protective clothing, personnel are preparing for the removal of the calandria after all the aluminum tubes containing rods of uranium have been removed. A health surveyor checks the activity of the reactor continuously during these operations. Heavy shielding on top of the calandria protects the workers.

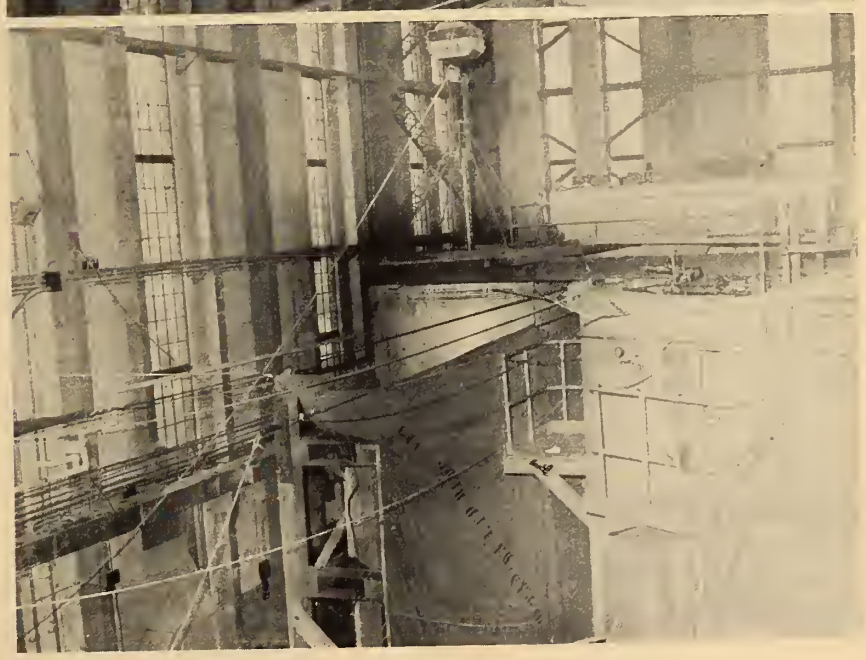
The four concrete shields were next removed and lowered to the floor of the reactor building, where they were decontaminated. It was still possible to work without special shielding, although of course gas masks and protective clothing were necessary. The two top steel thermal



The stained aluminum calandria — probably the largest radioactive object ever handled — is lifted out of the NRX reactor structure. The radiation field around this tank is approximately equal in strength to that from half of all the radium that has been produced in the world. In a practice operation a dummy — a steel cylinder filled with sand to give it the same weight (2½ tons) as the calandria — was lowered into the reactor structure on top of the shielded calandria and then removed to check all the steps of the actual removal which was to take place the following evening.

shields were then lifted off. The plan was to cut through the remaining thermal shield to get at the calandria tubes which contained the fused and broken pieces of X-rods.

However, moisture and sludge accumulations in the thermal shield made it impossible to operate satisfactorily the equipment designed for automatic cutting. This required



The calandria being lowered into a canvas bag which is fastened to a skid which is turned on its end against the side of the reactor structure. Workers pulled ropes to close the canvas bag and then the skid was lowered to the floor of the reactor building. From that position it was towed out of the project area.

constant manual attention, and workers were quickly receiving their maximum allowable exposure to radioactivity. It was then decided to make a special lead shield to replace this lower thermal shield. The lead shield was rotatable, and had a sliding door in a radial slot, to give access to various positions on the top tube sheet of the calandria.

Monitor probes had indicated that there was considerable highly radioactive material in the bottom of the calandria. Therefore, it was desirable to keep the lower portions of the calandria tubes intact so that the sludge would be retained within the calandria, rather than run into the basement and thus cause further contamination.

As shown in Fig. 5, a calandria tube was first cut internally at A. Then the top calandria tube-sheet was trepanned (at B), allowing a doughnut-shaped piece of the sheet with the top of a calandria tube attached to be lifted out. Then the X-rod was pulled out of the calandria tube. This allowed the pulling of only one X-rod, for the others were found to be too thoroughly fused with the calandria tubes.

In the next method used, after cutting off a calandria tube at the top as before and trepanning the top tube sheet, the calandria tube was clamped near the bottom tube sheet and cut off some three inches above the bottom tube sheet. A lifting device with a three-jaw clamp was then lowered to grasp this piece. A special lead flask with 4 in. of lead shielding, and weighing about 10 tons, was lowered onto the lead shield over the cut calandria tube. The latter was then pulled up inside the flask and lifted out of the calandria structure.

It must be remembered that the radioactivity made it impossible to look down directly inside the calandria to see how well the cutting and lifting tools were positioned and operating. Various optical viewing devices had to be used.

This method worked for two X-rods, but the third one broke off at the lower tube sheet, allowing radioactive sludge to pour into the basement. This meant that further arduous decontamination was necessary, and that there was no longer any point in attempting to keep the lower portion of the calandria tubes intact.

The method now adopted, therefore, was to clamp the calandria tube near the bottom tube sheet and simply pull it bodily out of its rolled joint. The tubes were pulled up into a standard X-rod flask and transported to a water trench leading to an extraction plant.

Calandria Removal

The next major operation in the dismantling of the reactor was the removal of the calandria. Heavy water system connections to this tank were cut and brackets were removed. Work here was hampered not only by radioactive fields from the tank, but also from the basement which was still highly radioactive in spite of extensive decontamination. The extremely "hot" tank (activity was about 700 r at 3 ft.) was lifted out of the 35-ft. high reactor structure during the evening when few employees were at the project.

The plan was to lift the tank out of the reactor structure with an overhead crane, swing it over a huge canvas bag that was attached to a skid turned on its end against the side of the reactor, then lower the calandria into the bag (Fig. 6).

The skid was then to be lowered into a horizontal position on the floor of the reactor building, and pulled out of the building by a tractor. Then a grader was to be hooked to the skid to tow it through the project and out to a burial ground outside the plant. A grader was to be used for the towing as it was the heaviest rubber-tired vehicle on the project.

A dummy-run was carried out in the reactor building the night before the actual removal. A cylindrical steel frame was loaded to give it the same weight as the actual calandria, and was lowered into the reactor structure on top of the calandria. The space left by the various shields which had been removed from above the calandria allowed the dummy to be lowered a considerable distance below the top deck plate.

The removal crew then took up their various positions, all wearing white coveralls and gas masks, and an announcer in the reactor control room called out the various steps. The removal crew learned at first hand how to control the maze of ropes needed to turn the dummy calandria through 65 degree angle, once it had been pulled out of the reactor. They also learned to pull the draw strings on the canvas bag once the dummy had been lowered into it, and to pull a pin that held the lowering ropes to the skid.

A scale model of the calandria, reactor and catwalks in the reactor building was constructed. A team of 70 men practised the removal procedure thoroughly on the model so that each man knew his particular job and that of others involved in the operation. No one would be able to move within 50 feet of the tank except in extreme emergencies.

At 6.30 p.m. the next evening, with 12 men trained to handle any of the many jobs in the operation standing by to handle emergencies, the removal got under way. Photographers were positioned behind shielding at strategic points to take still and movie shots of the operation. The announcer in the reactor control room called out the 28 steps, such as: "Step number one—attach hook to lifting device and align hook for lifting." Then "step number two—raise calandria six feet. Raise calandria six feet."

Slowly the stained aluminum tank rose above the reactor structure. "Health survey men take readings," called the announcer. These men moved forward with their radiation detecting instruments to predetermined points to measure the intensity of the field being given off by the tank. This operation was carried out quickly and then the announcer declared, "four minutes will be allowed for photographs, four minutes will be allowed for photographs." The photographers then moved to marked positions to take shots that will be used for scientific studies.

Once the photos were taken, the crane man, operating from a well-shielded cab high in the reactor building, lifted the "hot" calandria to a point directly above the canvas bag. The crane operator could not see the calandria. He made all his moves on signals from a man stationed at a distant point in the reactor building. The tank was lowered into the bag as neatly as pulling on a glove. Then the skid to which the bag was attached was lowered slowly to the floor of the reactor building.

At this point one of the multitude of ropes became snagged. It looked like a bad snag, but members of the stand-by crew, on orders from the announcer in the control room, moved forward and released it.

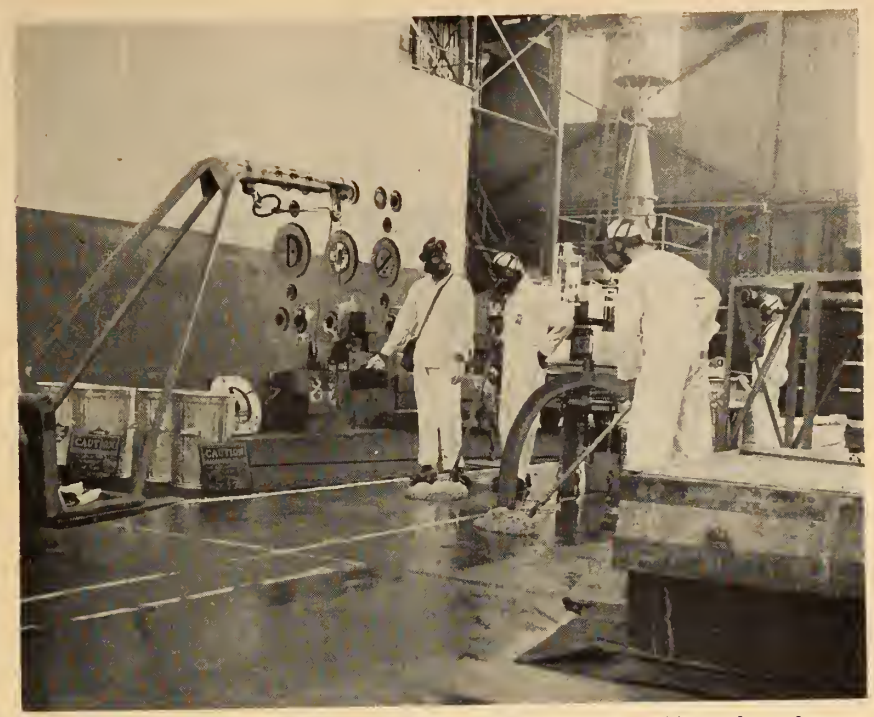
"Pull lowering cable pin from skid," called the announcer. Three men in white moved from behind their shielded position and pulled a rope attached to the pin. "Move grader to towing cable. Secure, and tow skid to first position," continued the announcer. "Rope Cutters, cut all trailing ropes."

Then, with only 30 minutes elapsed since the operation began, the announcer ordered: "Supervisor number three—resume towing. Complete control is transferred to you." The operator of the cab was protected from the radiation from the calandria by thick lead shielding fastened to the back of the grader cab.

A long blast of the project whistle warned men on duty at the project, such as security guards, that the calandria was now being towed out

through the plant. A funeral-like cortege moved slowly through the project—supervisors in cars ahead of the grader towing the skid, and health surveyors following to check the road for possible contamination. Apart from the personnel in these vehicles, not a soul was to be seen around the plant. Guard stations seemed strange unattended, and the usually well-guarded main gate was wide open.

The pen recorders in the continuously operating radiation monitors in buildings along the towing route went right off scale as the calandria passed. The calandria was towed to a spot well away from the project but still within the boundaries of Company property. There a bulldozer heaped sand over the tank to shield it. One end was left accessible for scientific studies.



Decontaminating the floor of the NRX reactor building. There have been no accidents due to radiation exposure at the Chalk River project.

Reconstruction

The NRX reactor operated for more than five years—a longer life than was predicted for it. During those years weaknesses in the design became evident, and a great deal of new information on nuclear processes was gained. Certain re-design work will, therefore, go into the reconstructed reactor which will result in a more powerful reactor with certain improvements in operation and research facilities.

From the valuable lessons learned in decontamination will come new methods of treating surfaces, which will make any future "spills" of radioactive material much easier to clean up.

Because of its porosity, concrete is one of the most difficult materials to decontaminate. Various methods are being used, depending upon the location and the degree of contamination: washing surfaces with a hot water (approximately 160°F.) and detergent jet; blasting the surface with steel grit using a machine equipped with a grit reclaimer and dust collecting unit; and removing the surface of floors by grinding, using a tool consisting of rotary cutters attached to a dust collecting system.

With the removal of approximately one-half inch of concrete by the blasting technique, an extremely rough surface is obtained due to the exposed aggregate in the concrete. The blasting process at this point became very inefficient since the grit and dust reclaiming system ceased to function properly.

Depending upon the level of radioactivity due to contamination remaining in the particular concrete surface, various subsequent treatments are being used: with the lower level, surfaces are smoothed and covered with a vinyl base paint which polymerizes in the pores of the concrete and presents a glossy and easily wipable surface.

With the higher levels of radioactivity, additional concrete is added to provide shielding. In some cases it is also necessary to add a layer of lead. Where a lead addition is required, the concrete is first painted with water-proofing paint. Where the new concrete is left exposed, it is treated with the vinyl base paint mentioned above.

In the reactor room reconditioning of all surfaces is necessary to eliminate any future health hazard due to dislodging of active particles and to lower the radioactive "background" to the absolute minimum so necessary for radiation monitoring and the experimental work carried out around the reactor.

The overhead trusses, cranes, and in fact all exposed horizontal surfaces require wiping and the walls vacuum-cleaning. The wiping technique is found to be much more efficient than vacuum-cleaning. Paint will be used in some places to fix radioactive particles which cannot be removed.

The NRX reactor is now nearly ready for the initial runs at low power. The problems of repair have been many and varied, and we have gained experience and information that is invaluable not only for the operation of this reactor but in the design of future reactors. We have incorporated some changes in the design of our NRU reactor (now under construction), as a result of our experience, that may save many times the cost of the repair job. We will also have an improved NRX reactor although design changes were frozen to an absolute minimum in order to ensure a reasonable reconstruction schedule.

The difficult working conditions, due to restrictive clothing and masks and disruption of the normal plant organization, have been accepted by all those involved, and the success of the whole operation is largely due to the staff and other technical employees who have taken a pride in getting the problems solved, no matter how difficult they seemed.

It is evident to us now that a planned program of, say, a calandria replacement would be a relatively simple job. The major problem we encountered was the contamination of the building and equipment due to the flooding by very active water. This NRX reactor, which was originally given a life of perhaps five years, may now be maintained for many years of useful service.√

A paper presented to the Annual General and Professional Meeting of The Engineering Institute of Canada. Halifax, May, 1953.

Modern Developments in Prestressed Concrete

by
Niels Thorsen
Freyssinet Co. Inc., New York City.

Prestressed concrete can be described as an improved type of reinforced concrete. Although reinforced concrete has proved to be an excellent material for many structures, it has certain drawbacks which have retarded its efficient use in a series of applications. The low tensile resistance of concrete causes cracks in the tension flange of most reinforced concrete members, therefore the concrete below the neutral axis is usually inactive, even for normal working loads (D.L.+L.L.), and is merely a dead weight decreasing the effective carrying capacity of a member.

The addition of compressive stresses (prestress) in the tensile zone of a concrete member, prior to loading, offsets the drawbacks mentioned above, as explained in the following:

1. When a suitable prestress is selected, no tensile stresses will occur in the bottom fibers of a beam for all loads up to working load (D.L.+L.L.). This means that a beam will remain crack-free for all loads up to D.L.+L.L., in most cases even for D.L+1.5 L.L. to D.L.+2.0 x L.L., as the concrete has a certain tensile strength itself.
2. Usually the prestress induces tensile stresses in the top fiber of a beam, increasing the effective carrying capacity.
3. Should a beam in prestressed concrete be momentarily overloaded and cracks occur, these cracks will disappear after removal of the load.
4. Usually the prestress reduces diagonal tension in a beam, and thus makes it possible to design members with thin webs giving lighter sections.

For more than fifty years, engineers have been aware of these basic advantages of prestressed concrete. Various attempts to apply the theory to actual construction problems were not successful however, as regular mild steel with a limit of elasticity of 40,000 lb. per sq. in. was used, and the major part of the prestress therefore lost due to creep and shrinkage of the concrete. About 25 years ago, Mr. E. Freyssinet was the first to formulate the influence of creep and shrinkage of concrete on prestressed concrete structures. He discovered that the use of high tensile steel was necessary to keep losses in prestress low. After this basic discovery, the next step in making prestressed concrete practical for construction was the development of suitable materials and methods of prestressing.

Materials

High Tensile Steel

Research has been directed towards development of steel with the highest possible tensile strength, and with low creep for high stresses (60 to 80 per cent of the ultimate used as initial stress). Wire of .2-in. dia., with a tensile strength of approximately 200,000 lb. per sq. in., has been available for several years from most of the major wire producers. Several mills are now producing wires especially for prestressed concrete. In Fig. 1 is indicated the guaranteed minimum tensile strength of wires for prestressed concrete, as manufactured by an American mill.

High strength bars with minimum guaranteed tensile strength of 145,000 lb. per sq. in. have been developed, and are now available in diameters from ½ in. to 1⅛ in.

Data on creep and still better stress relaxation (loss in stress for constant strain) for various stress levels are available from most pro-

Prestressed concrete may be considered an improvement of ordinary reinforced concrete. Prestressing makes possible concrete structures with slender members and long spans. It facilitates efficient use of prefabrication. The use of high strength concrete and high tensile steel is mandatory to keep prestressing losses low.

A brief description is given of the most important systems now in use in North and South America. Prestressed concrete can be used not only for bridges, buildings and reservoirs, but also for harbour structures, underpinnings, etc. Examples are given.

Current practice in the United States for letting prestressed structures makes it possible for owners, engineers and contractors to design and build prestressed concrete structures without the risk of infringing patents.

ducers, and allow the designer to determine the losses for the stress level used.

Concrete

The technique of producing high strength concrete has been further developed in recent years. Mixing and vibration equipment is available, allowing the use of concrete with 3-in. slump and less in the field, and "no slump" concrete in the yard. For most structures cast on the job site within the last couple of years a 28 days cylinder strength of 4,500 lb. per sq. in. to 5,000 lb. per sq. in. has been specified, and obtained without difficulty. For several products cast in concrete product plants, cylinder strengths of 6,000 lb. per sq. in. and higher have been used.

Pretensioning

In pretensioning, steel is stressed in the forms prior to pouring the concrete. After curing of the concrete, the tension in the steel is released and transferred to the concrete by bond. As the prestress depends entirely on bond, the steel used should be high-bond steel. Smooth wires of .1 in. to .2 in. dia., as well as deformed wires of .2 in. dia. to .25 in. dia., are widely used.

A new development in this particular field, principally applied to structures in the U.S., is the use of 7 wire strands of small diameter. A strand of $\frac{5}{16}$ in. nominal diameter with a cross sectional area of approximately .06 sq. in. and a minimum guaranteed tensile strength of 15,000 lb. is particularly suitable for the conditions prevailing in the U.S. at the present.

The price is reasonable. If the strength is taken as basis for comparison, the price of $\frac{5}{16}$ in. strand is 25 per cent above the price of smooth .2 in. dia. stress-relived wire when the strand is time-temperature treated, and only 11 per cent above the wire price when the strand is non-treated.

The bonding properties of the $\frac{5}{16}$-in. strand are excellent. These properties can be evaluated by measuring the distance from the end of a pretensioned member, to the section where full prestress is obtained. This length has been measured from 6 in. to 10 in. for a $\frac{5}{16}$-in. time-temperature treated strand and a 5,000-lb. per sq. in. concrete. For .2-in. dia. smooth wire the distance given above will measure 20 in. to 24 in.

Tests made with time-temperature treated $\frac{5}{16}$-in. strands, having a central wire with a diameter approximately 5/1000-in. larger

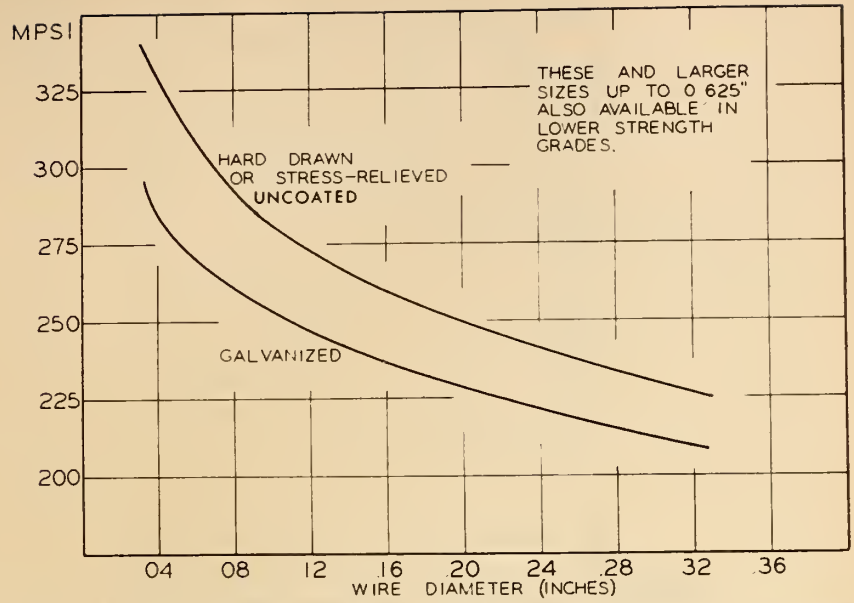


Fig. 1. Minimum tensile strengths of "super-tens" wire, (Courtesy American Steel and Wire Division, United States Steel.)

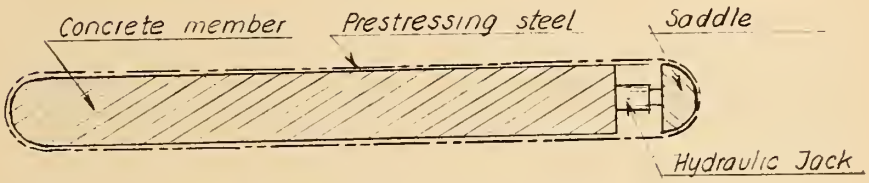


Fig. 2. Linear prestressing by looped cables.

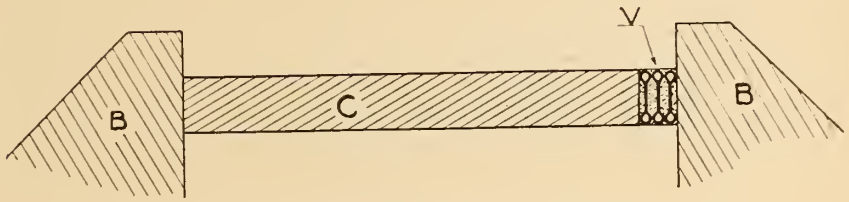


Fig. 3. Post-tensioning using jacks only, B=abutments; C=concrete member; V=jacks.

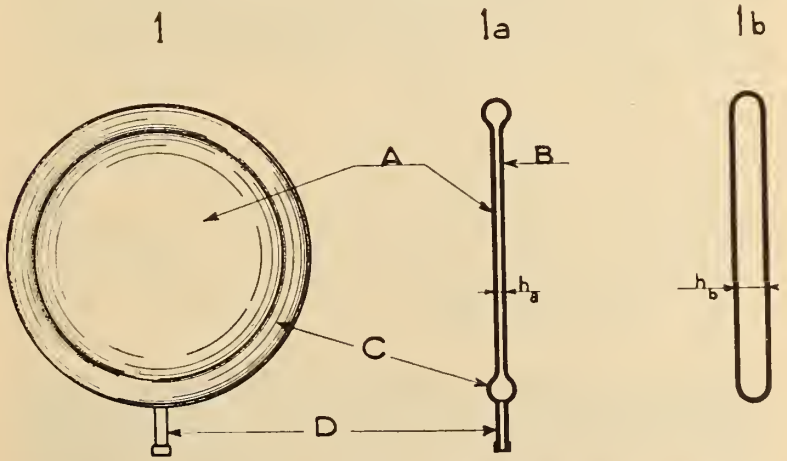


Fig. 4. Flat jack. 1 - plan view; 1a - cross-section before runout; 1b - cross-section after full runout.

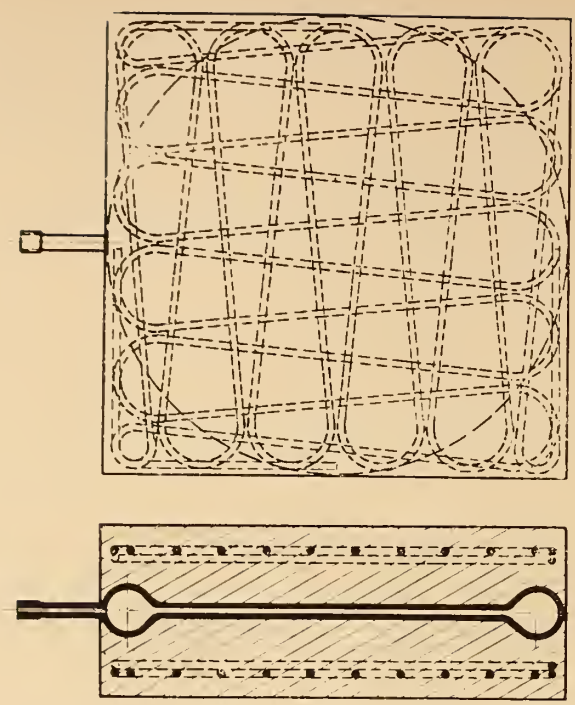


Fig. 5. Flat jack embedded in concrete block before runout.

than the diameter of the exterior wires, showed that the entire cross-section of the strand is active, i.e. not only the 6 wires which are in contact with the concrete, but also the central wire.

This means that the central wire does not slip (slippage insignificant) in relation to the exterior wires, neither during transfer of prestress (release of tension in stress-bed) nor during failure of a pretensioned member. In well-designed members the strand has nearly developed its full strength at failure of the member.

The creep properties for a 7-wire strand are close to those for a smooth wire for the various makes now on the market in the U.S. 5/16-in. strands are easy to handle, as they are perfectly "dead" (i.e. have no residual curvature due to coiling). Furthermore one strand has a minimum strength of 15,000 lb. which is the double of that of a .2-in. dia. wire. This means that a smaller number of units has to be handled, resulting in reduced labour cost.

It will be of interest to conduct further tests to find out if a time-temperature treated strand gives better results than a non-treated strand (the saving by using non-treated strand is considerable). Moreover, it should be determined what is the maximum-diameter strand that can safely be used. The price of the strand decreases with increasing diameter. The first to use 7-wire strands in the U.S. for pre-tensioned concrete was Concrete Products Co. of America, Philadelphia, Pennyslvania, in collaboration with American Steel & Wire Division of United States Steel.

It will be of interest to conduct bond tests on .276-in. dia. deformed wires of American make, as this wire might be competitive both in quality and price. The fittings to be used for gripping wires for pretensioning should preferably be re-usable. Several wedge type fittings are available today.

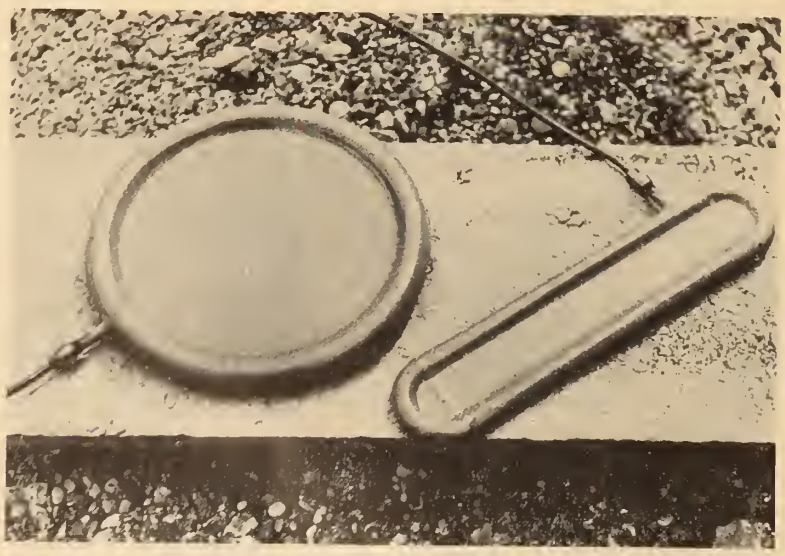


Fig. 6. Flat jacks. View of a circular and a rectangular jack.

Post-tensioning Systems

In post-tensioning, steel is either embedded in ducts in the concrete and stressed after curing, or the steel is placed outside the concrete member. According to the theory of rupture, embedded and grouted steel gives higher ultimate strength to a member than steel placed outside or not bonded. Where the steel is bonded, several cracks will occur during overloading of a member. Only a relatively short length of steel will be stretched at each side of the crack, giving high strain in the steel and corresponding high stress at failure, and therefore a high ultimate moment.

When the steel is unbonded, only one crack, in some cases a few, will occur, and as this crack opens up, the elongation will be distributed over the entire (or a considerable) length of the steel, giving low strain and corresponding low stress at failure of the member, and therefore relatively low ultimate moment. For this reason, in designing non-grouted structures, special consideration must be given to the ultimate strength. If the same structure is considered using both grouted and non-grouted steel, a reduction in steel area should be allowed for in the structure using grouted steel.

A variety of methods for gripping and stressing steel have been developed lately, and below is given a resume of the principal ones used in North and South America. Several others used on a relatively small scale are variations of these systems:

Bar Systems

The best known in North America is the Lee McCall system (Stressteel

system) using high strength bars with a minimum ultimate strength of 145,000 lb. per sq. in. and diameters from ½ in. to 1⅛ in. These bars are provided with special conical threads and a nut at each end, and can thus be gripped, stressed and anchored. The conical threads develop higher strength than a normal thread. Finsterwalder in Germany uses rolled threads also developing higher strength than normal threads.

Wire Systems:

Bridge Strands, furnished with factory-attached fittings, developing the full strength of the strand, are available in diameters from .6 in. to 1$\frac{11}{16}$ in., with minimum guaranteed tensile strength from 46,000 lb. to 352,000 lb. These strands have been pioneered by John A. Roebling's Sons Corp.

Parallel Wire Systems:

The Freyssinet system uses assemblies of 8, 10, 12 or 18 wires .196 in. dia. (250,000 lb. per sq. in. minimum tensile strength) or 12 wires .276 in. dia. (235,000 lb. per sq. in. minimum tensile strength) anchored in special concrete anchorage cones.

Most widely used in North America is the Stresscon system (headed wire system). In this system, 6, 7 or more .25 in. dia. wires (235,000 lb. per sq. in. minimum tensile strength) are gripped, stressed and anchored by means of cold pressed heads at the ends of the wires.

In the Magnel system, .196 in. or .276 in. dia. wires are anchored in pairs by means of steel wedges. The wires usually are assembled in groups in square holes or ducts.

Other Systems:

Wires (or fine strands) can be stressed and anchored by looping them around movable endblocks, at one or each end of the member to be prestressed. After pouring and curing of the member the endblocks can be pushed out by ordinary commercial jacks (or special jacks) and the steel thus stressed (Fig. 2).

This system was used by Mr. Freyssinet in most of his post-tensioned structures in the 1930's, such as the caissons for the Port of Brest. In the past few years the system has been widely used, especially for continuous bridges by Dr. Fritz Leonhardt who has developed special endblocks as well as ways of placing the steel and decreasing friction losses in double curvatures.

Best known in North America is the circular prestressing system developed by the Preload Company. In this method .163 in. dia. wire, with an ultimate strength of 225,000 lb. per sq. in., is wound around the circular container under a stress of 140,000 lb. per sq. in. The stress is created by running the wire through a die of slightly smaller diameter. After stressing the wires are covered with gunite.

"Linear" systems are also used for stressing circular tanks. In this case the prestressing units are usually embedded in the concrete walls and stressed after curing of the concrete. The prestressing units are anchored in reinforcements of the tank walls. In tanks from 100 ft. to 200 ft. dia., 4 to 8 anchorage points are used.

In this case the friction losses must naturally be taken into consideration. As the prestressing units are embedded in the tank walls, no

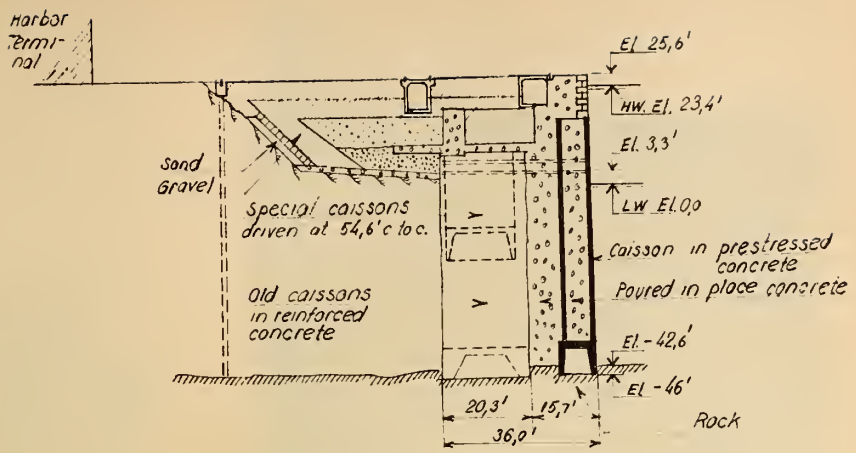


Fig. 7. Quai de France. Typical cross-section.

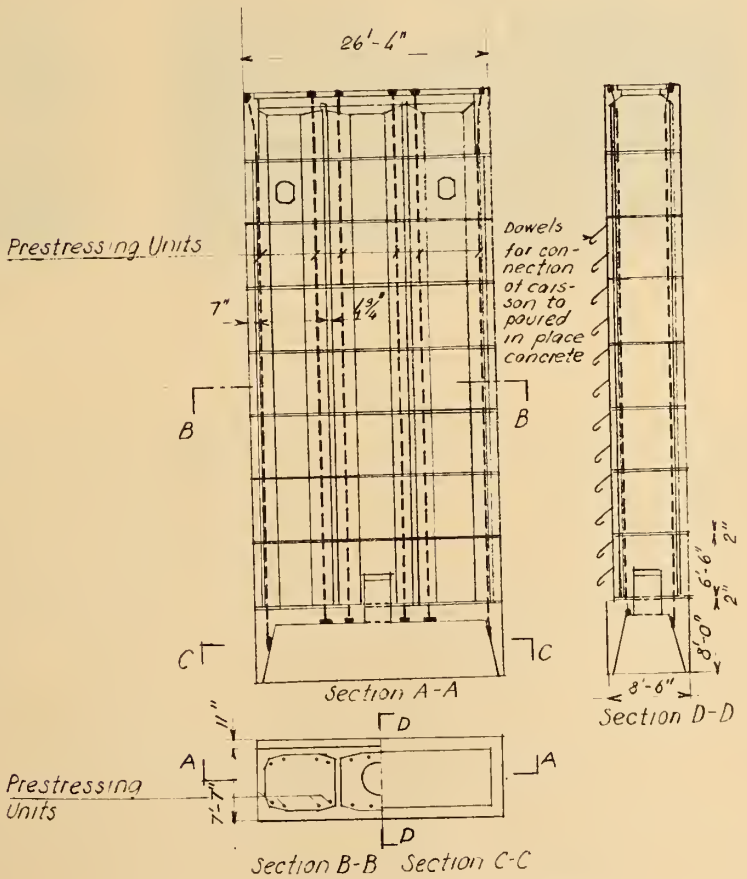


Fig. 8. Quai de France. Typical caisson.

Fig. 9. Precasting yard.

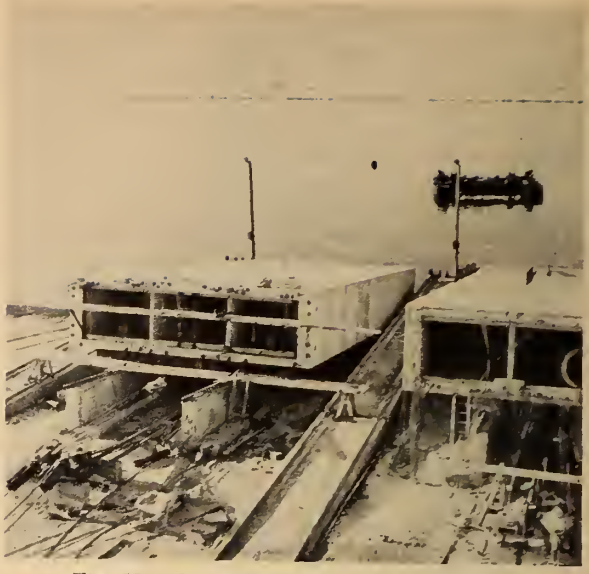


Fig. 11. Stressing of prestressing units.

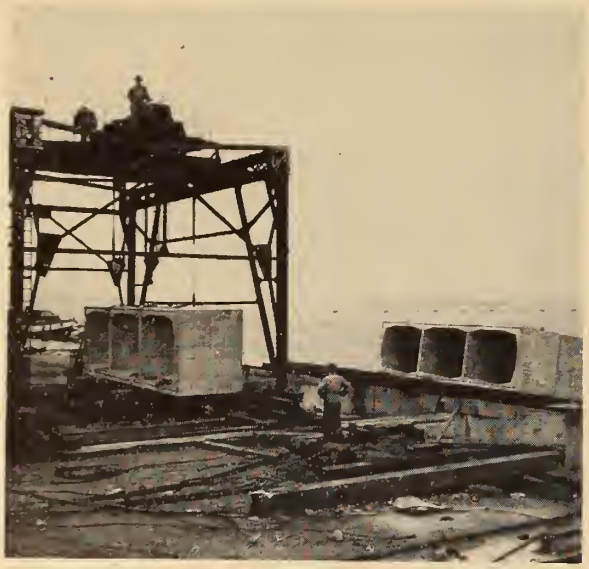


Fig. 10. Lining up of precast sections on slip.

Fig. 12. A caisson is lifted in vertical position by a crane.

gunite cover is required. This is of particular interest in places where the tanks are subject to freezing and thawing, which can cause some damage to the gunite.

Post-tensioning Using Jacks Only

In such cases where suitable supports are available at the ends of the members to be prestressed, the use of steel may be omitted (except some mild steel provided in end-blocks, etc.) and the concrete simply compressed by means of jacks (Fig. 3). For this method of prestressing, as well as for stressing looped cables (Fig. 2), Mr. Freyssinet has developed a special flat jack, shown on Fig. 4, 5, and 6.

This jack consists of two thin plates, circular, rectangular or any other suitable shape, welded together at the edges. On Fig. 4 (1) is a plan view of a jack, and (1a) a cross section of an empty jack. An inlet D is provided. The jack is embedded in a concrete block (Fig. 5), and by pumping water or cement grout in the jack it blows up (see 1b, Fig. 4); the maximum run-out h_b-h_a is approximately 1 in. Such a jack can work at a maximum pressure of 2,200 lb. per sq. in. The effective diameter of the jack is approximately 1 in. smaller than the overall diameter. A jack developing 100 tons will thus have a diameter of approximately 12 in.

The advantage of this jack is that it is extremely cheap, and only costs a fraction of an ordinary commercial jack. It can therefore be left in the structure: in such cases, the jack is pumped up with cement grout. Furthermore, the jack takes up very little space, and is therefore especially suitable for use in "active joints" in pavements, etc.

Prestressed Caissons

Many bridges, industrial buildings and tanks have been completed in prestressed concrete in recent years and described in technical literature. Less attention has been given to the use of prestressed concrete in harbour structures, foun-

dation problems, etc., which are just as important. The following describes some of these "unusual" applications of prestressed concrete.

The original Quai de France, at Cherbourg, France, built between the two World Wars, was destroyed by the German Army in June, 1944. This pier was built in deep water, and was composed of caissons in reinforced concrete and a poured-in place deck, supported at one side on the caissons, on the other by a pile system. After the destruction a large part of the old caissons remained, but were in no condition to be re-used as foundation for a new pier. The Port Authority therefore decided to place a row of new caissons outside the old ones (Fig. 7).

The new pier, recently completed according to this plan, has an overall length of 2,000 ft. The average water depth is 43 ft. measured at low tide (elevation 0). The maximum tide is 23 ft. and the top of the pier is at elevation +25.6. The general layout of a typical caisson is shown in Fig. 8.

The typical caisson is composed of several precast sections; these sections are cast vertically. The working chamber is 8 ft. high, the other sections 6 ft. 6 in. In Fig. 9 may be seen the yard used for the casting of these sections; some sections are already completed; for others the formwork is ready for pouring.

The precast sections are lined up on a slip with 2-in. joints between sections. The joints are packed wth dry mortar, and finally the sections are assembled by Freyssinet Prestressing Units anchored in anchorages embedded in the top of the working chamber and the inside edge of the top section (Figs. 10 and 11). The prestressing units run inside the box-shaped section.

After prestressing, the top of the caisson and the manhole in the ceiling of the working chamber are closed by boards. The caissons are launched in the water and floated to the job site where they are gripped by a crane and lifted into vertical position (Fig. 12). By the use of compressed air the working chamber is made accessible and the caisson driven 3 ft. into the rock. Reinforcing from the deck slab is bent down in the hollow part of the caisson, and finally the caisson is filled with concrete and the deck slab poured.

On the one hand the deck slab is cantilevered from the top of the caissons, thus providing a counterweight for inside earth and water pressure. On the other hand the deck is also supported on special caissons driven at 54.6 ft. centre to centre on the caissons from the

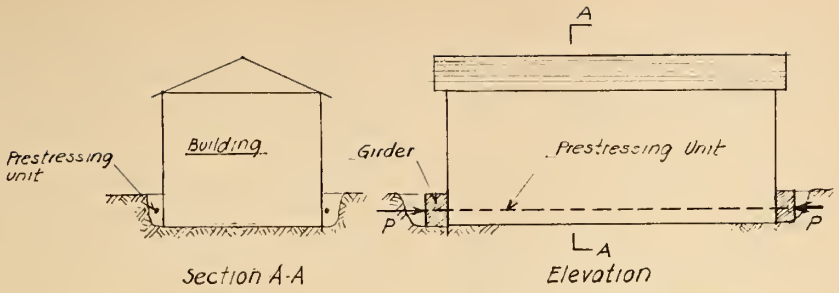


Fig. 13. Use of prestress in underpinning — schematical

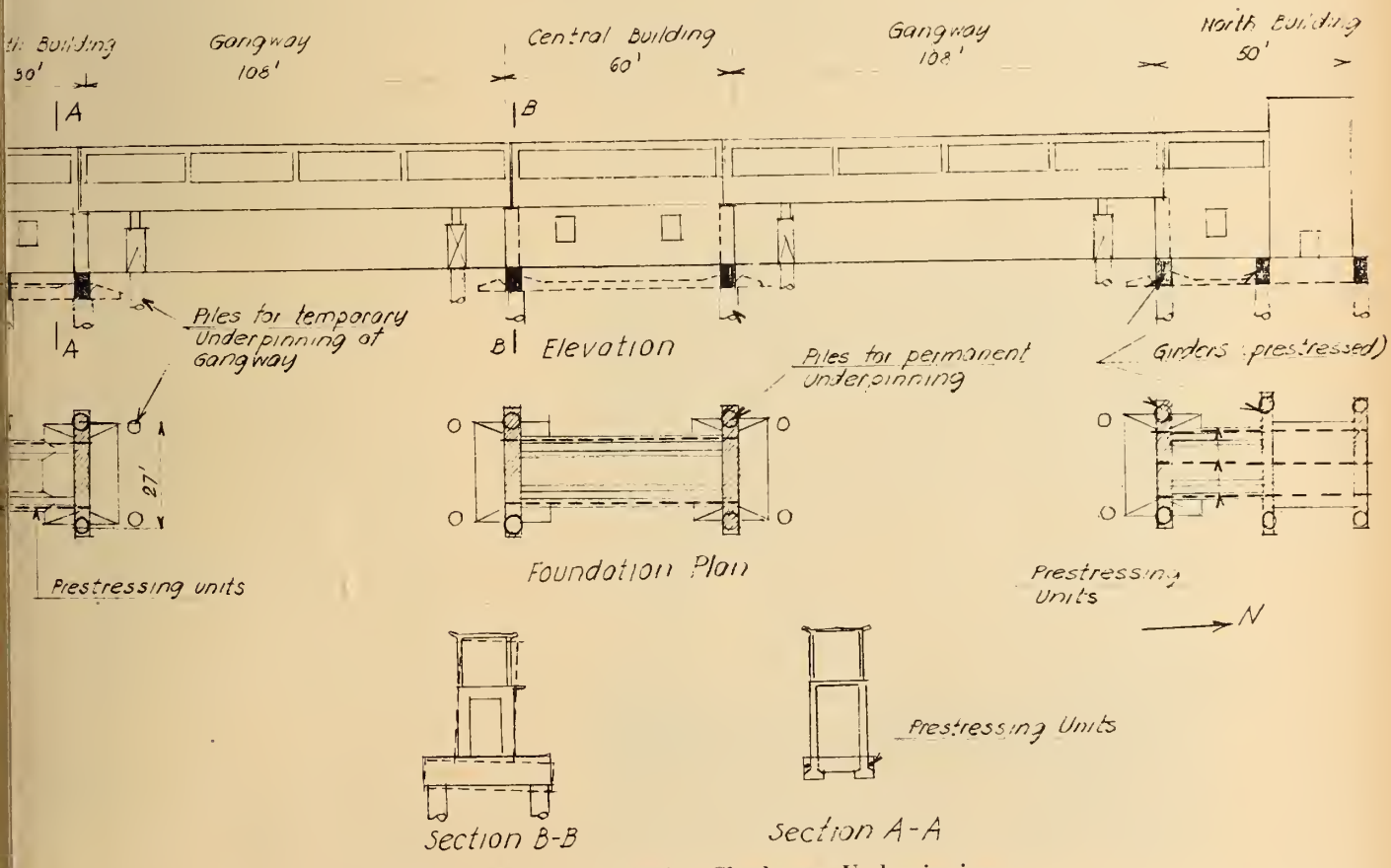


Fig. 14. Harbour terminal in Cherbourg. Underpinning.

old pier. Channels through the caissons at 3.3 ft. above low water (El. 0) reduce inside water pressure.

Prestressed concrete gave a very economical caisson construction on this job. Prestressing enabled box-shaped caissons to be cast in small vertical sections, making it possible to apply all the advantages of mass-production to this job such as use of steel forms, prefabrication of reinforcement, etc. Furthermore, the prestressing gave perfectly watertight caissons.

Underpinning Harbour Terminal at Cherbourg

The basic principle used for underpinning is explained in Fig. 13. Girders in reinforced concrete, prestressed concrete or steel can be attached to the sides of a building by means of prestress. At the same time the prestressing force can be used to reinforce the lower part of the building. The prestressing steel can usually be placed outside existing foundations, reducing demolitions to a minimum. In most underpinning work carried out according to the classical methods, girders are placed below the foundations, requiring costly temporary underpinning.

This principle has been applied to the underpinning of the harbour terminal in Cherbourg, France. The northern part of this terminal, consisting of three smaller buildings connected by 110 ft. long gangway bridges, is located close to the Quai de France described above. The foundations for the buildings are placed directly on sand without any piling.

The buildings started to settle, due to sliding of the sand below the foundations, immediately after completion of the terminal (between World War I and II). After the German Army blew up the Quai de France, this settlement was accelerated, as the pier had previously acted as retaining wall for the sand. The settlements varied from 4 in. to 13 in.; horizontal movements were insignificant. The Port Authority decided to consolidate the foundations and raise the three buildings to their original position (Fig. 14).

It was decided to support the buildings on large diameter piles of the Benoto type, placed close to the existing foundations. Two piles of 40-in. diameter and 2 piles of 60-in. dia. were used for the south building; 4 piles of 60-in. dia. were used for the central building; and 4 of 60-in. dia. and 2 of 40-in. dia. for the north building. The gangway bridges were supported during the underpinning work on 40-in. dia. piles each.

Girders in prestressed concrete were poured at the level of the old foundations with supports on the Benoto piles. On Fig. 14 may be seen that only a minimum of demolition work was required. As the ground water level was at the bottom fiber of the old foundations, it was advantageous that all girders could be placed at the same level as the foundations, instead of below.

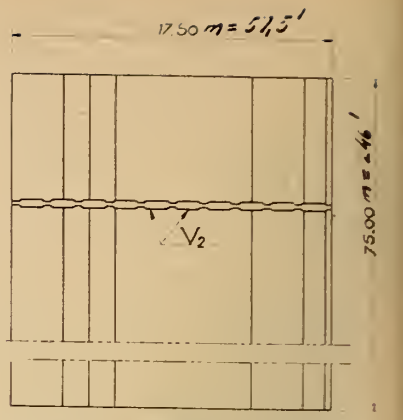


Fig. 16. Porte de Fer dam. Plan view.

The girders were connected with the buildings by prestressing cables running outside or between the existing foundations, and the buildings themselves were consolidated by prestressing cables. All exposed cables were covered with concrete, which at the same time stabilized the old foundations. The prestress connecting the girders to the buildings made the old foundations work as girders carrying the buildings above.

After stressing all cables, jacks were placed between the top of the piles and the girders, and the three buildings, including gangway bridges, jacked back to their original position. The weights of the buildings were:

South Building . . .	1,000 tons
Central Building . .	1,900 "
North Building . . .	1,700 "

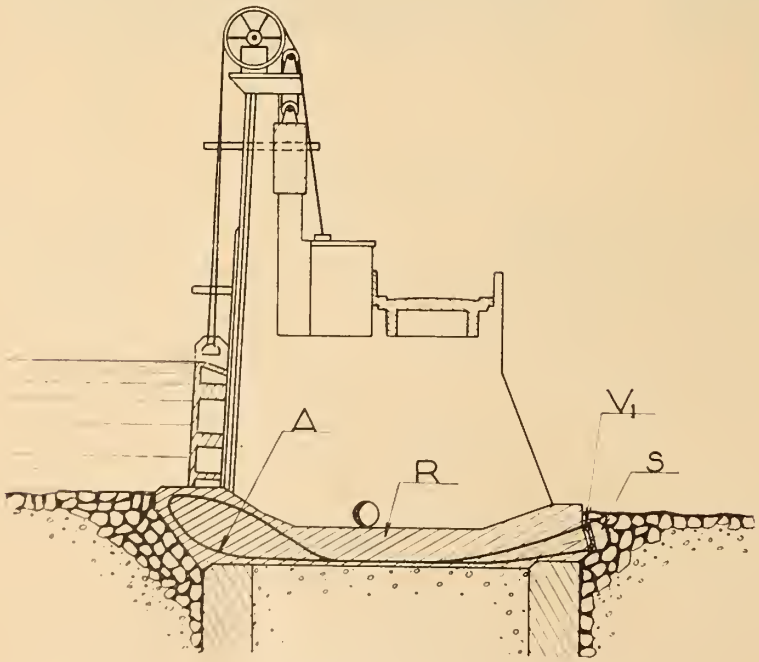


Fig. 15. Porte de Fer dam. Typical cross-section.

Prestressing in a Dam

A typical cross section of the Porte de Fer Dam in Algeria is shown on Fig. 15. The lower part of this dam is prestressed transversally as well as longitudinally. The transverse prestress is created by looped cables A. The cables are stressed by means of flat jacks V_1 inserted between the dam and the saddles *S*. The functioning of these flat jacks has already been described in this article.

Longitudinal prestress is created by flat jacks (V_2) *only*, inserted in an "active joint" at the middle of the dam (see plan view, Fig. 16). When the jacks V_2 are pumped up the concrete is compressed be-

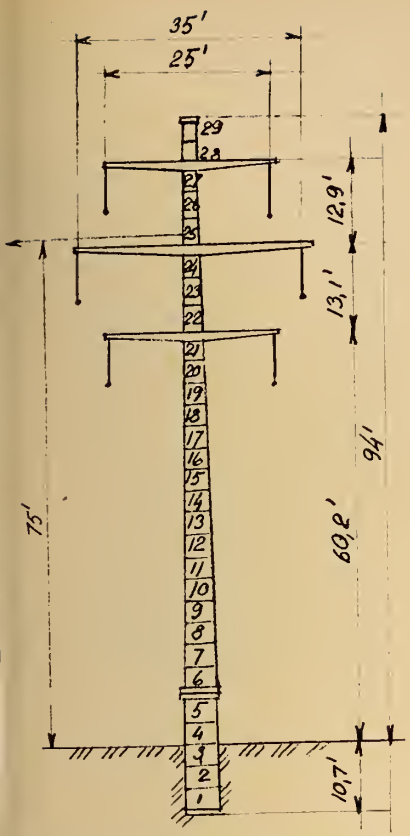


Fig. 17. Pole for 132-kv. line.

tween the rock at both sides of the valley (Fig. 16).

Prestressed Power Line Poles

During the past ten years an important development has taken place in the manufacture of transmission line poles in prestressed concrete. The most experience in this particular field has probably been accumulated in Algeria, North Africa, where more than 25,000 poles have been manufactured and now are in service.

In his report to the 1952 meeting of the Conférence Internationale des Grands Réseaux Electriques à Haute Tension, Mr. P. Lombard, chief operating engineer of Electricité et Gaz d'Algérie (owner of the more than 25,000 poles mentioned above) gives many interesting details.

Electricité et Gaz d'Algérie has established the following basic design criteria for prestressed concrete poles:

Safety factor for cracking: 1.5.

Factor of safety for elastic behaviour (total closing of cracks and reversibility within 5% of the deflexion): 1.65.

Factor of safety for rupture: 2.1.

The standard length and load requirements are: Total length in ft.—36 ft., 39.4 ft., 44.3 ft., 49.2 ft., 55.8 ft., 59 ft. Horizontal load at 10 in. from summit—440 lb., 660 lb., 880 lb., 1,320 lb., 1,980 lb., 2,640 lb., 3,300 lb., 4,400 lb. for poles of 36 ft. and 39.4 ft. length. Horizontal loads—880 lb., 1,320 lb., 1,980 lb., 2,640 lb., 330 lb., and 4,400 lb. for poles from 44.3 ft. to 59 ft. Many different cross sections have been tried, and in Table I are listed the principal characteristics of the various types.

A large number of the I type and the tubular poles have already been manufactured, whereas the box-shaped poles have only been manufactured in a limited number and present several production problems. From a statical point of view the box-shaped poles are preferable, as they give good resistance against both bending and torsion.

After more than 10 years experience with prestressed concrete poles, the Electricité et Gaz is favouring prestressed poles. The prices obtained are competitive with those for steel poles, and maintenance is nil. A recent inspection of poles manufactured in the early 1940's showed that all poles are in good condition. The I-shaped poles did not show any trace of wear and tear and the centrifugal (tubular type) only a slight crazing of the surface.

All the poles mentioned above have been pretensioned. On Figs. 17 and 18 is shown a post-tensioned pole 94 ft. high above ground, designed for a 132 kv. line with a spacing between poles of 1,000 ft., giving a horizontal component of the total load equal to a force of 8,000 lb. 75 ft. above ground.

This pole is composed of tubular sections poured vertically. The outside diameter of the tubes is 5.25 ft.

Fig. 18. Pole for 132-kv. line.

Table I—Characteristics of Various Types of Poles

Type of pole (cross section)	Total height of pole	Height above soil	Load available at 10″ from summit	Total weight of pole lb.	Number of elements per pole
I	36.0′	29.8′	660 lb.	1,970 lb.	1
	39.4′	33.4′	1,980 lb.	4,400 lb.	1
	55.7′	48.5′	1,320 lb.	5,820 lb.	1
Tubular composed of centrifugally prestr. tubes assembled by steel cables	36.0′	31.9′	660 lb.	2,970 lb.	2
	39.4′	34.8′	1,980 lb.	5,720 lb.	2
	55.7′	48.7′	1,320 lb.	7,150 lb.	3
Box-shaped poles with rectangular cross section	36.0′	—	660 lb.	1,940 lb.	1
	39.4′	—	1,980 lb.	3,740 lb.	1

at the base and 1.21 ft. at the top. The wall thickness is 3 in. and holes for prestressing units are provided in the walls. The sections 1 through 5 are first erected and assembled by 18 Freyssinet prestressing units. Afterwards the sections 6 to 29 are erected. The total number of prestressing units at the base is 18 and at the top 4. 14 cables are anchored between sections 6 and 29.

A pole of this type has been tested both for torsion and bending until failure, and satisfactory resistance was found against both these forces.

Prestressing Finding Wider Acceptance

The scope of this paper has only permitted the description of a few examples of prestressed concrete structures, and the summing up of some of the most important developments.

Whereas both engineers and owners were previously reluctant to accept prestressed concrete, the situation is now changing; many structures are already completed and serve as references. Many engineers have also been reluctant to use prestressed concrete as they thought they might infringe various patents. A practice eliminating this unfortunate situation has been established in the U.S. during the past couple of years and this practice might also suit Canadian conditions.

Highway Departments, consulting engineers, etc., only have to indicate the prestressing forces required on the bidding drawings for a structure; the job specifications indicate that any one of the major prestressing systems may be used and requirements for steel stresses, losses, etc., are specified for various qualities of steel. Although standard specifications are not available, such organizations as the Bureau of Public Roads have sent out recommendations to be followed on all B.P.R. structures.

It is up to the contractor to select the most economical prestressing system for a particular job, and he then submits drawings giving details for that system for the engineer's approval. Prestressing steel according to at least 3 major systems is available at present in the U.S. and sold by licensees of the systems on a price list basis. All royalties are usually included in the prices and the steel can be used without design restrictions. This practice very much simplifies the whole patent situation.

The fact alone that the Engineering Institute of Canada at this annual meeting has reserved a whole day for sessions on prestressed concrete is a good indication of the significance this material has attained today. ✓

Future Annual Meetings

of the

Engineering Institute

QUEBEC, QUE.—May 12, 13, 14, 1954

Chateau Frontenac

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TORONTO, ONT.—May 11, 12, 13, 1955

Royal York Hotel

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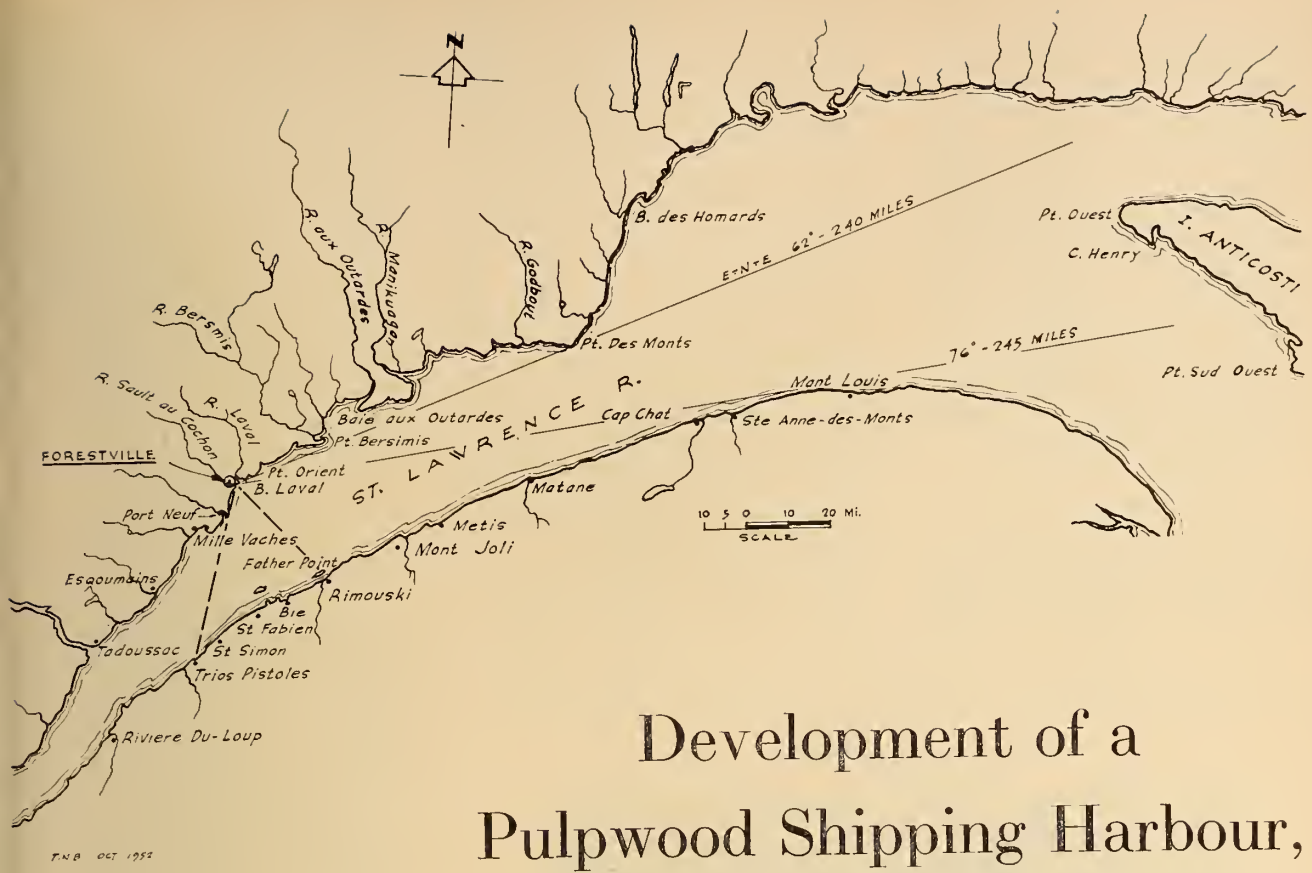
MONTREAL, QUE.—May 22, 23, 24, 1956



Development of a Pulpwood Shipping Harbour, Forestville, Quebec

by

Robert F. Legget, M.E.I.C.

Ottawa, Ont.

There are many hundreds of harbours on Canada's coast lines, some large, some small. Some of the works connected with the more important have been described in these pages, but we believe that this is the first time that the development of a small harbour has been followed from beginning to end in one of our papers. A fair proportion of the following pages is devoted to a discussion of whys and wherefores, though Mr. Legget touches on construction methods, some of them rather novel. His experiences in Forestville should be helpful to those faced by similar problems.

History and Site

Sixty miles northeast of Tadoussac, Quebec, the Sault au Cochon River joins the St. Lawrence River over a waterfall with a drop of 65 feet. The river has a length of about 100 miles and a drainage area of about 800 sq. mi. It is only since 1938 that access to the river by road has been possible, although the Government telegraph line along the north shore of the Gulf of St. Lawrence crosses the river near its mouth(1). The area is relatively isolated; there are only a few hundred families in the district today.

The lower reaches of the Sault au Cochon basin are heavily timbered. This "limit" was originally acquired by Price Brothers, Ltd., who took out large timber only between 1847 and 1922. In 1937 the limit was taken over by the Anglo Canadian Pulp and Paper Mills, Ltd., as a source of pulpwood for their large mill at Quebec City. A few of the buildings erected by Price Bros. are still standing and proved useful as initial accommodation when the Anglo Company started to study the development of the site.

The first reconnaissance was made in 1937 when a telegraph station was established; it has been in continuous operation ever since. Some timber was cut on the limit during the next few years, driven down the river, rafted at its mouth and loaded into steamers about one mile off shore by means of floating jackladders. A small control dam at the head of the falls and a flume were built to facilitate this loading operation, naturally only a temporary arrangement. Studies of permanent loading facilities were concurrently pursued. Detailed field surveys were started early in 1940, following the completion of a general topographical survey around the mouth of the river. On the basis of the results obtained in two summers' work, a final plan of development was adopted early in 1942. Construction work started later that year and the wharf was first used by a coastal steamer on September

30, 1942. Pulpwood was shipped from the wharf by schooners throughout 1943, steamer shipments of pulpwood started in 1944 and the harbour has been in steady use since that time throughout each operating season.

In 1948, the federal Department of Public Works took over the wharf and the surrounding 152 acres, not including the breakwater, after it had been proven that the harbour was providing a public service in addition to serving the company. The department is therefore now completely responsible for the wharf and the harbour and for their development.

Preliminary Planning

Fortunately, it was possible to plan the development of Forestville Harbour with ample time for the necessary preliminary studies, with the result that, at the end of each of the two seasons of field investigation, all the results could be summarized for circulation to those concerned with the completed harbour. Two-day meetings were held in Quebec City attended by all those interested. Full and frank discussion of the results took place and future work was correspondingly planned. The first meeting outlined necessary further field work and pointed the way to the solution of the problem of selecting the actual site for the harbour. This decision was only made at the second meeting, almost a year later, after all relevant data had been studied and all objections to the final location, especially from the operating standpoint, had been voiced.

The author has never seen a better example of the engineering method in action. It was a privilege to participate in these meetings and to hear the tentative results of purely engineering studies subjected to the informed criticism of experienced practical men—superintendents, loading foremen and even ships' captains. The successful performance of Forestville Harbour is testimony to their sound judgment. The account which follows summarizes not only the engineering studies, but also the advice which was obtained at the conferences and at other discussions with the men who were actually going to use the Harbour.

Basic Requirements

An essential preliminary to the field studies was a clear understanding of the basic requirements of the company. These were:

1. The harbour must provide for the loading of 150,000 cords of wood every shipping season, i.e. in conformity with operation of the limit on a perpetual yield basis.
2. The harbour must be available continuously throughout the open season of navigation, i.e. it must provide protection against the open sea and be so laid out that vessels could enter and leave it in heavy weather.
3. It must be laid out so that it could be used by the S.S. *Sable I* during her winter voyages.
4. The future use of the pulpwood loading structure as a public wharf had to be envisaged.
5. Since the coast on which the harbour is located offers no natural shelter from storms, the wharf and associated structures must be so designed as to provide in some degree a harbour of refuge.
6. The layout must provide some room and protection for booming pulpwood adjacent to the loading berth.
7. To save time, particularly in the turn-around of vessels, the wharf and loading layout must be as simple as possible, with a minimum of complications and of obstructions to navigation.
8. The entire project must present the maximum possible overall economy, consistent with the operating requirements listed above. While a low capital cost was desirable, fundamental economy was to be considered on the basis of the total annual charges.

Fig. 1. Tidal gauge and supporting crib at low tide.

Preliminary Field Studies

No detailed information of any sort regarding the natural features of

the Forestville area was available when the studies for the harbour were begun. The topographical surveys already referred to were started in 1939 by Henri Belanger, Q.L.S., and completed by company personnel. The survey involved no unusual features beyond the large area which it had to cover (about 20 square miles) which made a minor triangulation system necessary. The survey naturally extended appreciably beyond the area finally used for harbour development. Vertical aerial photographs were also obtained of the area immediately around the mouth of the Sault au Cochon River and proved very useful, even under merely visual observation.

(a) Tidal Observations

An early requirement was the establishment of a tidal datum and the determination of the local tidal characteristics. The nearest official tidal recorder is over 30 miles away at Father Point on the opposite shore of the Gulf, and there was no guarantee that Forestville records would be similar. A recording tide gauge was therefore installed off Rocky Point in June, 1941 (see Fig. 1). A round-timber rock-filled crib was sunk there, a substantial superstructure erected upon it and connected with the shore. A recording water level indicator was installed and its elevation was tied to the local benchmarks. Tidal records were taken for two years, charts being removed weekly; excellent correlation was obtained.

Mean tidal range was found to be 9.83 ft., the rise for spring tides varying from 15.0 to 17.2 ft., and that for neap tides varying from 9.5 to 11.6 ft. The ratio of the tidal range to that at Father Point was found to be 1.0864 so it was possible to determine mean sea level as 8.26 ft., and L.W.O.S.T. as 1.40 ft. above the datum adopted for the surveys.

(b) Wind Observations

The exposed location of the harbour area and the dependence of all navigation upon the wind made it necessary to obtain reliable data on wind conditions, more particularly during the navigation season. A site was therefore selected on the most exposed promontory in the vicinity and here an anemometer was installed. Since electrical power was not initially available, it was not practicable to install an elaborate instrument, but an ingenious mechanical counting device was developed by the observer such that, with the aid of dry batteries, an accurate wind-time record was obtained.

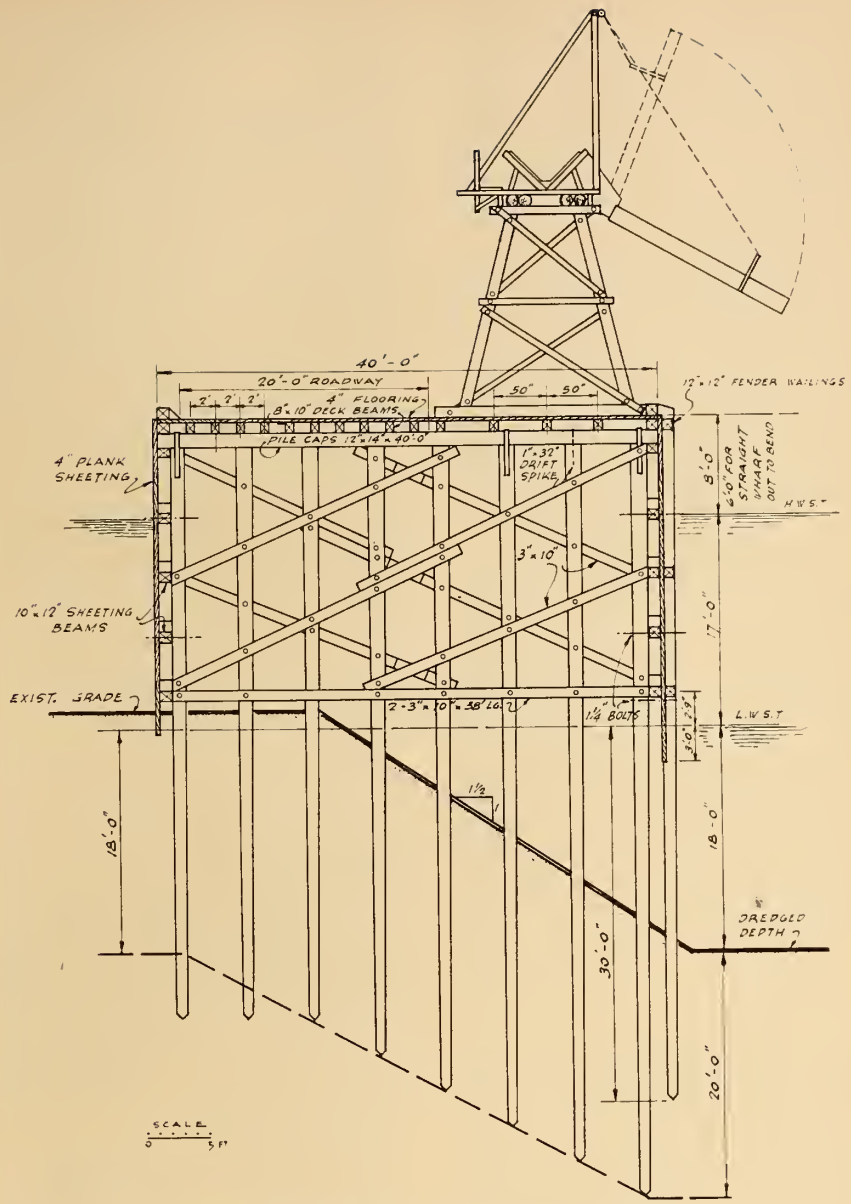


Fig. 2. Cross-section of Forestville wharf.

The station was operated for eight months in 1941 and similarly in 1942. Again it was possible to correlate the Forestville results with records taken at Father Point, where wind observations have been taken since 1922, so that by comparing the 1941 and 1942 figures with the long-term average, it was possible to assess the reliability of the short-term records. Two wind-rose charts were prepared to show wind intensities and wind frequencies. It appeared from a study of these diagrams that the Forestville records could be used with confidence in the planning of the harbour. They confirmed what had been suspected, that winds from the south-west would be most frequent, but winds from the north-east would be most severe.

(c) Current Observations

Immediately to the east of the bay into which the Sault au Cochon River discharges is a totally enclosed bay, the estuary of the Laval River. The ebb and flow of the tide into this large area, and the irregular configuration of the coast line, suggested that unusual tidal currents would probably be found particularly between the two bays, where the harbour would probably be located. Accordingly, a detailed study of currents was another

essential part of the preliminary field work.

Current observations in the open sea are never easy to make; those at Forestville were no exception. However, by sticking to the job night and day, the observers got the desired information, quickly and accurately.

Metal floats were used and check observations were made with current meters. Two separate sets of observations were made of surface currents and, by means of metal vanes connected by thin rod to a small surface float, of currents at a depth of five feet. It was suspected that due to the shallow depth of Laval Bay, surface currents would not always correspond with tidal flow beneath the surface; this suspicion was confirmed. A maximum velocity of about 1.2 m.p.h. was recorded.

The results were plotted on transparent maps of the area. By superposition of these charts, it was possible to follow the changing movements of the sea. Eventually composite diagrams were prepared, using different colours to indicate different times. Thus, those responsible for the work came to have a clear conception of the local currents, knowledge that proved to be of unusual value in later discussions.

(d) Wash Boring Operations

The most extensive part of the preliminary field work was the study made of the nature of the sea-bed by means of wash-borings. So essential was it to know that dredging could be carried out economically to provide access from the sea that some wash-boring was carried out in 1938. More extensive programs followed in 1941 and 1942 and work continued to a limited extent even past the start of construction. It will be appreciated that no detailed knowledge of the material in the sea bed was necessary, but it was essential to know that solid rock did not exist above channel bottom areas where dredging was a possibility, also the absence of rock had to be proved where the wharf might go, if piles were to be used, and some idea of the probable resistance to pile driving was desirable.

For these reasons, for economy, and by reason of the difficulty of doing work of this kind in tidal areas, sub-surface exploration was confined to probing with a high-pressure water jet and to an occasional wash-boring. This does not appear to be an ambitious program, but all who have had experience with this type of work will know well the difficulties involved.

The necessary pump and engine were mounted on two small scows lashed together. The lance was 1-in. pipe in convenient lengths and linen hose was used for lightness. Special sea anchors and the attending tug kept the rig in position. Borings were located by sextant, except near the shore, where marked ropes were used. The early morning hours, between dawn and about eight o'clock, were the calmest and so most of the work was carried out at this somewhat unusual time.

After a little experience, the operators were able to detect the several different types of soil constituting the local sea-bed. These included stiff blue-grey ("Leda") clay, sand and compacted sand and gravel. Fortunately, no solid rock was encountered in any of the locations which came under review during the harbour studies.

Construction operations confirmed the accuracy of the sub-surface investigations in all but one respect; that was an important one. Occasionally a boulder would be detected by the metallic ring of the lance contact. The dredging contractor was therefore advised that boulders would be encountered, but more boulders were encountered than had been anticipated, causing some delay in excavation. These ranged in size from one-man stones to large blocks, one of which had a volume of several cubic yards.

The failure of the probings to reveal the full extent of the boulders is easy to explain. A water pressure of about 100 lb. per sq. in. was required to carry out the probings at reasonable speed in the well consolidated materials encountered. If the jet did not land exactly on top of a boulder, it was natural that, with this water pressure, the jet pipe should be deflected down the side of the stone, the flexibility of the pipe being such that the deviation could not easily be detected. High-pressure water jet probings should therefore be used and interpreted with caution if the presence of boulders is even a remote possibility.

(e) Studies of Littoral Drift

The whole area of the bay into which the Sault au Cochon River discharges is dry at low tide. Preliminary observations showed that its bed consisted of hard Leda clay covered by clean uniform sand. It was soon noticed that this sand shifted with wind and tide. Since large sand cliffs stretch for several miles to the west of Forestville, littoral drift of the sand was suspected. Several attempts were made to determine the direction of the drift, if any, but all were unsuccessful. Experience subsequent to the construction of the harbour suggests that such sand as does drift moves to the east. There does not appear to be any pronounced littoral drift, most of the movement of the sand being due to local causes, such as wind, tidal currents and the discharge of the river itself.

(f) Navigational Studies

The vessels to be used for the transport of the pulpwood from Forestville to Quebec are lower lake freighters, some of which had already been used by the Company. The masters of these vessels were consulted on points of navigation, and the senior captain paid a visit to Forestville to examine the proposed wharf sites and the corresponding approach channels.

The critical and constructive comments thus elicited were helpful, especially in connection with the arrangement of the channel and the provision of the necessary aids to navigation. Other useful guidance was obtained from the study of navigation into and out of Rimouski harbour which had recently been considerably enlarged.

Selection of Site for Harbour

The preliminary studies have been described in some detail since they constitute one part of the Forestville Harbour work which can be adapted to comparable studies of any similar location. The application of the results of these studies in the planning of the harbour at Forestville was, of course, a local problem.

A number of sites for the harbour were considered, but they were soon reduced to four—at the mouth of the river, in Laval Bay, at Rocky Point, and in Baie Verte. Detailed analyses and sketch layouts were prepared for each and comparative estimates of cost made. The site in Baie Verte was the unanimous final choice.

Each location was considered with reference to the determining conditions previously listed and in the light of the results of the preliminary field work. The wharf and loading structures required were common to all. Variations were in the amount of dredging required, the work necessary for providing adequate protection against storms, and in the length of flume and serv-

ice road from the holding boom on the river to the wharf.

The river mouth site would have given the shortest flume, almost too short in view of the location of the holding boom above the falls and its consequent elevation. Because of the flats, opposite the river mouth, the cost of dredging would have been high and the provision of protection from the northeast difficult. The Laval Bay site involved a long flume, even if it were taken under Rocky Point in a tunnel. Protection would have been ideal, but since the Bay is dry at low tide dredging costs would have been prohibitive.

The other two sites were similar in many respects, but the Rocky Point site required practically no dredging, while that at Baie Verte involved the initial dredging of the harbour area and of the approach channel, with possible maintenance dredging of the latter. On the other hand, the use of the "Kyes" as a natural basis for an artificial breakwater, while convenient, would still have involved heavy expenditure.

The decision was one of real complexity, since there was no one location which was obviously the most desirable. Even with comparative estimates of cost available, a good deal of sound judgment was essential in their use. It was here that the conferences to which reference has already been made proved valuable. Experience has shown that the choice of the Baie Verte site was sound; economically, it proved to be more than justified since no maintenance of the dredged entrance channel has yet been necessary.

Wharf and Loading Facilities

The arrangement adopted for the harbour at Baie Verte is simple. A wharf forms one side of the enclosed area, which was dredged sufficiently to provide a turning basin and also an inner area in which wood could be boomed even at low water. The harbour entrance proper is a wide dredged channel, located so that it is in line with the direction of the strongest prevailing winds. A rock-mound breakwater affords protection from these northeast winds, and a low sheeted timber crib was built to guard against sand's drifting into the channel.

The layout of the wharf was determined by the necessity for berthing and loading two steamers at once. A break in the line of the wharf face achieves convenience in layout and aligns the outer part of the wharf with the channel.

A steel sheet pile structure was contemplated as the final type of wharf, for convenience, relative permanence and economy. To build such a wharf in open water, some type of temporary timber structure would be necessary. At Forestville this would have meant driving temporary wood piles into the stiff Leda clay of the sea bed. This requirement led to study of the economics of constructing a timber pile wharf in the first instance. This would be suitable for immediate use, its performance could be observed and arrangements could be made for its enclosure with steel sheet piling when its condition warranted. Economic studies showed the advantages of this proposal apart from the questionable availability of steel piling.

The wharf design is shown in Fig. 2. Controlling vertical dimensions were fixed by the tidal datum and range and by the necessary clearance between H.W.O.S.T. and the bottom of the discharge chute from the flume. This last figure was also related to the entire design of the flume. The width of the wharf was fixed at the minimum convenient figure for traffic between the flume bents and the western edge of the deck. Bollards, access ladders, fire walls, fenders and fender pile clusters at the outer end of the wharf were included in the design. A rock-filled timber crib connects the end of the pile structure with the approach road from the townsite.

Construction of the wharf started early in 1942. Creosoted piles and timber were delivered by schooner from Rimouski. Pile driving was carried out with a travelling pile driver, riding on top of piles already driven, the first few bents being driven from a scow resting on the bottom at low tide. A double-acting steam hammer was used.

Since wharf construction and dredging proceeded simultaneously, many of the piles were driven from original ground level. Although this caused a little extra work, the slight extra expense was more than justified by the time saved. Piles were driven mainly in stiff blue marine clay, so driving was not easy and required careful supervision. Detailed records of driving were kept; it is hoped that these data may sometime be analyzed so that they may be generally useful. Some unusual features were observed, most interesting being the formation

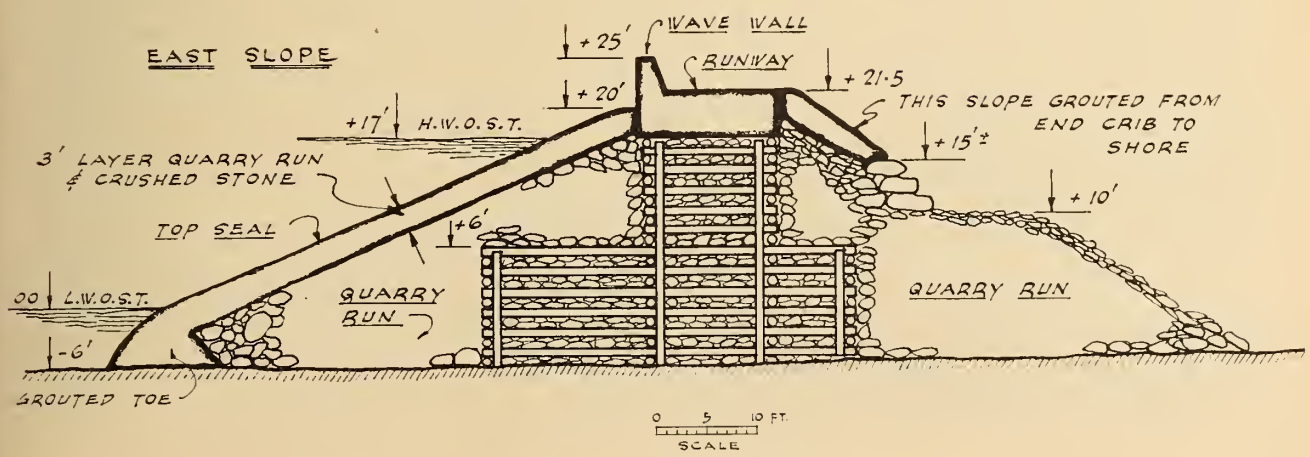


Fig. 3. Typical cross-section of Forestville breakwater.

Fig. 4. Suction dredge at work in turning basin, with wharf partially complete; looking west from Rocky Point at high tide.

around each pile, as it was driven, of an annular ring of clay slurry, due to the sudden change in soil moisture content, and the corresponding formation of a concentric mound of disturbed clay (2).

By floating the dredge into the inner harbour at high tide, the sloping face beneath the eastern part of the wharf was dredged before piles were driven there. Difficulty was encountered as various expedients were tried in attempting to hold the piles in correct position on this slope. Eventually a simple solution was found. To the point of each pile, a piece of 4-in. pipe was spiked, after having its top split into four leaves. As the pile was lowered into place, the pipe penetrated the stiff clay first and gave enough lateral support to prevent sideways movement of the pile until it had itself obtained a toe-hold (3).

Minor maintenance work only has been done on the wharf since it was completed. Now that it belongs to the Department of Public Works, the prospect of its completion with steel sheet piling is uncertain. The idea of building a timber pile structure as the first stage in developing a permanent wharf is commended as one of wide application.

Dredging

The estimated quantity of material to be removed by dredging was 170,000 cu. yd. in the turning basin and 260,000 cu. yd. in the approach channel, a total of 430,000 cu. yd. With a tidal range of 17 feet and a channel depth of 18 feet at L.W.O.S.T., the removal of this material called for the use of large floating equipment.

A diesel-operated suction dredge discharging into a 20-in. pipe line was therefore towed to Forestville from Montreal. The dredged material was deposited on shore, using the valley of the small creek discharging into Baie Verte as a spoil area. A timber crib dam with discharge flume was built at a location conveniently close to the harbour area; this was later replaced by a concrete structure. The valley immediately upstream was in due course filled to the crest level of the dam, and is now the site of an oil tank-farm.

The suction dredge performed satisfactorily, considering the character of the clay, apart only from the difficulties with boulders which have already been mentioned. It was not equipped with a rock trap, so small boulders caused some interruptions and eventually damaged the pump impeller. About 40 per cent of the dredging was completed by the end of the 1942 season. It was then decided to complete the work with a dipper dredge, since most of the material still to be excavated was at the lower levels. Thus a dipper dredge was towed to Forestville in the spring of 1944 and it completed the contract work without difficulty. All the material excavated during this season was disposed of by dumping at sea.

Protective Breakwater

The wharf and turning basin are only partly protected by Rocky Point, but it was clear that full protection from the northeast was imperative if the safety of the works were to be assured. The only practicable means of providing this protection was by a breakwater built out from Rocky Point. Estimates and sketch designs for this structure were therefore prepared. The estimated cost of even a short breakwater was substantial, and did not appear to be a direct contribution to the harbour development. Despite this, the necessity for the breakwater was recognized by the company after a good deal of discussion, and it was constructed as planned. Subsequent experience has completely justified this decision. The damage done to the breakwater itself in the famous storm of November, 1944, showed vividly what might have happened to the wharf if it had not been protected.

The coast around Rocky Point is of rugged character. Bare rock rises precipitously out of the water to a height of almost fifty feet above H.W.O.S.T. Access to the Point, except on foot and by boat, is impossible. At first it was thought that any sort of access road would have been prohibitive in cost; subsequent experience has shown that it should have been built. Accordingly, the design and construction of the breakwater were severely restricted. Rock was available, if it could be quarried. All equipment would have to be transported by water. Some spruce logs could be obtained on the Point, other timber could be floated in.

These factors led to the decision to design the breakwater with a rock-filled timber crib core, flanked

by rock slopes. The cribs could be built of local timber, the rock could be obtained by opening a quarry at the end of the breakwater. Calculations based on the fetch to the northeast showed that the face of the seaward rock slope would have to be formed of rocks weighing not less than ten tons each, if stability in the worst storms were to be assured. The maximum weight which could be handled with available equipment was only six tons. It was therefore decided to build the breakwater generally as shown in Fig. 3, using the largest rocks obtainable for the facing of the seaward slope.

The first section of the breakwater was built in the 1942 working season, using a standard-gauge track with hand-operated dump cars for transporting rock. No bad storms occurred during the two succeeding winters so it was possible to proceed with the second part of the structure during the summer of 1944. Unfortunately, some delays developed with the result that on November 30, 1944, there still remained one small section of cribwork and rock fill to be completed. On that day there occurred one of the worst storms in the recent history of the North Shore. This permitted the operation of the breakwater to be observed under storm conditions; the shielding which it provided to the wharf and turning basin was found to be quite satisfactory. At the height of the storm, cap rocks were tossed into the air by wave action and large blocks, known to weigh about six tons, were moved. Some damage was done to the breakwater, practically all because of its incomplete state. Although this was not extensive, it did show that further attention to the design of the structure was necessary, since even greater storms might occur.

It occurred to the writer that since no blocks larger than six tons could be moved to the breakwater, larger blocks might perhaps be made in place by cementing smaller blocks together. Clearly ordinary grouting would be ineffective for this purpose, so intrustion grouting was considered, adopted, and put into effect in the summer of 1945 along the lines indicated in Fig. 4.

A number of problems were encountered in this application of the Intrusion-Prepakt method but these were gradually overcome. This work has been described elsewhere (4). By carefully co-ordinating operations with tidal movements, the work was successfully completed, and the seaward face of the breakwater was converted into a practically monolithic slab three feet thick. Recent examinations show that the breakwater is performing well. There are some imperfections in the face, but these can be explained by known imperfections in construction. Even if major cracks do develop, the resulting cemented blocks will still be so large as not to be affected by any likely storm.

The construction of rock-mound breakwaters has so often been associated with difficulty and failure, that any improvement in the art should be welcome. The application of the Intrusion-Prepakt process at Forestville represents a step forward in the technique of breakwater design and construction. Its future performance will therefore be of special interest: it is hoped its condition may be reported upon after some years' exposure to the storms of the Gulf of St. Lawrence.

Some Additional Features

It was noted earlier that although the most severe winds were to be expected from the northeast, the most frequent would be from the southwest. Accordingly, in the original plan a breakwater designed to protect the entrance channel in particular from southwest winds was included as a future possibility. Experience to date has not indicated any real need for this protection so it is unlikely it will be built.

The wharf interferes to some degree with the normal flow of the Sault au Cochon River as it discharges over the flat bank exposed at low tide. It was suspected that this might cause erosion along the west side of the wharf and perhaps lead to the deposition of sand in the entrance channel. The west side of the wharf was consequently sheeted along its whole length and waste rock, etc., was dumped against this. No erosion has yet taken place. A timber pile-and-tie sand diversion wall was also built. It was soon damaged by storms, but performed long enough to show that the danger of sand drift into the channel was negligible. It was replaced by a timber crib wall; even this was damaged in the storm of November, 1944.

The flume leading from the holding boom on the River above the

Fig. 5. Rocky Point breakwater under construction, showing timber crib head work in place and car used for transporting rock from quarry.

Fig. 6. Completed wharf as seen from the bridge of an approaching steamer, fender pile clusters in place at end of wharf and schooners loading pulpwood at loading berths.

falls to the wharf is 6,000 ft. long. It is laid on a gradient of 0.45 per cent, to handle 150 cords of wood per hour. Its design follows the lines developed by the company, and is distinguished mainly because for almost half of its length it is built directly on mud-sills and on simple trestle bents less than ten feet high, the result of a combination of favourable topography and careful design and location. Its construction involved some interesting problems in ground water control.

Operation of Harbour and Loading Facilities

The preparation of this paper has been delayed in order that it might be presented only after a sufficient period had elapsed to demonstrate the way in which the works described performed. The development of even such a small harbour as that at Forestville involves such drastic changes to natural conditions that unexpected results may develop with disastrous consequences.

Forestville Harbour has now been in use for almost ten years, during which time it has been subjected to a number of serious, and to one or two violent, storms. Its performance has been satisfactory. The structures have fulfilled their designed functions, and, with the exceptions already noted, have safely withstood all storms. No unexpected developments have taken place as a result of the disturbance of natural conditions.

Since 1942 the harbour has been regularly used by the M.V. *Rimouski* and similar vessels, as well as by large numbers of schooners. It has been used during each navigation season for the shipping of pulpwood to the company's mill at Quebec City. The speed at which it has proved possible to load pulpwood regularly has surprised all concerned. Although the flume was designed to carry only 150 cords per hour, it has regularly delivered 200 cords per hour to the wharf. Loading arrangements have proved adequate and satisfactory.

Acknowledgments

The isolated location of Forestville made transportation arrangements complex, the harbour works were carried out concurrently with general development of the adjacent townsite, and local construction materials were used whenever possible. For these and other reasons practically all the work described was carried out on force account by the company. William Harney of Quebec City acted as superintendent of wharf construction for most of the work.

Dredging was done by J. P. Porter & Sons, Ltd.; W. Carniel of Montreal supervised the quarry work in 1942. Intrusion-Prepakt, Ltd., of Toronto, supplied a foreman, equipment and special materials for the grouting of the breakwater in 1945.

Since the works described are located at so isolated a site on the Gulf of St. Lawrence, detailed cost figures would be of little use elsewhere. However, an unusually economical job was obtained, despite all difficulties.

The owner is the Anglo Canadian Pulp and Paper Mills, Ltd., of Quebec City, of which E. M. Little, M.E.I.C., is president and general manager. J. O. Wilson, when woods manager, personally directed all the early field studies, being assisted by A. G. Butler as resident superintendent. J. O'Halloran, M.E.I.C., is chief engineer, but was absent on special war duty throughout the period involved; R. H. Farnsworth, M.E.I.C., his assistant, was therefore directly responsible for all the engineering work involved. He was assisted at Forestville by P. A. Harakas, M.E.I.C., and by members of the forestry engineering staff, especially by J. Henderson.

The writer of this paper was privileged to act as a special consultant to the company for the Forestville harbour development from the first reconnaissance in 1937 until his appointment to the staff of the National Research Council in 1947, since when he has kept only in general touch with the project, although following its performance with interest. Throughout his active service to the company, he reported to Walter G. Clarke, vice-president in charge of engineering, who made the development of Forestville Harbour his special concern. To Mr. Clarke the writer is indebted for what proved to be a stimulating and challenging experience; to all those mentioned and to many others for the pleasure and privilege of working with them; and to the company and to Mr. Little for permission to present this paper and thus to make public the experience which it records.

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THE ASME BOILER CODE

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication, in serial form, of a history of events leading up to the development of the ASME Boiler Code, back to the first development of boilers in the 18th Century. This history, continued through some eight issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in future issues of the *Engineering Journal* of Boiler Code Regulations, this history is here presented in condensed form, which will appear in four issues, of which this is the first.

I. Its History, Formulation, and Early Administration

The ASME Boiler Code was primarily developed as a safety measure and to furnish standards by which any state could be assured of the suitability of boilers for installation within its borders. It arose from rules, regulations and laws, set up over fifty years before its first publication in 1914, particularly from Boiler Rules of the Commonwealth of Massachusetts of 1909.

Prior to this time, rules for construction of boilers had been issued by underwriters or governments. Boiler insurance companies had issued tables showing proper proportions of boiler elements for stationary boilers; while some states and cities had passed laws relating to inspection of equipment and licensing of engineers, firemen and inspectors.

Steam was used for pumping as early as 1663. The Newcomen steam engine, invented in 1705, used steam at atmospheric pressure beneath a piston, as the piston was retracted in the cylinder by counterweights, in the form of a pump plunger. Condensation below the piston caused by admission of water to the cylinder allowed atmospheric pressure above the piston to force it down, thus raising the plunger at the other end of the beam. James Watt invented his engine with a separate condenser.

One of the first water tube boilers was invented by Barlow in 1793, and used by Robert Fulton on steamboats, at low pressures. Not until the early nineteenth century were patents issued for the use of high pressure steam, up to 1,400 lb. per sq. in. As pressures were increased, many boiler explosions were reported in America and Europe. This brought about recommendations for tests, safety valves, and monthly inspections.

Early Legislation on Inspection of Boilers

Following discussions and investigations by a committee appointed by the Franklin Institute in Pennsylvania during the 1830's, results of experiments and tests on boilers, and reports on boiler failures, were published in tabular form, and a U.S. Act was passed in 1833, calling for local inspection of hulls and boilers. Under the "Steamboat Act" of 1852, an inspection service under the U.S. Treasury was set-up to establish rules for, and administration of, Steamboat Inspection Laws. Concurrently, many associations for the prevention of explosions were established in Britain and Europe.

Organized inspection and insurance, instituted in Britain around 1855, was first established in America by Connecticut in 1867, and was followed by similar service by several insurance companies in other states. One of these, the Hartford Steam Boiler Inspection and Insurance Co., has assessed the number of boiler explosions occurring in the U.S.A. alone between 1868 and 1930, at over 11,000, in one case resulting in a loss of as many as 200 lives. This was over a period during which the number of boilers in use varied between 70,000 and 100,000.

The American Boiler Manufacturers Association met at Pittsburg in 1889, not for price fixing but for the purpose of raising the standards of boiler manufacturing, and for the prevention of sale of boilers unfit for safe operation. Meeting at Buffalo in 1892, this Association appointed a committee on uniform specification laws. The committee's report, as presented at the convention of the Association in 1898, made recommendations on specifications for boiler manufacture and testing.

In spite of the tremendous loss of life and property in the U.S.A. from explosions prior to the Twentieth Century, there was up to 1900 no legal code for safe stationary boilers in any of the states. Several serious explosions in 1905 and 1906 in Massachusetts however, brought about the passage of the first state law in the U.S.A., for the regulation of construction and installation of boilers. This law limited pressures on C.I. boilers to 25 lb. per sq. in. and on boilers with cast iron headers to 160 lb. per sq. in.

In 1911, Ohio approved rules formulated by the Ohio Board of

Boiler Rules, which adopted with few changes the Rules of the Massachusetts Board. Thus in the 80 intervening years since the Franklin Institute began its pioneering and attempts to reduce explosions, the groundwork was laid from which between 1911 and 1915 the ASME was to develop its ASME Boiler Code.

ASME Sets up Boiler Code Committee

Col. E. D. Meier, then president of the American Society of Mechanical Engineers, asked the ASME Council in 1911 to appoint a committee to formulate standard specifications for the construction of steam boilers and other pressure vessels. A committee of seven was set up, which met in 1912 at New York and Ithaca. A preliminary report was issued in 1913 and widely distributed. This report closely followed the wording of the Massachusetts Law, and also included rules for operation and care of steam boilers, recommendations, and an appendix for the design of boilers, furnaces and tubes.

It reduced Massachusetts allowable pressures from 25 and 160 lb. per sq. in. to 15 and 125 lb. per sq. in. for cast iron boilers and boilers with C.I. headers respectively, and included tables of efficiency for different types of joints, plate thicknesses and rivet diameters. A second and final report was issued in February 1914, 2,000 registered copies of which were sent to engineers, engineering and industrial organizations, and editors, with a covering letter asking their co-operation.

This letter brought a storm of protest, and stirred up dissatisfaction among members of the Society, and at a June 1914 meeting the ASME Council voted that final publication would not be made until a topical discussion was held. Public hearings followed in September, at which general agreement was reached on grades of material to be used on specifications for boiler tubes, and on uniform specifications for safety valves.

A third printing was sent out in November. Changes therein included restoration of allowable pressures to 160 lb. per sq. in. on boilers with cast or malleable headers, and 30 lb. per sq. in. on hot water heating boilers, when temperatures were less than 212°F.; new specifications following ASTM specifications; while the paragraph on factor of safety was rewritten.

After being approved by the Council of the Society, a fourth printing was prepared and presented at the ASME annual meeting in December. This fourth printing or "Progress Report" underwent a full week of discussion in December and on final adoption an advisory committee of 18 men representing different interests set to work on drafting a final Code.

The Final Code of 1914

Provisions contained in this Final Code of December 1914 included Part I of 87 pages and new installations, Part II of 5 pages for existing installations, and a 20-page appendix containing methods of computing the efficiency of riveted joints, formulae for surfaces, safety valve capacities, dimensions of standard fittings, and fusible plug requirements.

This code set the maximum allowable pressure on new installations at 15 lb. per sq. in. for low-pressure steam heating, and permitted cast iron to be used, while for steel plate in hot water or steam heating the factor of not less than 5 was required. On existing installations it prescribed maximum allowable pressures, with least factor of safety to be used in different years after the approval of the Code.

Age limits for continued use of boilers, safety factors on second-hand boilers, and discontinuance of boilers with cracks in a longitudinal riveted joint were specified. The unknown strength of steel was to be taken at 55,000 lb. per sq. in. and the strength of riveted material was given. Needed gauges, pipes and fronts, capacities of safety valves, and hydrostatic pressure tests were also specified.

At its Council meeting of March 12, 1915, the ASME approved the copyright, and also the title, "Rules for the Construction of Stationary Boilers and for Allowable Working Pressures". The ASME Boiler Code then became the official Society document with the approval of its governing body, the Council. All actions taken by the Council had been those of the American Society of Mechanical Engineers, with all the prestige which comes from its history, membership and reputation. From the very inception of the plan for a Boiler Code, the committee has always been answerable to the Council.

Thus, five years after Col. E. D. Meier had asked the Council of the ASME to approve appointment of a committee to formulate standard specifications for steam boilers and other pressure vessels, the first ASME Boiler Code had come into existence and the ASME Boiler Code Committee had only just begun. Almost immediately the Committee was launched into a situation demanding the administration of the Code, the establishment of methods of procedure, and the interpretations of its provisions.

Interpretations—1914-1918

At the first meeting of the Boiler Code Committee after the adoption of the Code by the Society, held in Buffalo on June 23-24, 1915, subjects omitted from the Code were discussed. Council approval was given that the code symbol applied to a boiler would indicate the boiler had been built according to the Code; that rulings respecting constructions not covered by the Code, and interpretations of any part of the Code could be given. The Committee was authorized to consider subjects of economizers, pressure vessels, rules for care of steam boilers and the section on recommended practice, all for future editions.

Council also asked that consideration of model laws be omitted from the Committee's activities, and that the Committee report its actions to Council. The Committee would formulate the procedure for making interpretations of the Code. Any opinion or reply was to be given a code number, as this would establish a precedent or guide. Case matters, together with the final decision, were to be sent to each committee member for approval before the ruling was sent to the enquirer.

The first ten cases considered at this first meeting indicate their nature, and the Committee procedure in carrying out the objects of the Code. Some of the replies were as follows:

1. Where strength of a boiler structure or part thereof cannot be calculated with reasonable accuracy, a full size sample shall be tested to destruction before one or more Code Committee members.
2. Where additional loads are placed on a boiler, additional strength must be provided, using a factor of safety not less than that given in the Code.
3. In accordance with paragraphs 2 and 3, flange steel may be used in shells of boilers under ASME Code.
4. Though the Code did not provide for the return products of combustion passing over the tops of horizontal return tube boilers, when such is the case, firebox steel must be used as required in the Code.

5. There was nothing in the Code to prohibit the use of a quadruple riveted butt and double strap joint under Code rules.
6. Though the Code referred to portable, semi-portable, and traction boilers, the title of the Code rightly referred to "Construction of Stationary Boilers", since the word had been used to distinguish between land boilers and marine boilers, and it also referred to boilers not used for propulsion.
7. It was not allowable to publish extracts from the Code in a textbook.
8. Stamps as specified in paragraph 332 of the Code were obtainable through ASME at $3.00 each.

Between June 23 and December 9, 1915, cases considered totalled 45. The first 10 rulings were reported to Council, which voted to rescind its action granting authority to the Code Committee to make final decisions as to interpretations. Council also voted to empower the Committee to rule on questions of construction not covered by the Code, and to interpret any part of the Code, but to report actions on all rulings to Council for approval before they were issued. Council also authorized its Executive Committee to exercise the authority of Council in interim between Council meetings.

Thus began the practice of issuing interpretations after approval of Council, its Executive Committee, or as the bylaws of the Society have been changed, by some agency of the ASME established for such purposes. Through its life of almost 40 years, decisions of the Boiler Code Committee have been, in fact, actions of the ASME. Minutes of Council contain the record of approvals by case numbers, coupled with authorization of publication.

In November 1915, interpretations 1 to 35 inclusive were approved for publication in the *Journal* and release of the interpretations was ordered. In October of the same year the practice of inviting certain non-members to give detailed information was established, a practice which is still continued. It was also decided to re-open certain cases on which adverse replies had been received from members, another practice which developed during the first year of administration. At the same meeting, it was ruled that "Communications" did not warrant a case number, because a reply by letter would give the necessary information.

The introduction of the Code stated that public hearings on the Code for interested parties should be held every two years. It was later announced in the *Journal* that monthly meetings would be held by the Committee for the purpose of considering communications relative to the Code.

Welding Considered

Case 80, from Union Iron Works of California, asked if the Committee had investigated recent methods of welding, as much time and effort had been spent by manufacturers of autogenous welding apparatus. The Committee replied that since its inception it had constantly observed all sorts of welding of pressure vessels, and had invited welding experts to write papers for the Society on the subject. Suggestions for change would be considered at the public hearing, where all interested parties might be heard.

At a meeting in July 1916, certain questions on welding were presented. During the revision of the 1918 edition, autogenous welding was permitted in paragraph 186, when stresses were carried by other construction, and when safety did not depend upon the strength of the weld. Case 93 from the Lackawanna Boiler and Grate Co., asked exemption from paragraphs 186-187, which applied to the welding of boiler joints where electrical metal electrode or "pencil type" of autogenous welding was used, as the process was claimed superior to any form of gas welding.

The reply quoted the reply to Case 80 above. In objection, a member introduced an expert, to explain the advantages and the performance of the Seimund-Wenzel process. No boilers, he said, had yet been constructed by its use, but he would like Committee approval to build boilers with such welds. This the Committee would not do, with the information then available.

An advisory committee of the Boiler Code Committee, solely of representatives elected or appointed by states and municipalities adopting the Code, was appointed by Council on October 13, 1916, to be called the Conference Committee. It has proved its worth over the years by its suggestions and aid in the formulation of replies, and in bringing uniformity in the application of the Code among all states and municipalities adopting it.

American Uniform Boiler Code Congress

At one of the later sessions of the public hearing on the Code of 1914, the question of forming an organization to bring the Code before State Legislatures, and to the attention of municipalities, was discussed. In the interests of uniformity, the American Uniform Boiler Law Society was formed in 1916, for the purpose of presenting the ASME Code to governing bodies of all states, provinces and cities so as to secure, where possible, its legal adoption and to promote uniformity in boiler and pressure vessel inspection regulations.

To bring uniform laws before the United States as a whole, a Congress for representatives of government and industry was planned in Washington, D.C., in December, 1916, under auspices of the Industrial Commission of the State of Ohio. Twenty-two states, one Canadian province, the District of Columbia, and four cities, each appointed from one to five official delegates.

The two maxims of the Congress were: (1) Civilization and government are based on human life. Its protection is the government's first duty, and (2) standardization is the foreword of business efficiency. These maxims were the controlling thoughts of the Congress and the rallying cry of the American Uniform Boiler Law Society.

The Congress adopted the report of the Committee on the interchangeability of inspectors' certificates, and then that of the Legislative Committee which required that inspection bills contain the following points: (1) Pressure vessels to be included or exempted; (2) Frequency and character of inspection; (3) Acceptability of inspection other than that by government; (4) Appointment and authority of inspectors; (5) Code of rules to govern inspection; and (6) Fees, if any.

Resolutions were adopted as follows:

1. That it is the sense of this Congress that all states should exercise supervision over the manufacture and use of steam boilers.
2. That it is the sense of this Congress that the Congress recommend that all states adopt as their standard the ASME Boiler Code.
3. That this Congress recommends to the various states where boiler inspection may in the future be provided for, that these states give full consideration to the system adopted by the Federal Government which required training and experience, tending to qualify the inspectors for their exacting duties, to the end that they may devise an efficient system, that the most efficient service may be rendered to the various states where a uniform code is adopted.

Revisions of the 1914 Code

Revision meetings of the Boiler Code Committee were held during January 1917, with 17 members present. Appointment of a subcommittee was approved to secure evidence on the dependability of malleable iron, in view of developments in its production since earlier action on the subject. Expert consultants gave evidence at a meeting the following September that the quality, uniformity, strength, elastic limit and dependability of malleable iron castings had greatly improved. Possible care in production was a drawback.

In November the Committee took no further action on the revision, but increased the allowable working pressure with malleable iron boxes from 160 to 200 lb. per sq. in. At the last session of the 6-day meeting the Committee decided no actions would be disclosed until all revisions had been finally acted upon by the Committee. Work on revision was continued at meetings until December 3, 1918, at which time Council authorized printing of the so-called 1918 edition of the Code.

The Committee had refused in March 1917 to grant permission for electric welding on superheated tubes. A special committee was appointed to deal with this matter, and in April of that year Frank Speller reported to this Committee that he had found Bessemer steel tubes brittle on beading ends, and hence his Company had used open hearth steel tubes. When boilers were not code boilers, customers were to be asked if boiler tubes could be accepted.

Autogenous welding was referred to a subcommittee on welding. Many requests for welding had been made, but the answer given was always that autogenous welding was only allowed where no strains were placed on the weld. At a meeting of the Boiler Code Committee in September, autogenous welders were heard, but no agreement was reached. The Committee then asked that when agreement should be reached among all welding interests, they should present their recommendations. A subcommittee of the Boiler Code Committee was set up with representatives of the National Welding Council, for investigation and standardization of welding procedure.

The 1918 Edition

Numerous further committee and subcommittee meetings were held during the last four months of 1918 respecting revisions and improvement of the Code. Matters discussed included revision of the heating boiler section; tables of tube sizes; miniature boilers; appointment of a subcommittee to prepare rules for inspection of boilers; and safety valves. On completion of the revisions and with their publication in the *Journal*, Council authorized the Boiler Code Committee to publish the 1918 Edition of the Code.

Thus, in the four-year interval between 1914 and 1918, the Boiler Code Committee succeeded in developing procedures whereby "interpretations" and "revisions" of the Code were formulated, approved and published. It also set up conference committees and instituted the practice of appointing subcommittees of experts to deal with special phases of the committee's work. In spite of pressures brought to bear by several groups and interests, the Committee held steadfastly to a high and unbiased concept of its function as trustee of the public welfare, and established confidence in its integrity and achievements.

The 1918 edition of the Code had the same arrangement and paragraph numbering as for the 1914 edition: Part I, sect. I, New Installations of Power Boilers, sect. II, Low Pressure Heating Boilers; and Part II, Existing Installations. The wording was changed, however, to meet the interpretations, suggestions, reports, etc., by members of the Committee or by subcommittees.

New tables for the gauges of water tubes of paragraph 21, with formulae, replaced the empirical tables developed from experience up to 1914 with steam pressures of that day. The method of finding allowable pressures on fire tubes when the gauge was increased beyond that for 175 lb. per sq. in., was added.

Many material specifications of the 1914 Code were brought into agreement with those of the ASTM. Changes were made respecting boiler joints. Paragraph 186 was changed to allow autogenous welding. Paragraph 193 on efficiencies of ligaments of shells and drums was entirely new, and required the use of a chart. Changes were made respecting domes, heads, braced and stayed surfaces and connections therefor. Allowable pressures with malleable iron headers were increased from 160 to 200 lb. per sq. in. Test pressures at destruction were raised from 1,200 to 1,500 lb. per sq. in. Requirements for stamping and data reports were changed.

Section II of Part I on low pressure steam was changed to cover only interpretations. Part II, Existing Installations, was left practically unchanged, with a new paragraph added requiring consultation with a state, municipal, or insurance inspector when repairs affecting working pressure or boiler safety were needed. Recommendations for repairs by welding, prescribed by the U.S. Steamboat Inspection Service, were given in the Appendix. Certain changes and additions were made to the Appendix.

In January 1919 there were six subcommittees, two conferring committees, while an executive committee acted on special matters referred to it, and on emergency questions that arose between committee meetings. During the period 1919-1924 the Committee met nine times a year. The number of new cases considered during this six-year period averaged 44 per year.

Locomotive Boilers

In March 1921, the ASME Council accepted the Rules for the Construction of Boilers for locomotives not subject to Federal inspection, Part I, section III of the ASTM Boiler Code, as presented by James Partington, a member of the subcommittee which prepared these rules. The original subcommittee had been formed in 1915, for considering Case 20 relating to rules for locomotive boilers.

Work was interrupted during the War, and by disagreements over material specifications and factors of safety. In April 1919 a preliminary report was submitted and printed for public hearing at the ASME Spring meeting. After the report was approved, it was sent to all locomotive boiler builders, and was checked with the Interstate Commerce Commission. Public hearings were held in 1920.

The principal subjects of dispute by the Committee and those attending the hearings were the minimum gauges of fire tubes, differing material specifications used by builders, and the factor of safety. The latter was set at 4.5 for design and construction of new boilers, and at not less than 4 for conditions in actual service. On account of the limited use of this section III of the Code, it was published as a separate document. At many of the meetings of the Committee, objections were frequently made against the allowance of 95,000 lb. per sq. in. for the crushing strength of rivets, the contention being that higher values should be used. After years of consideration the Committee refused to change the original value.

Miniature Boiler Code

A separate organization, similar to the Conference Committee of the ASTM Boiler Code Committee, had been suggested by C. O. Myers in April 1919, to pass upon and approve particular boilers. The need of such a body to formulate a Code for Miniature Boilers was evident to the Boiler Code Committee, and at the May 1919 meeting, the Executive Committee and F. C. Fairbanks were named as the Subcommittee on Miniature Boilers.

The chairman of this subcommittee reported the draft of a proposed Miniature Boiler Code to the Boiler Code Committee, and copies were sent to members for study and report. This draft was partially approved in September 1921, and in October it was ordered printed for the public hearing at the December annual meeting of the ASTM. Final draft of the Code was considered by the Committee in January 1922, and was approved by the ASTM Council in March 1922. It included an Appendix covering the gas burner specifications of the American Gas Association.

Autogenous Welding

The Subcommittee on Welding had originally been appointed by Council in March 1918, in response to a request for co-operation from the Electric Welding Society. In June, the National Welding Council asked the Society's co-operation at á conference to be held in January 1919. This conference concluded by accomplishing a tentative organization to be known as the American Welding Association. It was suggested that the Welding Committee of the Emergency Fleet Corporation solicit funds from shipbuilding contractors to keep research work active.

It seemed the concensus of opinion at the conference that all prominent engineering societies should be represented in the new Association, and that it should be merged with the Bureau of Standards, Bureau of Mines, War and Navy Departments, and thus eliminate duplication of effort. If aid were given by the ASTM, no action should be taken which would compromise the judicial standing of the Boiler Code Committee respecting welding problems. Council approved the recommendation that the ASTM be represented in the new Association, provided there was no financial obligation without further authorization by Council.

In January 1920, due to complaints of Committee inactivity on welding, it was suggested that arrangements should be made to legalize welding in the Boiler Code. The American Welding Society was to be formed, affiliated with the American Bureau of Welding, to represent the entire industry, undertake research and act as a judicial body. Council was requested to invite the American Welding Society to appoint a committee to confer with the Boiler Code Committee on welding the joints of pressure vessels.

In June, the International Acetylene Association was informed by the Boiler Code Committee that it could not rule on the safe ending of tubes by the oxy-acetylene method until rules and restrictions could be prepared. The Association was invited to submit rules. The enquiry was submitted to the Subcommittee on Welding, which reported at the next meeting and the same reply was given as had been given to former Case 80.

In June 1923, a conference of the Subcommittee on Welding, the American Welding Society and the American Society of Refrigerating Engineers was held, at which it was agreed the Welding Society and the ASRE would obtain data on autogenous welding, while the subcommittee would obtain data on forge welding. In October 1920 the Boiler Code Committee requested that the Subcommittee on Welding should prepare a Code on welding.

At a conference in April 1922 between the Boiler Code Committee and manufacturers using forge welding, a preliminary draft for the Rules for the Production of Forge Welded Pressure Vessels was discussed. Necessary changes in many of the paragraphs that had been discussed at the December 1921 public hearing, were introduced with the proposed Code for Unfired Pressure Vessels.

At a public hearing on the Code at the ASME Annual Meeting in December 1922, three paragraphs of the section on autogenous welding were discussed. As the Low Pressure Heating Boiler Code was adopted in 1923, it was the first section of the Boiler Code in which welding rules appear.

During 1923 and 1924, S. W. Miller, of the Subcommittee on Welding, called to the attention of that subcommittee a number of researches and papers published on welding, and defended fusion welding on the basis of his own experience and on tests of his own products, as well as of structures built by others. His letter to the Boiler Code Committee made clear the success of autogenous welding and the requirements for welds which were reliable.

Low Pressure Heating Boiler Code

In October 1921, the Boiler Code Committee directed the Subcommittee on Heating Boilers to formulate rules for welding heating boilers. After five meetings it submitted two sections of the Code. A public hearing was held on this Code in December 1922. Reheating was discussed, and paragraph H-30 was amended to read that red must show for a width of 3 inches in daylight. The Boiler Code Committee voted that no paragraph on the rating of heating boilers should be included in the Code, and that gas fired boilers for domestic hot water should be excluded from the Code. The Code for Low Pressure Heating Boilers was approved by Council in May 1923.

Sections IV and VII

The Code on Steel Plate Boilers was published as a separate book, as section IV of the Boiler Code. It was limited to steam boilers with pressures of 15 lb. per sq. in., and to hot water boilers to 160 lb. per sq. in. and 250°F. Ultimate strength and plate thickness followed the rules for power boilers. The concluding 15 paragraphs of Part I were devoted to autogenous-welded boilers, describing the boilers on which autogenous welding could be used. Design, materials and methods of inspection were also specified.

Part II, Cast Iron Boilers, limited the pressures and temperatures to be used with cast iron boilers, and contained requirements for openings, connections, safety and relief valves, gauges, regulators, plugs, tests, inspection and marking. It was decided to base the size of the safety valve or relieving capacity on the grate area.

The Boiler Code Committee in 1919 appointed a Subcommittee on a Code for Air Tanks and Pressure Vessels. In October this subcommittee submitted formulae for stress, based on the elastic limit and maximum elongation for substances other than steel.

After discussion at public hearings in May 1920 and December 1921, this Code, now called the Code for Unfired Pressure Vessels, was turned over to the Committee on Welding for revision, so as to present a Welding Code. As a result of representations from the Range Boiler Manufacturers, who showed they could build safe hot water boilers

by brazing, tanks for hot water and water storage were excluded from the Code on Hot Water Heating Boilers and from the Code for Unfired Pressure Vessels.

Following further public hearings and several meetings of the subcommittee, the Code for Unfired Pressure Vessels (sixth draft) was finally adopted by ASME Council on January 15, 1925, as section VIII of the ASME Boiler Code.

Rules for Inspection—Section VI

A subcommittee was formed in May 1918 to prepare Rules for Inspection of Material and Steam Boilers, not as a mandatory part of the Code. Following approval by the American Boiler Manufacturers Association the rules were presented at the ASME Spring meeting in May 1923. Following Committee approval the rules were included by ASME Council in its approval of the Boiler Code of 1924 as section VI thereof.

Conferences and Hearings—1919-1924

Due to the need for closer cooperation between the Boiler Code Committee and the ASTM towards eliminating differences in their specifications, conferring committees of the two societies met frequently during the period 1919-1924, and held several hearings with this objective in view. Thirteen different specifications for the Code were considered in April 1923, some of which were adopted and some altered.

In May 1920, following representations from 11 safety valve manufacturers taking exception to 17 paragraphs dealing with attachments, the Committee decided most of these could be dealt with by interpretations, while some required conference. Data was prepared and presented at a hearing in September. After complete agreement among the members in October the revised paragraphs were ordered printed in the next issue of *Mechanical Engineering*.

A hearing in April 1922 on the question of raising the allowable working on malleable iron boxes from 200 lb. per sq. in. to at least 300 lb. per sq. in., resulted in the problem being turned over to the former Subcommittee on Malleable Iron, for consideration and report. After consultation with Professor Enrique Touceda, Director of the Malleable Iron Research Institute, the Committee suggested that a pressure higher than 250 lb. per sq. in. was permissible. The Committee had difficulty in reaching a conclusion, but finally placed the allowable working pressure for malleable iron between that for steel and cast iron, viz. 350 lb. per sq. in., with test pressure at 2,250 lb. per sq. in.

At a hearing in January 1922, the Range Boiler Association requested exclusion of range boilers and water storage tanks from the ASME Code. From facts gained at this hearing, these structures were excluded from the Heating Boiler Code and from the Unfired Pressure Vessel Code.

Other Business

Revision work for the 1924 edition of the Code continued from February 1922 until February 1924. During this period discussions, conferences and hearings reduced the points of difference between the two sets of rules to 22. A subcommittee on steam piping was appointed in December 1919 and its work expanded in 1920 to include valves and fittings. Copper and brass specifications were referred to the Conferring Committee, which in September 1923 established a formula for the gauges of copper pipes, after that committee had accepted the specifications for copper and brass pipe. In September 1923 the Boiler Code Committee also decided not to attempt revisions at four year intervals.

At a Boiler Code Committee meeting in September 1919, it was suggested that in the interest of uniformity of methods among inspectors in different Code states, inspectors should form an organization named the "National Board of Boiler and Pressure Vessel Operators". This Board became an effective organization in later years in bringing about uniformity. In November 1920 Council authorized the appointment of one member of this Board to the Boiler Code Committee.

In April 1919, Charles E. Gorton had stressed the importance of extending information of the Code to foreign countries, to inform them of the rules under which U.S. boilers were built and thus stimulate foreign trade. Later he urged translation of the Code into Spanish.

In October 1922 the question of rotation of membership of the Boiler Code Committee was brought again to the ASME Council. The Committee remained a special committee of the ASME Council, subject to annual appointment. In May 1924 a subcommittee of three was set up, for the purpose of maintaining close contact with the American Marine Standards Committee respecting unification of requirements of the Steamboat Inspection Service and the Classification Societies, on approval of the Committee.

1924 Code

In January 1920, the Committee voted to confine ballots on cases to members of the Committee, and on June 27, 1923, it voted to make the new Code of 1924 of pocket size, printing section I, Power Boilers; section II, Material Specifications and the Appendix in one volume, and omitting the recommendations on repairs by welding. Section VI, Rules for Inspection, was added. Section III, Boilers of Locomotives; section IV, Low Pressure Heating Boilers, and section V, Miniature Boilers, were published separately as they were issued. In October and December, 1924, the Committee authorized the use of materials under specifications of the 1918 edition of the Code, provided they were ordered before the approval of the new Code on March 19, 1924. Throughout these years interpretations were published in *Mechanical Engineering* and also in pamphlet form, while all revisions were also published in *Mechanical Engineering* so that the industry was informed of all actions affecting the Code.

After Council approval of the 1924 edition, no further interpretations based on the 1914 and 1918 editions were made, but all replies were based on the 1924 edition, annulling all previous cases. √

Next Annual Meeting of the Engineering Institute:

QUEBEC, QUE.—May 12, 13, 14, 1954

Chateau Frontenac

Remuneration of Engineers

by

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A paper presented to the Montreal Branch of the Engineering Institute of Canada, in November 1952.

Any logical classification of engineering salaries must rest upon some standard foundation, the same for all types and grades of positions. The determination of a satisfactory standard is no easy matter; a completely acceptable one may never be developed. This paper describes the philosophy behind the salary schedule of the Corporation of Professional Engineers of Quebec, which has also been adopted by the associations of most of the other Provinces.

"$20,000 a year is a good salary, $2,000 a year is a poor salary"—most of us would agree with the statement, most of us would apply the statement to our own circumstances, and in so doing most of us would consider the statement true.

Some of us would realize that the statement is incomplete and that as it stands it actually means nothing at all. In order to make it mean something, we must apply conditions. $20,000 a year is not necessarily a good salary, no matter how attractive it may appear at first sight. In fact, it might properly be considered a quite inadequate salary by many senior executives. On the other hand, $2,000 a year is not necessarily a poor salary, no matter how unattractive it may appear. It might properly be looked upon with envy by some classes of unskilled labour. $20,000 a year may once have been an exceedingly attractive salary up to a certain level of management, but be quite unsatisfactory for the same level today, just as $2,000 would have seemed high to many of us when we graduated, but would be considered entirely inadequate by today's graduates. It is apparent, therefore, that the opening statement must be qualified, defining position and circumstances, to have any significance. In other words, we are dealing with relative, not absolute values.

It may be well to remind you at this point that we have as yet almost no knowledge of absolute values and that all our experience and mental activity are necessarily in terms of relative values only.

All languages have been built up from words devised to provide a means of communicating experience and sensation. The extremes of experience and sensation to which men had been exposed when the words were invented, in fact the extremes to which men have yet been exposed, provide only a very limited scale, and the words that have been devised to describe the opposite ends of this scale have only relative meaning. For instance, one should not think of "hot" as the opposite of "cold". Present knowledge tells us that when we say something is cold, we mean that it is at a lower temperature—contains less heat per unit—than something else. What is described as hot is only so by comparison with something less hot and what by one comparison is cold is hot when compared to something colder. Hot and cold are words devised to express two relative conditions on a very long scale, the absolute upper and lower limits of which are outside our experience. Similarly, only relative values are expressed by the so-called opposites "light" and "dark", "wet" and "dry", etc. None of these express absolute values and if they are to be considered as opposites, they can only be so considered within a small range of common experience or definition on the applicable scale of absolute values. We can say that $20,000 a year is more attractive than $2,000 a year, but we cannot say that one is good or the other is bad or that the one is adequate and the other inadequate. We cannot evaluate except by comparison with something else or by measurement relative to some accepted standard.

Standard Scale

Originally men did business by barter. This is a cumbersome system, involving as it does some sort of computation of the value of, say, apples, in terms of the value of potatoes. Eventually, the necessity for a common standard medium of exchange was recognized, and money was invented. In much the same way it is impracticable to compare the many thousands of engineering jobs with one another in order to arrive at a value for each. Some common standard must be established, so that such jobs may be measured against it to establish the value of each, before we can say what is and what is not adequate. What should be the extent of such a standard?

Instead of trying to answer this question directly, let us pose certain other questions. Which of us thinks that Canada is the country of greatest opportunity at this time? Which of us believes that demo-

cratic, capitalistic free enterprise is the most desirable system under which to live and work? Who among us feels that he would be better off in some other country under some other system? How many of us consider that they are paid more than they are worth? How many are convinced that they are paid less than they are worth?

The response to these questions is sure to be revealing. To summarize we almost all agree that we are living in the land of greatest opportunity under the most desirable economic system, but that, while we are better off than we would be anywhere else in the world, we are nearly all underpaid. This is interesting. It means that we do not compare ourselves to any universal scale, deriving satisfaction from being collectively and individually at a higher level on the scale than the rest of the world. It means that we compare ourselves with a much smaller scale limited by our own environment and experience.

This is all natural and to be expected, perhaps even to be desired. It would be well for us to realize occasionally that even the least fortunate here is much better off than his opposite number in almost any other part of the world. However, it is the standard of living, the customs and habits of our own country with which we are immediately concerned, and it is proper that we should restrict our standard scale to measuring relative values under our own living and working conditions.

Job Evaluation

The first problem, therefore, is to devise a standard scale against which to measure our own positions to see whether we are or are not well off in a relative sense, this being, as we have seen, the only criterion. How shall we do it? Every job involves certain prescribed duties. Performance of these duties requires at least certain minimum qualifications. The content of any job may therefore be determined in terms of the minimum qualifications required. The process of breaking the content of any job down into elements common to all jobs in a certain field, evaluating the degree of each element in each job, synthetizing the results and determining their dollar values—job evaluation—will give us the kind of scale we are seeking.

In 1948 the Corporation of Professional Engineers of Quebec undertook to develop a schedule of minimum salaries for professional engineers in the employee class. This project was undertaken because it was felt that many engineers were underpaid, but it was realized that nothing useful could be done about this situation until a comprehensive analysis of the actual conditions had been made.

A survey was therefore conducted among employers of engineers and employed engineers, resulting in a total of approximately 1,700 complete job descriptions. The data contained in these descriptions were such as to cover all factors which might have a bearing on the evaluation of these jobs.

Study of these data soon revealed that only education, experience and organizational level of responsibility could be accurately described or considered as criteria. The job descriptions were therefore all analysed in terms of these factors. The education factor was broken down into six elements, ranging from no university education to a doctor's degree, each of these being subdivided into engineering and non-engineering. The experience factor was broken down into one-year increments. The responsibility factor was divided into nine elements, pyramiding from a base of inexperienced beginner to organization head at the top of six normal organizational management levels.

Various methods of allotting point values to the degrees of each factor were tried, and various combinations of factors were used. When finally a combination of factors and point values was found which expressed the results of the survey in a straight-line relationship, it was considered to be satisfactory evidence of the validity of the procedure.

From this relationship, nine grades were defined based on the results of the survey, with some rationalization of requirements of education and experience for responsibility grades. Minimum salaries were obtained from the above-mentioned curve for the appropriate point values.

No one, engineer or not, is in a position to know whether he is well or badly paid until he has compared his position to other similar positions by means of a standard scale, which can be and has been developed. There still remains the problem of how to apply such a scale so as to remove the inequities that do exist.

Application

We are agreed that we believe in free enterprise. Whether we like it or not, wherever free enterprise exists the law of supply and demand prevails. In this country we still consider that we are working under a system of free enterprise; in spite of some restrictions, this is still predominantly the case. Therefore, the law of supply and demand must function. It cannot be otherwise. The moment any aspect of the free operation of the law of supply and demand is curtailed, freedom of enterprise is correspondingly limited. When there is more of something available than there is demand for it, the value of that thing decreases. Conversely, when there is less available than the demand, the value increases. This is true of services just as it is of things, and the salary and wage values of people respond to the same law.

One of the ways that has been suggested and is actually being tried as a means of forcing engineering salaries higher is reducing the number of engineers available. For example, this can be done by restricting the immigration of engineers. Canada has reached a point in her development where one thing required to develop her resources and to increase her internal consumption of goods and services so that quantity production will bring lower prices and a higher standard of living, is population. Do we want the riffraff from other countries or do we want the skilled artisans, the educated people, the professional men? Can we say that we do not want engineers?

Some still think that the law of supply and demand can be controlled and still have free enterprise. Take, for example, collective bargaining. A group of people speaking with the strength of unity may demand and obtain higher wages. This is, of course, a restriction of the free action of the law of supply and demand and a control of free enterprise. For a time there is an apparent financial advantage to the group. However, relativity soon asserts itself. Administrative salaries must be raised, the cost of operations is increased, the price of the product or service must be increased to compensate, and finally, the cost of living rises to a point where inflation has washed out the gain. Then the cycle repeats. This, of course, is only possible if there continues to be a sufficient demand for products or services to permit prices to be raised to compensate for increased costs. Higher prices will eventually result in a reduction of demand as surely as quantitative saturation or qualitative inferiority, and when prices must be reduced to

maintain sales volume, costs must be reduced accordingly.

It has been suggested, and in fact tried, that engineers adopt union methods and organize for collective bargaining, to enforce a scale of minimum salaries. In the first place, these methods produce little advantage in the long run due to inflationary aspects. In the second place, engineers should be, are in many organizations, and are becoming increasingly an integral part of management. By unionizing engineers would separate themselves from management and would therefore establish themselves as just another, perhaps somewhat more highly paid, group in the total labour force. In the third place, any schedule of salaries so enforced would quickly become not a scale of minimum salaries but a scale of pin-point salaries, and it would become increasingly difficult either to move up from any classification to the next higher, or to obtain more than the minimum salary for any classification. In the fourth place, the professional status of the engineer would retrogress, as the tendency to do only the amount or quality of work defined and paid for in any classification would become increasingly pronounced.

Another suggestion that has been made is that the accepted schedule of minimum salaries should be enforcible by law. This would have the same effect as unionizing on a provincial scale and, apart from the undesirable features previously mentioned, enforcement of such a law would be so difficult that it would probably actually be to the disadvantage of many engineers.

What the Corporation of Professional Engineers hoped to accomplish was to "develop a schedule of minimum salaries for professional engineers in the employee class to serve employers of engineers as an acceptable and practical instrument for the determination of minimum remuneration consistent with the specific requirements and conditions of any engineering employment, to serve engineers in the employee class as an equitable and adequate standard of monetary compensation commensurate with the prerequisites and obligations of any engineering position or classification, and to serve the entire profession as a practical and logical basis for the recognition and acceptance generally of uniformly high standards of qualification and correspondingly high standards of remuneration."

In setting up and recommending the adoption of this procedure, the law of supply and demand has been interfered with as little as possible. The relationship between the various categories of responsibility was established when the original schedule was devised in 1948, when new graduates were being paid approximately $220 a month. The salaries paid to new graduates are now and probably always will be, directly determined by the law of supply and demand. If this amount increases because of a short supply, as it has done to its present average level of approximately $300 a month, it is clear that the minimum salary for each of the other responsibility categories should be increased correspondingly. This has been done once already by the Corporation and a further upward revision is now being studied.

One of the peculiarities of employers of engineers seems to be their reluctance to increase the minimum salaries of the higher grades. Many of them appear to be quite unable to accustom themselves to the thought that five-figure annual salaries may be in order. This is largely a hangover from prewar days when such salaries meant something. An employer who paid a salary in prewar days of, say $10,000 a year to his chief engineer, simply does not seem to be able to bring himself to think in terms of the more than $20,000 a year that is required today to give even comparable status. Minus income tax, the purchasing power of $20,000 today is very much less than that of the remainder of a $10,000 salary in 1939. The effect of this attitude, combined with the necessity of paying three times as much to new graduates as in prewar days is to compress both ends against the middle, resulting in a somewhat static condition in the range where so many of us find ourselves. It is high time that we concentrated on improving the lot of the upper grades.

There is a further point that is one of the fundamental differences between the engineering profession and the other professions, such as medicine and law. Whereas in the medical and legal professions the majority of members are independent practitioners or consultants, in the engineering profession, the majority is employed by relatively large organizations. If we wish to compare the financial status of engineers with that of either doctors or lawyers, we should remember to compare the employed engineer and the employed doctor or lawyer, the consulting engineer and the independent doctor or lawyer. By the same token, we should not compare the financial status of the employed engineer with that of the independent consulting engineer. The security of employment in a large organization finds no analogy in private practice.

I have not discussed professional fees here as they are subject to rather different considerations. Fees and salaries are in fact linked together, because the consultant must receive fees which will provide income for himself and salaries for his professional and other staff not less than those that could be derived from comparable employment elsewhere, and which must also pay rent, insurance, taxes and other costs of operation. Since he is selling a service rather than a product, and since the most practical basis of measurement of that service is the time required to perform it, professional fees are usually a function of time. Some engineers have stated that they considered themselves underpaid because the consulting engineer for whom they were working was charging a fee for their time equal to twice their salary. Let them learn more whereof they speak. √

Future Annual Meetings of the Engineering Institute:

QUEBEC, QUE.—May 12, 13, 14, 1954
Chateau Frontenac

TORONTO, ONT.—May 11, 12, 13, 1955
Royal York Hotel

Standard Curves for Calculation of Forces Between Parallel and Perpendicular Conductors

by

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The literature about forces between conductors carrying currents is rather extensive. Numerous papers (2, 4, 5, 6, 7)* deal specifically with forces between short parallel and perpendicular conductors. The whole problem is of considerable importance in the case of systems of large busbars carrying heavy currents.

Various authors give formulae for the most important arrangements of conductors (7), and some papers deal with more complicated systems. However, it would seem more convenient to have, in one place, a *standard* collection of curves for forces between characteristic circuit *elements*. One of the most complete and best presented papers in this field is by W. Frick (6), wherein a number of charts are presented in a form which allows a minimum of calculation.

Nevertheless, the use of even these curves is rather difficult unless they are being used regularly, owing to lack of uniformity in presentation and of generality in choice of units. Therefore, an attempt is made herein to present, simply and clearly, a standard set of curves which will be generally applicable, although not necessarily involving the least time. Extensive application of the paper by Frick is made.

General Remarks

It is assumed that there is no ferromagnetic material in the region surrounding the conductor: and that in all cases but one (bent conductor) the current is concentrated in the centre line of the conductor. A more accurate consideration including the "proximity effect" (see for instance Dunton (3)) is of importance only for parallel busbars located very close together. Suitable correction factors (see Dwight (1)) can then be introduced. The "proximity effect" in the case of alternating current interacts with the "skin effect", and both must be considered together. In most practical cases the assumption of a concentrated current gives sufficiently accurate results.

A given conductor (the "influenced" one) carrying a current is acted upon by electromagnetic forces, due to a flow of current in another conductor (the "influencing" one). The finite *influencing* conductor 1 carrying a current i_1, is replaced by one of infinite length, carrying the same current, and parallel or perpendicular to the "influenced" conductor 2. Suitable *correction factors* k are then applied to the results obtained with this idealized situation, to give the forces applicable in the case of the finite conductors.

These correction factors are presented as curves which might be called "Standard Curves for the Calculation of Forces". In all cases the correction factors are dimensionless and have values such that $0<k<1$. Formulae for the calculation of correction factors in typical cases are given in Appendix I (see also (6)). The direction of the magnetic flux produced by a current is given conventionally by the right-hand screw rule, while the direction of the electromagnetic force exerted by a flux on a conductor carrying a current is given by Fleming's left-hand rule.

All equations are written in very general form and contain, in addition to these dimensionless correction factors, only the "basic force" F_o and the lengths of the conductors. To obtain results in any units it is only necessary to express F_o and the lengths involved in the appropriate units (8).

All data used in the plotting of the correction factor curves were calculated to four significant figures. Values of $\sin^{-1}$ and $\sinh^{-1}$ were taken from accurate tables (10), or for large values of $\sinh^{-1}$ were calculated from series expansions (11). Curves for intermediate parametric values have been obtained by graphical interpolation. Several busbar combinations are now considered:

1. Conductor influenced by another parallel infinitely long conductor

The force on a length x of an infinite conductor carrying a current i_2 parallel to, and s units from a similar conductor carrying a current i_1, as in Fig. 1, is

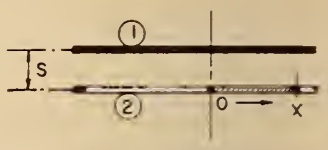

Fig. 1. Long parallel conductors.

$$F = 2i_1 i_2 \frac{x}{s} \text{(in abs. E.M.U.)} \quad \ldots (1)$$

If the "*Basic Force*" F_o of this system is defined as the force acting on the length $x=s$, then

$$\underset{\text{(dynes)}}{F_o} = 2\underset{\text{(abamps)}}{i_1 i_2} \quad \ldots (2)$$

If i_1 and i_2 are expressed in Amps and the Force F is required in *newtons* (MKS-System), or *Kiloponds* (now used for Kilograms when the force and not the mass is meant), or *lbs.*, then

$$\left.\begin{aligned} \underset{\text{(Newton)}}{F_o} &= 2\underset{\text{(Amps)}}{i_1 i_2} 10^{-7} \\ \underset{\text{(Kp)}}{F_o} &= 2.04\,\underset{\text{(Amps)}}{i_1 i_2} 10^{-8} \\ \underset{\text{(Lb)}}{F_o} &= 4.5\,\underset{\text{(Amps)}}{i_1 i_2} 10^{-8} \end{aligned}\right\} \quad \ldots (3)$$

since

$$\left.\begin{aligned} &1 \text{ abamp} = 10 \text{ Amp.} \\ &1 \text{ dyne} = 10^{-5} \text{ newton} \\ &= 1.0194 \times 10^{-6}\ Kp \\ &= 2.2474 \times 10^{-6}\ lb. \end{aligned}\right\} \quad \ldots (4)$$

The general formula may now be expressed as:

$$\boxed{F = F_o \frac{x}{s}} \quad \ldots (5)$$

When x and s are both expressed in the same units, then F is also expressed in the same units as F_o.

The distribution of force per unit length is in this case:

$$\frac{dF}{dx} = \left[\frac{F_o}{s}\right] = \text{Const.} \quad \ldots (6)$$

*These figures refer to items in the list of References.

The *total force* (as already known) is:

$$F = \int_0^x \frac{dF}{dx}\,dx = \int_0^x \frac{F_o}{s}\,dx$$

$$= \left[F_o \frac{x}{s} \right] \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The *moment about 0 of the force* is:

$$M = \int_0^x \frac{dF}{dx}\,x\,dx = \int_0^x \frac{F_o}{s}\,x\,dx$$

$$= \left[\frac{F_o}{s} \cdot \frac{x^2}{2} \right] \ldots\ldots\ldots\ldots\ldots (8)$$

II. Conductor influenced by another parallel short conductor

Formulae for the case (Fig. 2a), when one end of the portion ox of the influenced conductor lies opposite the middle point of the short conductor, can be represented as follows:

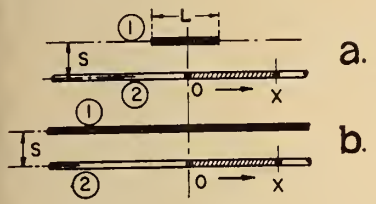

Fig. 2. Short (a) and long (b) influencing conductor.

$$\frac{dF}{dx} = \left[\frac{F_o}{s} \right] k'_F \ldots\ldots\ldots\ldots\ldots (9)$$

$$F = \left[\frac{F_o}{s} x \right] k_F \ldots\ldots\ldots\ldots\ldots (10)$$

$$M = \left[\frac{F_o}{s} \cdot \frac{x^2}{2} \right] k_M \ldots\ldots\ldots\ldots (11)$$

where the values in parenthesis correspond to an arrangement similar to Fig. 2a, but with an infinitely long conductor 1 (Fig. 2b); k'_F, k_F, k_M are reduction factors whose values lie between 0 and 1 given in graphical form in Figs. 3, 4, 5.

When the mid-point of the short conductor does not lie opposite one end of the portion of the influenced conductor under consideration, then the total force F and the Moment M consist of two parts combined, as indicated in Figs. 6a and 6b.

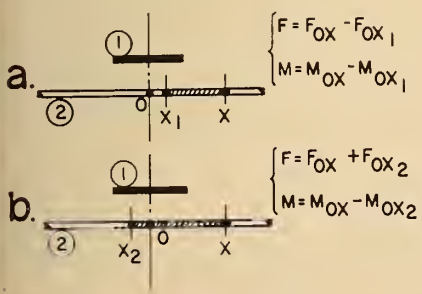

Fig. 6. Different locations of a short parallel conductor.

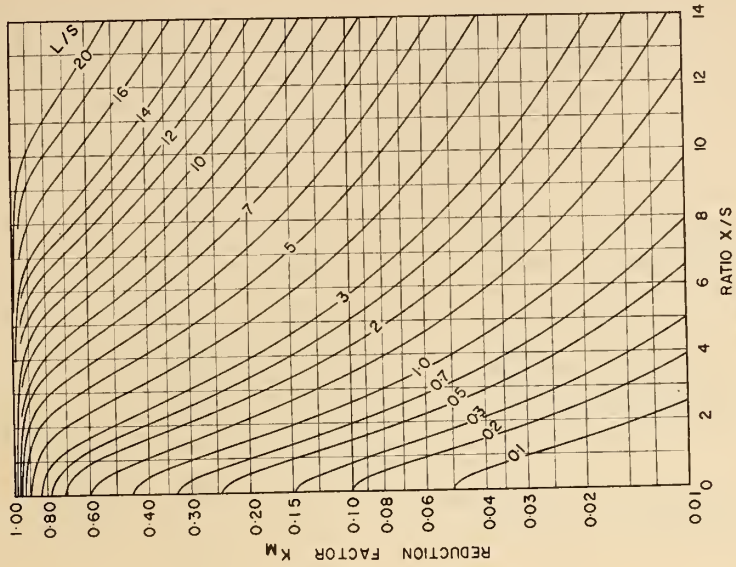

Fig. 5. Moment about O.

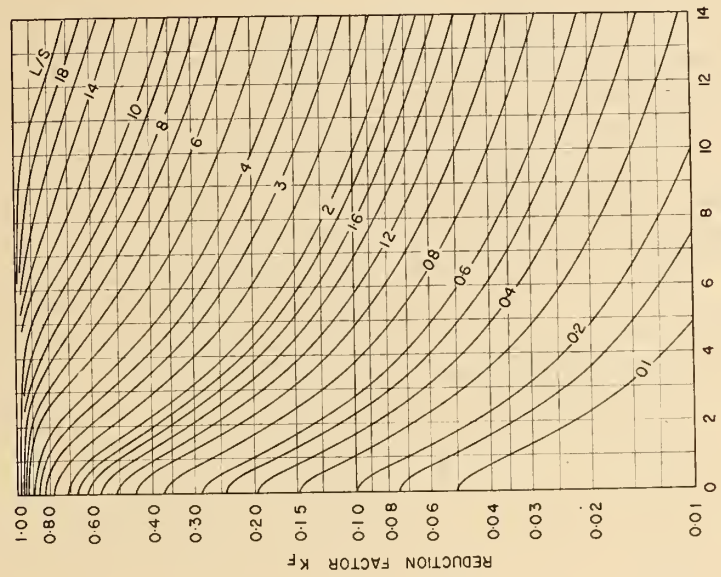

Fig. 4. Total force.

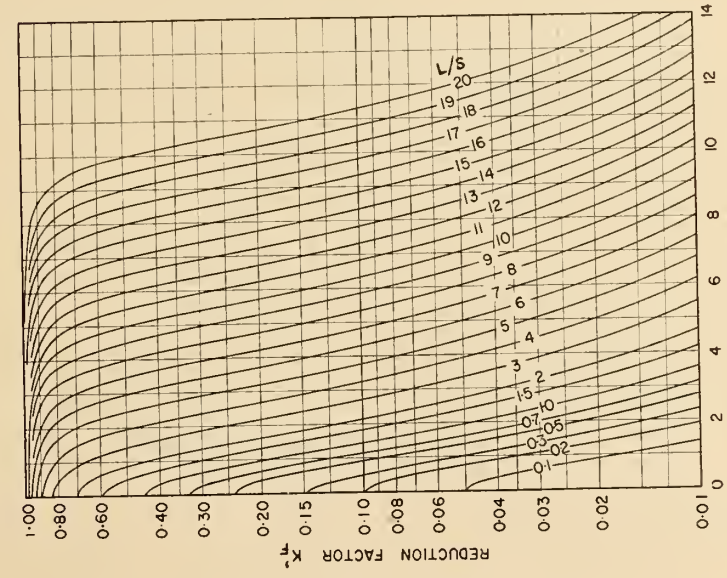

Fig. 3. Distribution of force.

Reduction factors for a short parallel influencing conductor (Fig. 2).

III. Conductor influenced by another parallel semi-infinite conductor

For the case represented in Fig. 7a (the end of the influencing conductor opposite one end of the influenced one):

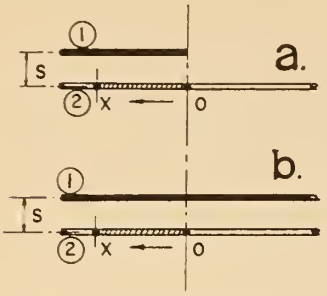

Fig. 7. Semi-infinite (a) and infinite (b) parallel influencing conductor.

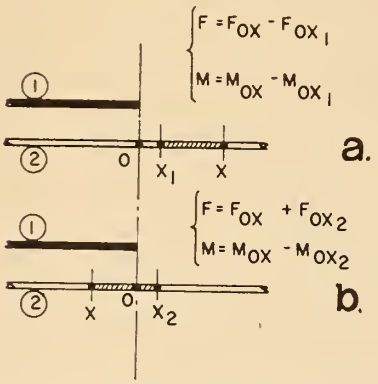

Fig. 9. Different locations of a semi-infinite parallel conductor.

$$\frac{dF}{dx} = \left[\frac{F_o}{s}\right] k'_F \quad \ldots\ldots\ldots\ldots (12)$$

$$F = \left[\frac{F_o}{s}\, x\right] k_F \quad \ldots\ldots\ldots\ldots (13)$$

$$M = \left[\frac{F_o}{s}\cdot\frac{x^2}{2}\right] k_M \quad \ldots\ldots\ldots\ldots (14)$$

where the values in parenthesis correspond to an arrangement similar to Fig. 7a, but with an infinite conductor (Fig. 7b); k'_F, k_F, k_M are reduction factors whose values lie between 0 and 1 given graphically in Fig. 8.

When the end of the influencing conductor does not lie opposite one end of the portion of the influenced conductor under consideration (Fig. 9), then the total force F and the moment M consist of two parts combined, as indicated in Figs. 9a and 9b.

IV. Conductor influenced by another in 90°-"cross-over" position

For an infinite influencing conductor (Fig. 10a), we have:

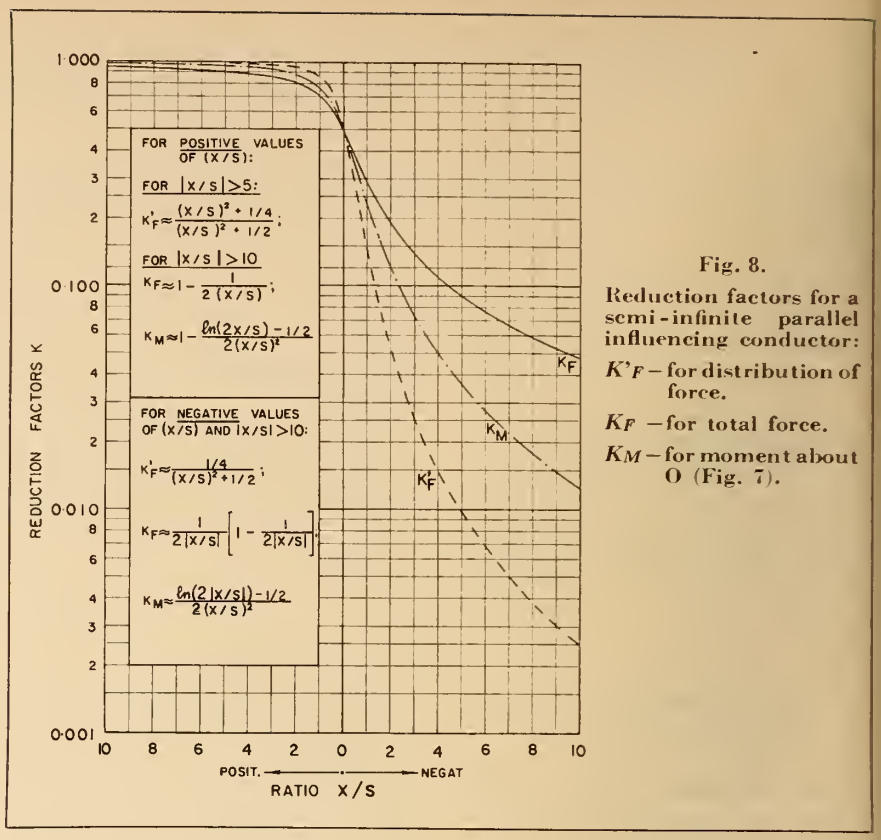

Fig. 8.
Reduction factors for a semi-infinite parallel influencing conductor:
K'_F – for distribution of force.
K_F – for total force.
K_M – for moment about O (Fig. 7).

$$\frac{dF}{dx} = \left[\frac{F_o}{s}\right] c'_F \quad \ldots\ldots\ldots\ldots (15)$$

$$F = \left[\frac{F_o}{s}\, x\right] c_F \quad \ldots\ldots\ldots\ldots (16)$$

$$M = \left[\frac{F_o}{s}\cdot\frac{x^2}{2}\right] c_M \quad \ldots\ldots\ldots\ldots (17)$$

where the values in parenthesis correspond to an arrangement similar to Fig. 10a, but with both conductors parallel (Fig. 10b) and with the same spacing s: c'_F, c_F, c_M are *reduction factors* (see curves for the parameter $L/s = \infty$ in Figs. 14, 15, 16). The distribution of forces is schematically shown in Fig. 11.

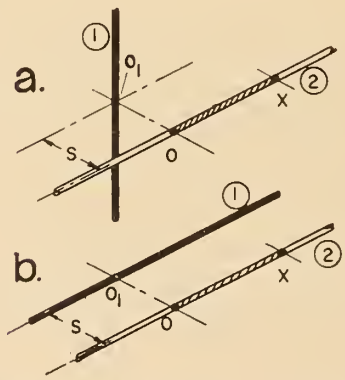

Fig. 10. Influencing conductor in 90°-cross-over (a) and parallel (b) position.

It is clear from Fig. 10a that the upper and lower portions of the influencing conductor 1 (above and below 0_1) are symmetrical with respect to the influenced conductor 2; each half therefore produces

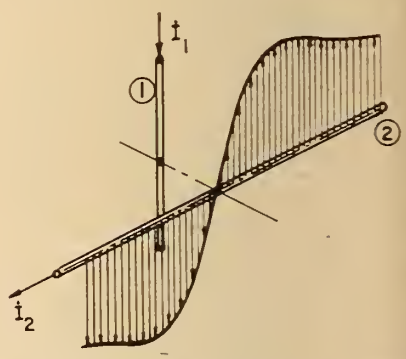

Fig. 11. Forces distribution on a 90°-cross-over.

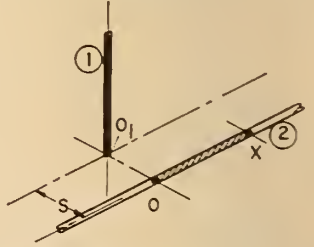

Fig. 12. Semi-infinite influencing conductor in 90°-cross-over position.

exactly one half of the total force on each element of 2.

When the influencing conductor 1 is asymmetrical, i.e. it consists for instance of the upper *half* only (Fig. 12), we then obtain (in analogy with equations (15) - (17)):

$$\frac{dF}{dx} = \left[\frac{F_o}{2s}\right] c'_F \quad \ldots\ldots\ldots\ldots\ldots (18)$$

$$F = \left[\frac{F_o}{2s}\, x\right] c_F \quad \ldots\ldots\ldots\ldots\ldots (19)$$

$$M = \left[\frac{F_o}{2s}\, \frac{x^2}{2}\right] c_M \quad \ldots\ldots\ldots\ldots\ldots (20)$$

where F_o still is the "basic force" between two long parallel conductors, as given by equations (2) - (4) and c'_F, c_F, c_M have the same values as in (15) - (17).

When we now consider a *short* asymmetrical influencing conductor *1*, (Fig. 13) instead of the long one, we get:

$$\left.\begin{aligned} \frac{dF}{dx} &= \left[\frac{F_o}{2s}\right] c'_F g'_F \\ &= \left[\frac{F_o}{2s}\right] k'_F \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots (21)$$

$$\left.\begin{aligned} F &= \left[\frac{F_o}{2s}\, x\right] c_F g_F \\ &= \left[\frac{F_o}{2s}\, x\right] k_F \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots (22)$$

$$\left.\begin{aligned} M &= \left[\frac{F_o}{2s}\, \frac{x^2}{2}\right] c_M\, g_M \\ &= \left[\frac{F_o}{2s}\, \frac{x^2}{2}\right] k_M \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots (23)$$

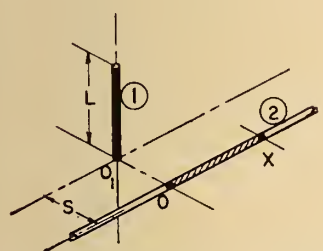

Fig. 13. Short influencing conductor in 90°-cross-over position.

where g'_F g_F, g_M are reduction factors expressing the effect of the *short length* of the influencing conductor while c'_F, c_F, and c_M still express the effect of the *cross-over position*.

The factors k'_F, k_F, k_M combine both effects and are given in Figs. 14, 15, 16 where, as already indicated,

$$k'_{F\infty} = c'_F \quad \ldots\ldots\ldots\ldots\ldots\ldots (24)$$

$$k_{F\infty} = c_F \quad \ldots\ldots\ldots\ldots\ldots\ldots (25)$$

$$k_{M\infty} = c_M \quad \ldots\ldots\ldots\ldots\ldots\ldots (26)$$

If neither end of the *influenced conductor* coincides with the point *O*

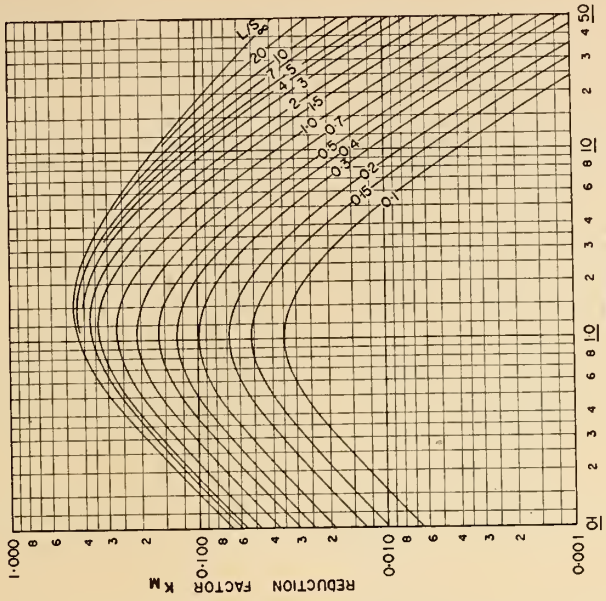

Fig. 16. Moment about O.

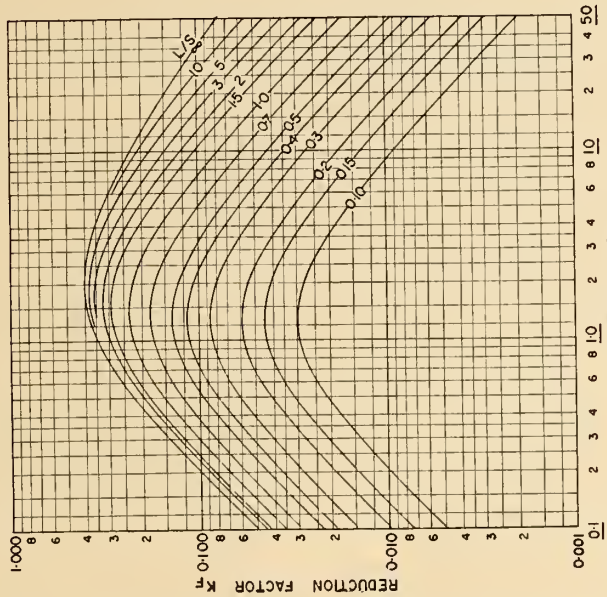

Fig. 15. Total force.

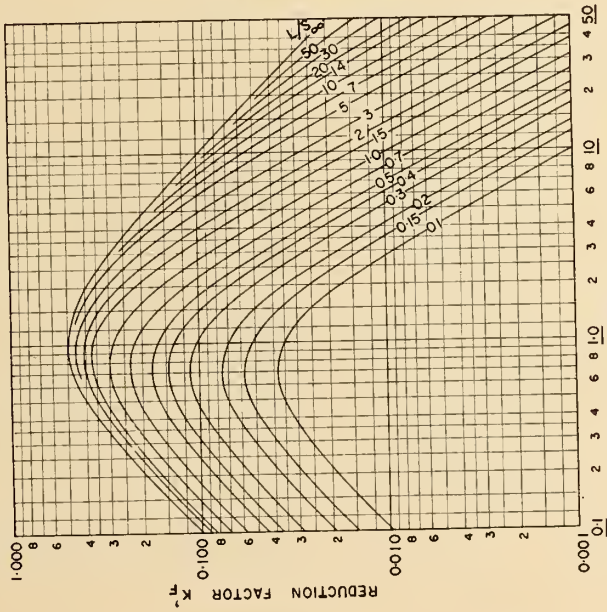

Fig. 14. Distribution of force.

Reduction factors for a short influencing conductor in 90°-cross-over position (Fig. 13).

(nearest to the influencing conductor) then the total force F and the total moment M consist of two parts, which are combined, in a way, analogous to that of Fig. 6. Attention must be given however to the fact that the force direction is different on different sides of O.

When neither end of the *influencing conductor* coincides with the point O_1, then it must be replaced by the sum or difference of two conductors, each of them terminally at the point O_1.

V. Conductor influenced by another conductor perpendicular to it and in the same plane

This system corresponds to a "cross-over", Fig. 10a, with the spacing $s=O$. The conductors will first be considered as geometrical lines isolated from each other, Fig. 17. It may be seen that the force $dF\ dx$ on a conductor element at the point x is of the same magnitude as in the case when the conductor 2 is in the "parallel" position (shown dotted in Fig. 17) for a spacing $s=x$.

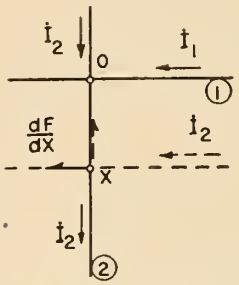

Fig. 17. Perpendicular conductors in the same plane.

The force direction is still *perpendicular to the influenced conductor 2*, as indicated by the solid arrow, where the dotted arrow shows the force direction for the "parallel" position. We now have:

$$\frac{dF}{dx} = \frac{F_o}{x} \quad \ldots\ldots\ldots\ldots\ldots\ldots (27)$$

$$F = \int_o^x \frac{F_o}{x}\,dx = F_o \Big| \ln x \Big|_o^x \quad \ldots (28)$$

$$M = \int_o^x \frac{F_o}{x}\,x\,dx = F_o x \quad \ldots\ldots (29)$$

The assumption of currents concentrated in geometrical lines (Fig. 17) results in

$$\left(\frac{dF}{dx}\right)_{x\,=\,o} = \infty \text{ (from (27))} \ldots . (30)$$

and

$$F = F_o(\ln x - \ln 0) = \infty$$
$$\text{(from (28))} \ldots\ldots\ldots\ldots\ldots (31)$$

To avoid the divergent value infinity, we must consider the current distribution in the *finite* physical conductor cross-sections in the neighbourhood of the cross-over point O (see later).

VI. One leg of a right-angle bend as influenced by the current flowing in the other leg

We first consider the bend as a pair of geometrical lines (Fig. 18), and obtain for $\frac{dF}{dx}$, F and M exactly one half of their values for a complete cross-over (Fig. 17), because of the symmetry in the way equations (18) - (20) are derived from (15) - (17):

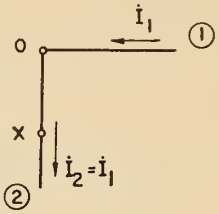

Fig. 18. Idealized bent conductor.

$$\frac{\overline{dF}}{dx} = \frac{\overline{F_o}}{2x} \quad \ldots\ldots\ldots\ldots\ldots\ldots (32)$$

$$F = \frac{F_o}{2} \Big| \ln x \Big|_o^x \quad \ldots\ldots\ldots\ldots (33)$$

$$M = \frac{F_o}{2}\,x \quad \ldots\ldots\ldots\ldots\ldots\ldots (34)$$

where F_o is still the "basic force" between two long parallel conductors as given by eq. (2) - (4) but with the particular condition:

$$i_1 = i_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (35)$$

To overcome the divergent values in eq. (30), (31) we must consider the actual cross-section of both parts of the bend in the neighbourhood of the bending point O, (Fig. 18). When considering the "influencing" conductor 1 of a *finite* cross-section, it is clear the flux density at the centre-line is zero, increases toward the conductor surface, and then drops gradually. The actual force distribution curve appears therefore as indicated by the plain curve in Fig. 19a. A non-homogenous current distribution occurs near the bending point; but the density of the internal magnetic flux is still finite at every point.

To obtain a formula accurate enough for the total force on the influenced portion of a 90° bend HAK(4) uses a very general derivation. He expresses the total force exerted on one movable side of a conductor element by $\frac{\delta L}{\delta \rho}$, where δL is the increase of inductivity due to a "virtual" movement of the conductor in the force direction.

It is shown in this way that the correct expression for the total force is obtained when the "influencing" conductor 1 is replaced by a thin hollow circular cylinder, with the current concentrated on its surface. The "influenced" conductor 2 is represented by a current concentrated at its centre line; the radius of the cylinder (x_o) must have the value of the G.M.R.* of the conductor cross-section. This is sufficiently accurate even for a short "influencing" conductor.

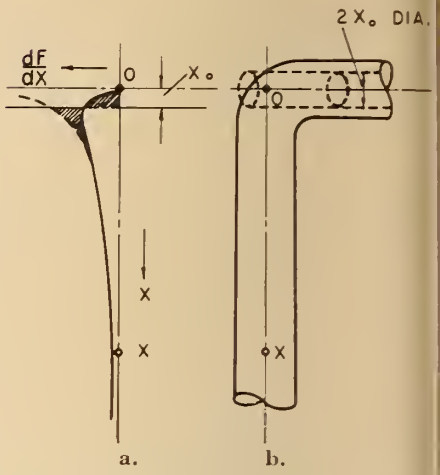

Fig. 19. Distribution of force in an idealized (– – –) and real (—) bend.

Fig. 20 indicates the GMR values for circular and rectangular cross-sections. The above mentioned hollow cylinder is indicated schematically in Fig. 19b, while the dotted line in Fig. 19a has the shape of the corresponding force distribution curve; this force is zero inside the cylinder, and is a decreasing hyperbolic curve *vs.* the distance from the centre line outside it (as if the current were concentrated at the centre line of conductor 1).

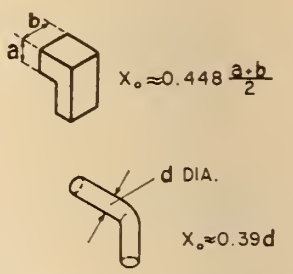

Fig. 20. Mean geometrical radius of different conductors.

*The G.M.R. is the radius of a tubular conductor, with an infinitesimally thin wall that has the same external total *flux* as the internal and external flux of the solid conductor (12).

We now have:

$$F = \left[\frac{F_o}{2}\, 1n\, \frac{x}{x_o}\right] \quad \ldots\ldots\ldots\ldots (36)$$

and

$$M = \left[\frac{F_o}{2}\,(x - x_o)\right].$$

It should be kept in mind, that the value $x_o = GMR$ for the radius of a cylinder replacing the actual conductor was derived only to get the correct *total force* expression and not for the total moment, but the portion in the neighbourhood of the bending point contributes only a little to the total moment value. The last formula can therefore be considered as accurate enough. In most practical cases x_o is very much smaller than x and

$$M = \left[\frac{F_o}{2}\, x\right] \quad \ldots\ldots\ldots\ldots (37)$$

The *force distribution outside* the conductor surface is given with sufficient accuracy by eq. (32) for conductors of a circular or nearly circular cross-section and for flat bars with flat bends. In the case of flat bars with edgewise bends there is a considerable drop in the force distribution curve, up to a distance approximately twice the flat width (6).

When the influencing portion of the bent conductor is *short* (Fig. 21) we get:

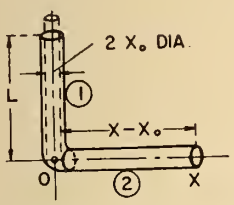

Fig. 21. Real short bent conductor.

$$\frac{dF}{dx} = \left[\frac{F_o}{2x}\right] k'_F \quad \ldots\ldots\ldots\ldots (38)$$

$$F = \left[\frac{F_o}{2}\, 1n\, \frac{x}{x_o}\right] k_F \quad \ldots\ldots\ldots (39)$$

$$M = \left[\frac{F_o x}{2}\right] k_M \quad \ldots\ldots\ldots\ldots (40)$$

where k'_F , k_F , k_M are reduction factors; k'_F, k_M are given in Fig. 22, k_F in Fig. 23 together with $1n\,(x/x_o)$.

Acknowledgments

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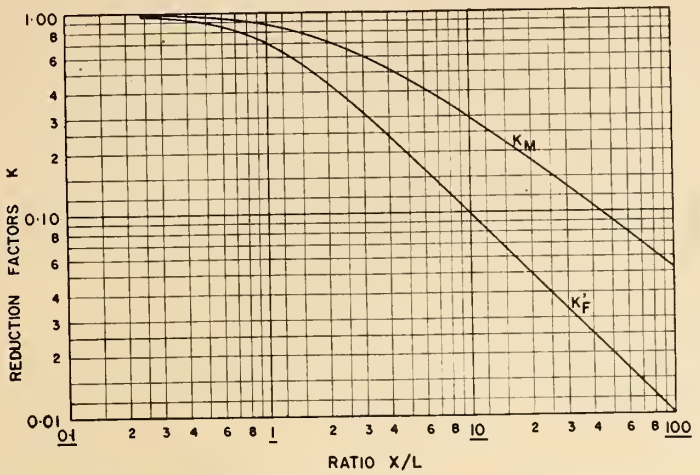

Fig. 22. Reduction factors for distribution of force and moment for a short bent conductor.

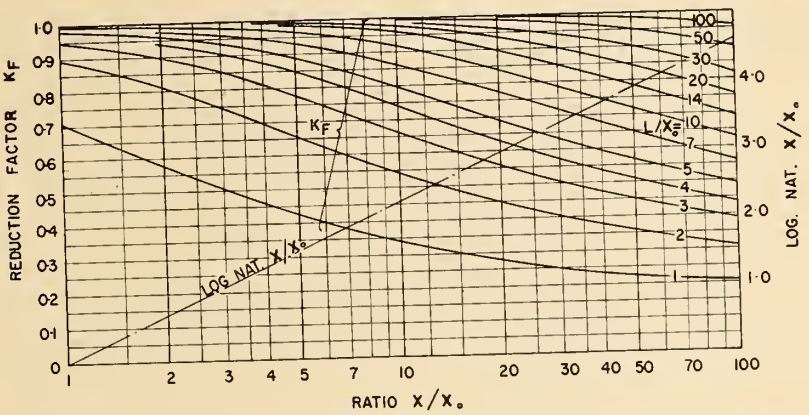

Fig. 23. Reduction factor for moment about O (Fig. 21) for a short bent conductor.

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(For Appendix I, see next page.)

APPENDIX I

PARALLEL CONDUCTORS

$$\begin{cases} K'_F = \frac{1}{2}\left[\dfrac{\left(\frac{L}{2S}+\frac{X}{S}\right)}{\sqrt{1+\left(\frac{L}{2S}+\frac{X}{S}\right)^2}} + \dfrac{\left(\frac{L}{2S}-\frac{X}{S}\right)}{\sqrt{1+\left(\frac{L}{2S}-\frac{X}{S}\right)^2}}\right] \\ K_F = \frac{1}{2}\left[\dfrac{\sqrt{1+\left(\frac{L}{2S}+\frac{X}{S}\right)^2} - \sqrt{1+\left(\frac{L}{2S}-\frac{X}{S}\right)^2}}{\left(\frac{X}{S}\right)}\right] \\ K_M = \frac{1}{2}\left[\dfrac{2\left(\frac{L}{2S}\right)\sqrt{1+\left(\frac{L}{2S}\right)^2} + 2\sinh^{-1}\left(\frac{L}{2S}\right) - \left(\frac{L}{2S}-\frac{X}{S}\right)\sqrt{1+\left(\frac{L}{2S}+\frac{X}{S}\right)^2}}{\left(\frac{X}{S}\right)^2} + \right. \\ \left. + \dfrac{-\left(\frac{L}{2S}+\frac{X}{S}\right)\sqrt{1+\left(\frac{L}{2S}-\frac{X}{S}\right)^2} - \sinh^{-1}\left(\frac{L}{2S}+\frac{X}{S}\right) - \sinh^{-1}\left(\frac{L}{2S}-\frac{X}{S}\right)}{\left(\frac{X}{S}\right)^2}\right] \end{cases}$$

$$\left(K'_F\right)_{\frac{X}{S}=0} = \left(K_F\right)_{\frac{X}{S}=0} = \left(K_M\right)_{\frac{X}{S}=0} = \frac{\left(\frac{L}{2S}\right)}{\sqrt{1+\left(\frac{L}{2S}\right)^2}}$$

END OF A LONG PARALLEL CONDUCTOR

$$\begin{cases} K'_F = \frac{1}{2}\left[1 + \dfrac{\left(\frac{X}{S}\right)}{\sqrt{1+\left(\frac{X}{S}\right)^2}}\right] \\ K_F = \frac{1}{2}\left[1 + \dfrac{\sqrt{1+\left(\frac{X}{S}\right)^2}-1}{\left(\frac{X}{S}\right)}\right] \\ K_M = \frac{1}{2}\left[1 + \dfrac{\sqrt{1+\left(\frac{X}{S}\right)^2}}{\left(\frac{X}{S}\right)} - \dfrac{\sinh^{-1}\left(\frac{X}{S}\right)}{\left(\frac{X}{S}\right)^2}\right] \end{cases}$$

$$\left(K'_F\right)_{\frac{X}{S}=0} = \left(K_F\right)_{\frac{X}{S}=0} = \left(K_M\right)_{\frac{X}{S}=0} = \frac{1}{2}$$

BENT CONDUCTORS.

$$\begin{cases} K'_F = \dfrac{1}{\sqrt{1+\left(\frac{X}{L}\right)^2}}, \quad (x > x_0) \\ K_F = \dfrac{\operatorname{LOGN}\left[\left(\frac{X}{X_0}\right)\dfrac{\left(\frac{L}{X_0}\right)+\sqrt{1+\left(\frac{L}{X_0}\right)^2}}{\left(\frac{L}{X_0}\right)+\sqrt{\left(\frac{X}{X_0}\right)^2+\left(\frac{L}{X_0}\right)^2}}\right]}{\operatorname{LOGN}\left(\frac{X}{X_0}\right)} \\ K_M = \dfrac{\operatorname{LOGN}\left[\left(\frac{X}{L}\right)+\sqrt{1+\left(\frac{X}{L}\right)^2}\right]}{\left(\frac{X}{L}\right)} \end{cases}$$

$$\left(K_F\right)_{\frac{X}{X_0}=1} = \frac{\left(\frac{L}{X_0}\right)}{\sqrt{1+\left(\frac{L}{X_0}\right)^2}}$$

CONDUCTORS AT 90 DEGREE CROSS-OVER.

$$\begin{cases} K'_F = \dfrac{\left(\frac{X}{S}\right)\left(\frac{L}{S}\right)}{\left[1+\left(\frac{X}{S}\right)^2\right]\sqrt{1+\left(\frac{X}{S}\right)^2+\left(\frac{L}{S}\right)^2}} \\ K_F = \dfrac{\sinh^{-1}\left(\frac{L}{S}\right) - \sinh^{-1}\left[\dfrac{\left(\frac{L}{S}\right)}{\sqrt{1+\left(\frac{X}{S}\right)^2}}\right]}{\left(\frac{X}{S}\right)} \\ K_M = \dfrac{2\left(\frac{L}{S}\right)\operatorname{LOGN}\left\{\dfrac{\left(\frac{X}{S}\right)}{\sqrt{1+\left(\frac{L}{S}\right)^2}} + \sqrt{1+\left[\dfrac{\left(\frac{X}{S}\right)}{\sqrt{1+\left(\frac{L}{S}\right)^2}}\right]^2}\right\}}{\left(\frac{X}{S}\right)^2} + \\ - \sin^{-1}\left\{\dfrac{\left[\dfrac{\left(\frac{L}{S}\right)^2-1}{\left(\frac{L}{S}\right)+1}\right]\left(\frac{X}{S}\right)^2 - 1}{\left(\frac{X}{S}\right)^2+1}\right\} - \frac{\pi}{2} \\ + \dfrac{}{\left(\frac{X}{S}\right)^2} \end{cases}$$

$$\left(K'_F\right)_{\frac{X}{S}=0} = \left(K_F\right)_{\frac{X}{S}=0} = \left(K_M\right)_{\frac{X}{S}=0} = 0$$

$$\begin{cases} \left(K'_F\right)_{\frac{L}{S}=\infty} = \dfrac{\left(\frac{X}{S}\right)}{1+\left(\frac{X}{S}\right)^2} \\ \left(K_F\right)_{\frac{L}{S}=\infty} = \dfrac{\operatorname{LOGN}\sqrt{1+\left(\frac{X}{S}\right)^2}}{\left(\frac{X}{S}\right)} \\ \left(K_M\right)_{\frac{L}{S}=\infty} = \dfrac{2\left(\frac{X}{S}\right) - \sin^{-1}\left[\dfrac{\left(\frac{X}{S}\right)^2-1}{\left(\frac{X}{S}\right)^2+1}\right] - \frac{\pi}{2}}{\left(\frac{X}{S}\right)^2} \end{cases}$$

$$\left[\frac{K'_F}{\left(K'_F\right)_{\frac{L}{S}=\infty}}\right]_{\frac{X}{S}=0} = \left[\frac{K_F}{\left(K_F\right)_{\frac{L}{S}=\infty}}\right]_{\frac{X}{S}=0} = \left[\frac{K_M}{\left(K_M\right)_{\frac{L}{S}=\infty}}\right]_{\frac{X}{S}=0} = \frac{\left(\frac{L}{S}\right)}{\sqrt{1+\left(\frac{L}{S}\right)^2}}$$

These formulae correspond to following figures:

Parallel cond.: Figs. 3, 4, 5.

End of long parallel cond.: Fig. 8.

Cond. at 90°-cross-over: Figs. 14, 15, 16.

Bent cond.: Figs. 22, 23.

Prestressed Concrete Applied to Roof Joists

by

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This paper, presented at the Halifax annual meeting in May, 1953, calls attention to some of the discrepancies between theory and practice in prestressed concrete design and construction, as well as giving a detailed description of a particular job. The author offers a tentative explanation for some of the observed peculiarities of behaviour of this relatively new material. His explanation has been favourably received, but as yet lacks experimental confirmation.

The Hydro-Electric Power Commission of Ontario, being a large user of concrete, is, of course, interested in the possible economies of prestressed concrete. The Commission's Consulting Engineering and Research Divisions have been acquainting themselves with this type of construction for the past four years. Several experimental projects have been carried out with a view to learning more about prestressing.

The first real opportunity to get actual field experience, even on a relatively small scale, came late in 1951. An extension was to be added to the Commission's service garage at its large service centre just outside Toronto. This was at a time of critical steel shortage, so the Commission decided to make use of its stocks of Bailey bridging for the main frame. The size and spacing of the supporting members being thus predetermined, it was necessary to keep the roof construction as light as possible to avoid costly changes to the steel. At first, prestressed channel slabs were considered; though these would have proved structurally successful, they had three drawbacks:

1. While considerably lighter than ordinary reinforced concrete slabs, they still weighed about 30 lb./sq. ft.
2. Their manufacture required the installation of a somewhat elaborate prestressing bed, the cost of which would have been too high for this single project.
3. Operations would have had to be carried out in winter and the placing of concrete would have necessitated special precautions, thus limiting the possible locations of any prestressing bed.

The Commission was much interested in the work done in the United States with concrete blocks and anchored cables. However, the cost of 4,800 anchors for the 1,200 joists required would have been prohibitive because of the relatively short lengths of the beams.

It was finally decided to combine the advantages of bonded prestressing with the use of concrete blocks. The joists are made up of 8-in. blocks of a modified I-section, which can be produced on block machines. Spaced at 24 in. apart, the joists support a light wooden deck protected from fire by a sprayed asbestos insulation. Each joist consists of 26 blocks mortared together end to end, and tied with pre-

Fig. 1. Typical blocks used in manufacture of joists.

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Fig. 2. Stressing end of bed.

stressing cables grouted in grooves cast in the blocks (Fig. 1). Only six tons of steel were required for the 1,200 joists used.

Before production began the Commission's Research Division, together with its Consulting Engineering Division, undertook a program investigating many aspects of the design and construction. The following points were studied:

1. The effect of the cable-lay on the bond.
2. The type of mortar to be used for grouting the cables.
3. The type of mortar to be used between the blocks.
4. The strength and elasticity of the prestressing cable.
5. The strength of the blocks as received from the block plant.

In addition as an over-all check on the design and manufacture, measurements were made of the cable and concrete stresses, the deflection, and the ultimate load sustained by a number of complete beams. L. Schenker, M.E.I.C. formerly of the Research Division staff, was responsible for an interesting analysis which confirmed the design assumptions.

Considerable research and testing were necessary to produce a grout which would develop a good bond with the prestressing cables at an early age. Workability and minimum shrinkage were also important factors. Eventually a combination of an aluminous cement grout and a cable with a 3¼-in. lay were recommended; this combination provided the required bond within 15 hours.

There was some difficulty encountered in maintaining the required block strength, but close co-operation between the Commission and the manufacturer provided blocks of reasonably uniform quality. There was little difficulty in obtaining wire of the proper specifications. Its ultimate strength was over 200,000 p.s.i. and it was processed into five-strand cable, consisting of four 0.135-in. wires around a 0.057-in. core.

Nine complete beams were tested to destruction; stresses in four were measured by means of strain gauges attached to the concrete. Results indicated that the bond between cables and grouting was satisfactory.

After the testing program had proved the adequacy of the design, production was started by the Commission's Construction Division under joint supervision of the Consulting Engineering Division and the Research Division. A special enclosure near the site of the building was erected, since the work was to be done in winter. Assembly and prestressing were carried out on six tables, each about 125 ft. in length. Twelve beams were produced simultaneously on each table at the rate of 36 per day, the production cycle lasting 48 hours.

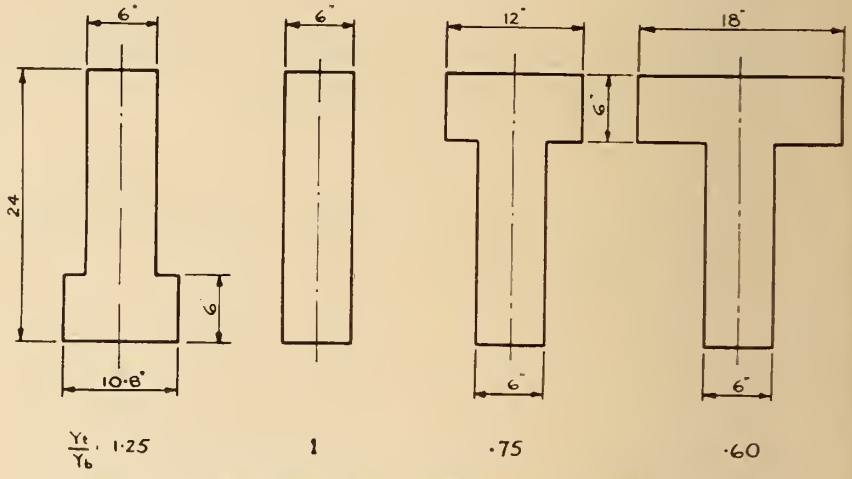

Fig. 4. Typical shapes and corresponding symmetrical ratios.

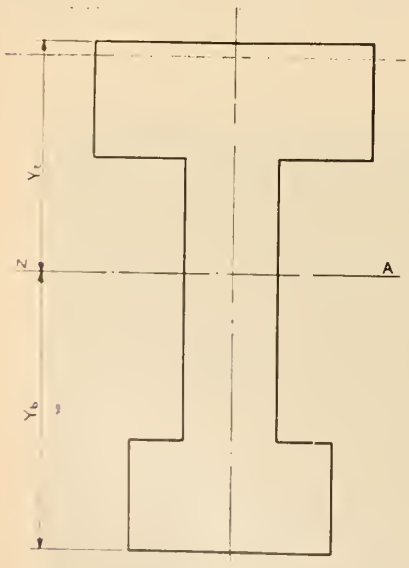

Fig. 3.

The manufacture consisted of:

1. Mortaring the blocks together.
2. Curing the mortar for several hours.
3. Placing the steel cables in the grooves and swaging metal sleeves on each end.
4. Gripping the cables at the sleeve and tensioning them with a hydraulic jack, the load being then transferred to screw jacks. Stressing was done against the beams themselves as shown in Fig. 2; thus no heavy external abutments were required.
5. Filling the cable grooves by means of a mortar gun.
6. Vibrating along the cables to

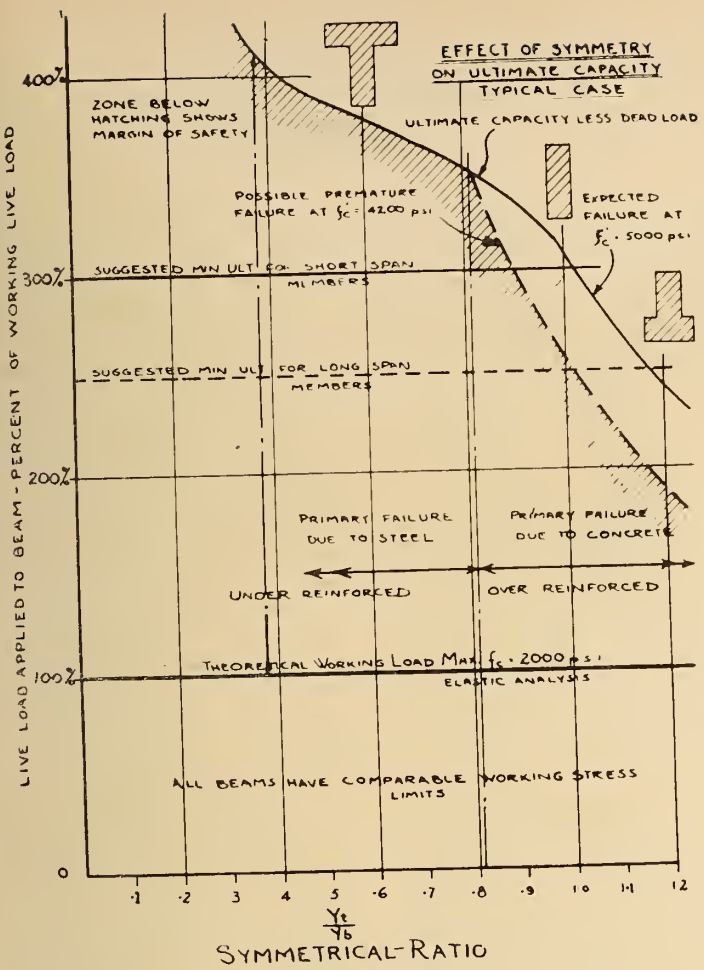

Fig. 5.

ensure that the grout flowed freely into the grooves.

7. Removing excess grout and covering with a compound to delay drying.
8. Curing for 15 hours.
9. Slackening off the screw jacks and separating the beams by cutting the cables.

It should be noted that between successive beams there was a reusable metal hinge to control secondary stresses. At the ends an external moment was introduced in order to raise the center of gravity of the prestress prior to grouting of the cables. This had the effect of raising the lower flange stresses at a critical stage of the operation. A 2-in.-by-4-in. nailing strip was strapped to the top of each beam and it was then ready for erection.

The scheme adopted had the following advantages:

1. The weight of the joists and roofing was low, only 18 lb./sq. ft.
2. No expensive prestressing bed was required, though this advantage was offset to a certain extent by the cost of block dies.
3. It was possible to do the work inside an existing building.

It would not be fair to say that everything always went smoothly. Much was learned from construction operations; from the experience obtained it should be possible to repeat them to compete with other forms of construction. The following are some of the points that emerged:

1. A sufficient number of dies was not provided to fill the block moulding machine completely, only one-third of its pallet being in use. This turned out to be false economy, since it led to breakage of dies and slower production than anticipated.
2. Working stresses were within the usual limits and, while the factor of safety was satisfactory, it would have been better if it had been somewhat higher, in view of the nature of the product. Stricter control than normal was thus necessary and this affected costs adversely. It would have cost only a few cents more per beam to have doubled its ultimate strength and that would have done away with the necessity of large scale production proof-loading. This was perhaps the most important lesson of all. In prestressed concrete work one should think not merely in terms of either working stresses or ultimate load, but realize that the relationship of the one to the other is to a great extent dependent upon the shape and symmetry of the section used. It may be readily demonstrated that, using this principle, the cost of structures can actually be reduced, while at the same time their ultimate strengths can be increased. Limit design is a necessary adjunct to elastic design in the case of prestressed concrete.
3. The beam spacing should be greater in future, as with this type of joist the cost of making units twice as strong is only slightly greater than for the present design. It is a good principle to use as great a joist spacing as practicable. In this case lack of familiarity bred caution. The close spacing was considered wise since the procedure was untried. The deck would act as bridging, allowing for any possible understrength beams. Such a pre-

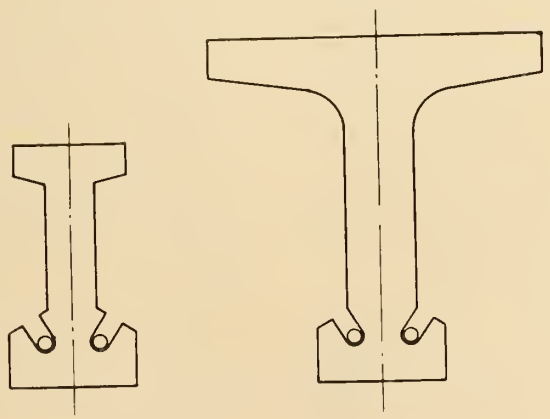

Fig. 6.

caution is no longer considered necessary.

4. The wood deck was an unfortunate necessity, as time did not permit the development of the thin roof slabs originally planned. Such slabs (1 in. thick) have since been developed and are now being considered for use as covers for cable trenches in switching yards, as well as in larger units where economy and suitability permit.

New features of the design were thoroughly investigated by the Commission's research engineers. An extensive program of testing was carried out to check the safety of the joists. The Commission's research panel on prestressed concrete took advantage of the project to obtain valuable data. One of the most interesting results was the conclusion reached in a report by Leo Schenker, formerly of the Research Division staff, that the strain gauge measurements verified the assumption that up to the cracking load, prestressed concrete, even when made up of individual concrete units, does in fact behave as a perfectly homogenous material. About 14 full scale flexure tests were carried out by the Research Division and over 40 beams were proof-loaded at the time of erection. This program added a considerable cost burden to the project; in future such an expenditure should not be necessary. In fact, it is to be deplored that where prestressed concrete follows already proven procedures, there is a tendency to "test", just because it is prestressed concrete. Expensive test programs should not be necessary, unless a new process is involved, some specific research data is required, or there is real doubt as to the adequacy of a particular member.

The lesson learned by this experience is one that has fully justified the Commission's approach to the use of prestressed concrete. Even if little or no saving was achieved on this initial application, the work done has been justified, since information has been obtained that should enable the Commission's engineers to save in the future many times the amount spent on this relatively small project.

The greatest question arising from the project was why a beam, which had generally accepted working stresses at working loads, should have only just made the grade on the score of ultimate capacity. Errors in calculations could be ruled out, since the strain gauges checked the theoretical design well. After some hard thinking about the problem, it was realized that an important factor had been previously overlooked. This, as far as is known, has not been covered in the present literature on prestressed concrete.

The author has developed a theory which explains the behaviour of these beams. It is still his personal opinion and requires checking experimentally. It is mentioned here in view of its importance in the design of prestressed concrete.

Given acceptable working stresses for a beam, one is accustomed to taking for granted a reasonably constant margin of safety, that is, the extra carrying capacity over and above the live plus dead loads. However, an examination of the results of tests carried out by the Commission and by other bodies showed a remarkable inter-relation between the symmetry of a prestressed concrete beam and its margin of safety, provided that the working stress limits for steel and concrete at working loads are the same for all the beams. As a measure of symmetry the term "symmetrical ratio" has been adopted. Fig. 3 illustrates what is meant by this term. Fig. 4 shows symmetrical ratios for typical beams, and Fig. 5 shows the effect of the symmetrical ratio on the ultimate capacity of beams for a typical case.

The theoretical working load, of the beams of the previous figure, as determined by elastic analysis, has been calculated. The calculated expected ultimate capacity is shown, expressed as a percentage of the working load. This chart applies only to the examples chosen; other cases would result in the shifting of the curves.

It must be emphasized that this chart is merely representative of one series of beams. It is meant to illustrate a point and is not intended as a basis of calculation in itself, though it is hoped that further study and experimental research will provide data to simplify calculations.

While all the beams have the same maximum working stresses they do not have the same ultimate capacities. The beams with a symmetrical ratio of less than 0.8 have safety factors much larger than usually necessary. The beams with a symmetrical ratio of more than 1.1 have safety factors that are marginal for most purposes and inadequate for some.

Of even more importance is the type of failure. The beams with low values of β will have a gradual failure with plenty of warning before collapse. The failure will be due primarily to the steel. On the other hand, the higher values of β will result in beams with the sudden-failure characteristic of concrete cylinders. Little or no warning will precede the collapse. There is no question which type of failure is more desirable; many authors, including Whitney, Jensen and Hognestad, have emphasized the importance of the mode of failure.

It is easier to ensure adequate steel strength than concrete strength. When the failure is due primarily to the steel, the usual concrete strength variations will have little effect, the capacity of the beam may be predicted fairly accurately and will be uniform over a large number of tests. When the failure is primarily due to the concrete, the capacity will vary in direct proportion to the variations in concrete strength, and a wide scatter of test results may be expected. It is therefore usual to provide a greater safety factor against a concrete failure than against a steel failure.

In the range of steel failures, the odd cylinder may drop to as low as 85 per cent of specified strength without materially affecting test results. But such a reduction in strength would have serious consequences in the range of concrete failures.

This is one of the many places where theory and practice must be tightly interwoven in prestressed concrete. Contractors can produce 5,000-lb. concrete easily and have produced 8,000-lb. concrete. However, the higher the specified concrete strength, the greater the cost and the greater the possibilities of delays and rejections. It can be easily seen that the need for high strength concrete and rigid tolerances is much greater with high values for the symmetrical ratio than it is for low values.

The beams produced for this project were in the range of high symmetrical ratio (1.25) which suited the adopted working stresses well. The beams were designed in accordance with accepted practice and there was no reason to expect trouble. However, events proved that strict field control measures were necessary to ensure an acceptable minimum strength for the beams.

Fig. 6 shows a cross-section of the original beam, with suggested revisions in proportions and spacing.

This does not mean that working stresses should be abandoned as a basis of design. These are important

(*Continued on page 1216*)

Characteristics of the Electric Space Heating Load in the Province of Quebec

by

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This article introduces some new aspects to the subject of space heating with electricity. By use of load regulators, demand can be held far below the possible maximum demand due to heating load superimposed on the domestic load.

Thus the capital investment is proportional to the incremental demand only, rather than to the heating capacity installed. The load regulator, combined with individual thermostats, makes controlled electric space heating a profitable load for the utility.

The heating of homes by electricity, where individual room heating units and thermostats are used combined with load regulators, presents resultant load characteristics vastly different from that obtained with central furnaces equipped with heater elements, as was done 20 years ago.

To demonstrate these new characteristics, recording demand meters were installed during the 1952-53 heating season, on four installations in the Province of Quebec. It had also been intended to study the diversity at the transformer, of a group of houses heated by electricity. However, because such a group of houses connected on the same transformer does not exist, so far as is known, in the Province, that project was postponed.

This paper discloses the facts pertaining to each test, with comments, followed by an economic study based on the analysis of electrical bills of representative installations, operated for more than one year.

The installation of the recording demand meters and replacement of charts was done by "Power Survey and Equipment Co." of Montreal. For the tests made in Montreal and Chateauguay, the daily outside maximum and minimum temperatures were used, as compiled by McGill Observatory in Montreal.

For the Ste. Adele test, the outside temperature was read twice a day, viz., in the forenoon and late in the evening, so that the readings corresponded approximately with the maximum and minimum temperatures for the day. This information was provided by the Gatineau Power Co. in Ste. Adele.

Tests were conducted at the following places:

1. A residence in Ste. Adele, Que.
2. A residence in Chateauguay Heights (15 miles from Montreal).
3. A residence in Outremont, Que.
4. A typical flat of a duplex in Montreal.

Test at the Ste-Adele House

The Ste. Adele house is a two storey cottage without a basement (cubical content 10,500). The total house load is as follows:

1 Electric range	9.0 kw.
1 Hot water heater	1.5 kw.
14 Electric heating panels of 1.0 kw. each	14.0 kw.
Lights and appliances	3.0 kw.
Total load	27.5 kw.

In it were installed for the test:

1. An instantaneous recording demand meter on the total house load for a period of two weeks, January 17 to January 31, 1953 inclusive. A part of the graph only is reproduced in Fig. 1. Since the pattern repeats itself indefinitely, it was unnecessary to reproduce the whole chart.
2. A Thermal demand recording meter, having the same time lag action as those used by Power companies for billing purposes.

The graph in Fig. 1 shows the effect of the load regulator (C.T. Control). It is seen that at a specific time (9:00 p.m. on Saturday, January 17) the demand reaches a sharp peak of 15.8 kw. The load regulator being set at 12.0 kw., trips a part of

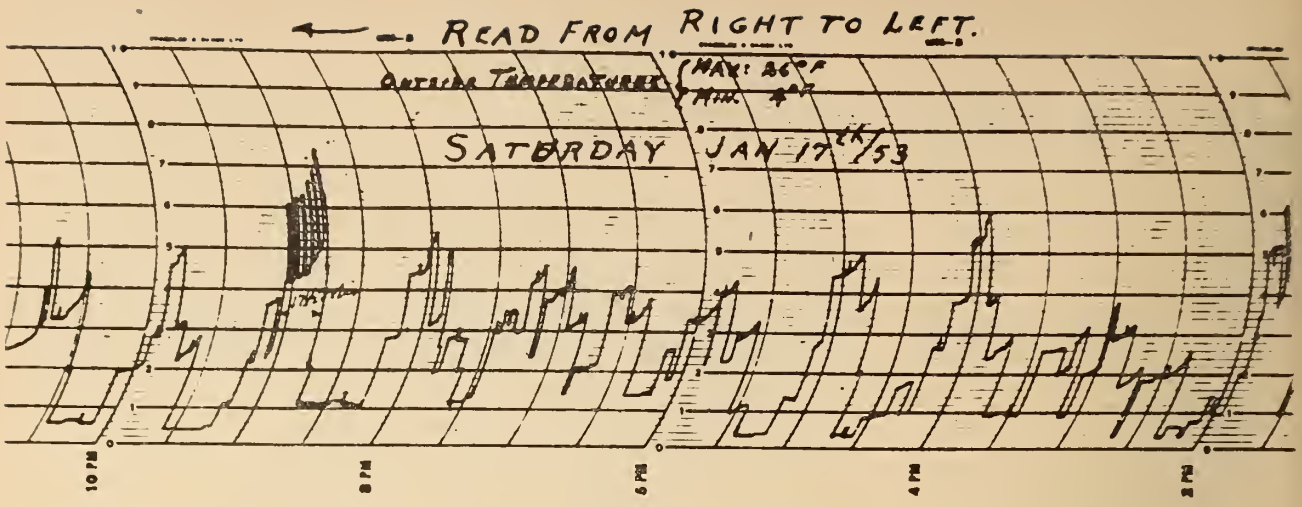

Fig. 1. Graph of the total load, at the Ste. Adele house, obtained with instantaneous demand meter.

the heating load and the hot water heater to 110 volt.

Momentary reductions of the heating capacity (during a 17½ minute period, as noted on the chart) do not affect the comfort by lowering the inside temperature, as might be expected, since the graph shows that in the following 30 minute period there was no heating demand.

The Thermal demand meter was installed in order to ascertain the effect of the demand fluctuations, due to the thermostats on a meter of the type used by power companies. The graphs show that the demand is not continuous, even in such cold weather as 20 degrees below zero, indicating that a diversity remains possible.

The important finding from this test is that, by the use of a load regulator, the demand was successfully held at 12.0 kw. when the possible maximum demand could easily have reached 17 or 18 kw. As the non-heating load demand is 7.4 kw during the summer months, the responsibility of the heating system, or the incremental demand created, is only 4.6 kw. to serve 14 kw. of heating load.

Test on a House in Chateauguay

This is a well insulated bungalow type house, measuring 40 ft. x 21 ft., exclusive of garage and breezeway. Seven electric heating panels are installed on the main floor, and three 1,400 watt convector heaters in the basement. The total heated space is 20,030 cubic feet.

The test was conducted for two weeks — from February 21 to March 9, 1953. Three recording demand meters were installed on the total load — the non-heating load and the heating load. The total connected load includes:

1 Electric range	10.0 kw.
1 Hot water heater	3.0 kw.
The heating load	11.2 kw.
Lights, pump, appliances	3.0 kw.
Total load	27.2 kw.

The load regulator (C.T. control) was set to trip 8.2 kw. of heat and 3.0 kw. of hot water heater to 110 v. when the demand exceeded 9.0 kw. The highest peak recorded during the test period was 9.2 kw., which occurred on a Sunday morning at 10:00 a.m. The heating demand at that time was 4.3 kw., and the domestic demand, due to the oven operation, was at 4.9 kw. Outside temperature was approximately 20 degrees F.

This clearly demonstrates that, by installing load regulators, we prevent the heating load from superimposing completely on the domestic load. The result is that the capital investment on the part of the power company is not proportional to the heating capacity installed, say 11.2 kw. in this case, but it is proportional to the incremental demand only. Further, as this incremental demand is created in the winter season, it can be more easily taken care of as the current carrying capacity of conductors, and transformers can safely be increased to 150 per cent of their summer time capacity. The non-heating or domestic demand is rather low at this house. This is explained by the fact that only two persons are living in the house.

A Residence in Outremont, Que.

The question now arises as to what happens in the all-electric house, where every operation in the kitchen and the laundry room is done electrically, and where there is a family of 7 or 8 persons. To learn the answer to this operation, reference is made to test number "three".

For this test, made in a residence in Outremont, the measured domestic load includes:

1 Electric range	15.0 kw.
1 Clothes dryer	5.0 kw.
1 Automatic dishwasher	
1 Automatic washing machine, lights, appliances	3.0 kw.
Total domestic load	23.0 kw.

There is also a gas hot water heater in this case.

We see that the domestic load went as high as 11.6 kw. on Friday, and that the normal peak is 8.8 kw. at meal times. Our intention in reproducing this chart was to demonstrate that such a peak as 10.0 kw. is not unusual in the modern house. It would seem quite evident that the capital investment necessary to take care of such a domestic load is greater than that required for the house in Chateauguay.

It is interesting to note which of these two clients: a) consumes more electricity during day and night; b) which has a higher rate due to the demand charge, and c) which supplies more revenue to the power company, in relation to capital investments.

Test on a Typical Residence in Montreal

In Montreal, a test was conducted in a lower flat of two adjoining duplexes located in the northeast part of the city. The "duplex" arrangement is common in Montreal, and the facts that there are only three walls exposed, and that there is no heat-loss from the ceiling makes it easier to heat. The four flats are electrically heated, and it would have been interesting to measure the simultaneous demand in order to establish the diversity.

Unfortunately, the four loads are connected to two transformers. The test could be realized at a lower cost by the power company serving the area. The total connected load is made up of:

8 Electric heating panels..	8.0 kw.
1 Electric range.....	9.0 kw.
1 Hot water heater.....	3.0 kw.
Lights and appliances...	1.5 kw.
Total.....	21.5 kw.

The maximum total load recorded was 7.5 kw. on February 2, when the outside temperature was as low as minus 8 degrees F., as recorded by the McGill Observatory. The total load and heating load only were recorded. By subtraction, the non-heating load is obtainable.

It is interesting to note that as the result of this test, it was found that the heating demand was kept at 5.0 kw. except for very short periods occurring mainly between 9:00 p.m. and 9:00 a.m. The total load chart indicates that the load regulator might have been adjusted to 6.0 kw. instead of 7.0 kw. This would have flattened the curve and thus further improved the load factor.

Economic Study Based on Electricity Bills

A compilation of electricity bills covering the operation of one full year gives the following information:

1. The total revenues that the customer supplies to the utility.
2. The annual total consumption in kwh.
3. The total load maximum demand.
4. The summer months' bills (June, July and August) show approximately the demand and consumption of the domestic load (Electric range, hot water heater, lighting, dryer, refrigerator, etc.). Actually, many utilities have stated that the domestic load reaches a peak in December.

The foregoing information is used to calculate:

(a) The annual utilization factor of the total load.
(b) The annual utilization factor of the domestic load.
(c) The responsibility of the heating load or the incremental demand created by that load.
(d) The annual revenue in dollars per kw. of the domestic load, also the revenue of the total house load.
(e) The profit or loss caused by the electric space heating is obtained by subtracting the non-heating load revenue from the total load revenue.

In Table 1 is shown the results of an analysis of electricity bills of a number of installations that have been operated for more than one year. The number is restricted because the majority of the installations do not cover one full year, having been installed last fall.

The facts obtained from this tabulation are: that the utilization factor of the "all electric house" heated by electricity is surprisingly superior to the utilization factor of the same house not so heated. The only exception to this is the residence in Laval sur le Lac, where 52 kw. of heat are connected. Such a large installation is far from the average.

It must also be noted that the residence in Laval sur le Lac is in a summer resort of large and expensive private residences. It is probably the only house to consume as much electricity in winter time, when all the transformers in the surroundings constitute non-productive capital investment.

The annual utilization factor is always more than doubled in the case of the average house having less than 15.0 heating kw. connected. The incremental demand created by the heating load is quite small if we look at the high consumption that this demand produces. This consumption is: 2,500 kwh. per incremental kw.

Electrical Heating in Florida and Tennessee

Here it is interesting to compare the figures obtained with those of the Florida Power Corporation, as reported by Mr. R. H. Giedd, in a paper entitled "Our Experience with Electric Space Heating". We see that the average house in Florida requires 10.0 kw. of heat (average of 13 houses) and that the average heating consumption was 4.634 kwh. in the 1950-51 season. This means 463 kwh. per kw., against an average of 1,200 kwh. per kw. of connected heating load in the Province of Quebec.

Such a result is exactly in line with a comment of Mr. Giedd when he says: "A comparison of our territory with the T.V.A. area is interesting, in that their normal heating season ranges from 2,800 to 4,200 degree days. Their design temperature differential ranges from 65 degrees to 70 degrees F., whereas, the design temperature for our areas varies from 35 degrees to 45 degrees."

"Thus, although our heating season is from approximately 1/7 to 1/3 of that of the T.V.A., we must provide heating capacity equal to or greater than ½ of theirs. Likewise, due to their greater number of degree days, they can anticipate approximately three to four times more heating kwh. per kw. of heating load than we can in our area."

If the power company in Florida envies the T.V.A. because of its 4,200 degree-days, they have greater reason to envy the power companies in this province, because of our 8,100 degree-days.

Table I also shows that the revenue per kw. is greatly increased when the house is heated by electricity. The increment in revenue is not only due to a better utilization factor; it is also the result of the demand charge $2.00 per kw. per month in excess of 7.5 kw.

We note that the increase in revenue is unduly high in the case of the average size house, approximately $13.63 per kw. while it is quite reduced in the case of a big installation. (There is a decrease of $0.57 per kw. the first year, at the residence in Laval sur le Lac, and an increase of $4.82 the second year.)

Diversity of Heating Load at Transformer

It has been stated in the past that the house heating load does not allow any diversity, and that the apparent increase in revenue is lost along the line, back to the substation. The answer to this is that a test on the diversity of the transformer was conducted during the season 1947-1948 by the Murfreesboro Board of Public Utilities in Murfreesboro, Tennessee. Table 2 gives the results of that test, where 10 electrically heated houses were connected on the same transformer.

The houses are small 5 and 6 room residences, reasonably well insulated and heated by means of individual room-type electric heaters. During the worst conditions, when the outside temperature dropped to —4 degrees F., the diversity

TABLE 1. Analysis of electricity bill for installations that have been operated for more than one year.

	(1) Total yearly consumption kwh.	(2) Total billing for the year $	(3) Total load maximum demand kw.	(4) Total load annual utilization factor	(5) Non-heating load maximum demand	(6) Non-heating load annual utilization factor %	(7) Connected Heating load kw.	(8) Responsibility of the heating load-kw.	(9) Annual revenue in $/kw. of non-heating load	(10) Annual revenue of the total load (heating plus non-heating) $/kw.	(11) Increase in revenue due to heating $/kw.	(12) Heating consumption in kwh. per connected heating kw.	(13) Heating consumption in kwh. per additional kw. of demand
Residence at Hudson Heights, Que													
First Year	28,272	413.34	19.0	17	6.4	16.6	19.0	12.6	$16.40	21.75	$ 5.35	1,092	1,511
Feb. 51 to Feb. 52													
2nd Year	26,760	385.03	16.8	18.2	6.4	16.6	19.0	10.4	16.40	26.92	10.52	922	1,684
Feb. 52 to Feb. 53													
Residence at Ste. Adele, Que.													
First Year	27,510	312.17	12.4	25.1	7.8	8.8	11.0	4.6	10.20	25.17	14.97	1,955	4,674
Sept. 49 to Sept. 50													
Second Year	20,340	298.82	15.0	15.4	8.1	8.6	14.0	6.9	10.30	19.92	9.62	1,024	2,078
Sept. 50 to Sept. 51													
Third Year	19,940	328.16	15.0	15.0	8.1	8.6	14.0	6.9	10.30	21.87	11.57	995	2,020
Sept. 51 to Sept. 52													
Residence at Sabrevois, Que.													
First Year	32,030	449.43	13.0	28.1	4.5	19.2	15.0	8.5	22.80	34.57	11.77	1,670	2,950
Mar. 52 to Mar. 53													
Residence at Laval-sur-le-Lac, Que.													
First Year	76,920	1,243.34	46.8	18.7	—	24.8	52.0	39.0	27.13	26.56	0.57 Loss	1,150	1,540
Oct. 31/51-Oct. 52													
Second Year	77,940	1,289.90	48.0	18.5	7.8 9.6	20.0	52.0	38.4	22.05	26.87	4.82	1,170	1,585
Residence at Roberval, Que.	23,285	281.57	11.5	23.0	7.5	7.3	12.0	4.0	6.90	24.48	17.58	1,540	4,620
Residence at Sorel, Que.	12,688	164.54	8.0	18.5	4.4	8.9	6.0	3.6	13.40	20.57	7.17	1,545	2,560

The annual non-heating consumption is obtained by applying the summer months average (June, July and August) to the twelve months of the year.

of the total load at the transformer was 64.4 percent.

Another similar test was conducted by the Atlantic City Electric Company in Northfield, New Jersey. In this case, the demand was measured on the primary feeders serving a group of 20 houses. The total connected load of 400 kw. was made of 132.2 kw. of space heating and 268 kw. of domestic load. The maximum winter time peak recorded on the primaries was 126 kw. or 31.5 percent of the connected load in January at 6:00 a.m. The non-heating peak is obtained by taking the reading of May 8, at 4:45 p.m., where 60.0 kw. demand was recorded.

This is an average of 3.0 kw. per customer. The difference gives the responsibility of the heating load: 126 kw. — 60 kw. — 66 kw. or 3.3 kw. per customer. The diversity of the heating load is thus — 66 126 — 50 percent. Here again we realize that the heating demand does not superimpose *entirely* to the non-heating load. The increase in revenues is not lost along the line, due to a poor diversity, as was thought and expressed so many times.

Space Heating Increases Revenue

If we compare the results of the Atlantic City test with the results of a test made by the Quebec Hydro in Montreal, we find that the diversity obtained from residential districts where the cooking load is high (no space heating), is not any better than the diversity obtained with electrically heated houses.

This test in Montreal shows that the ratio of the maximum demand at the transformer to the sum of the maximum demands at the houses is not lower than 53 percent. (See the report submitted by Mr. Le Guerrier to the Provincial Electricity Board, in September 1952). The above discussion can be summarized in a simple case, Table 4, where the customer does and does not heat by electricity.

Conclusions

1. It has often been said that electric space heating of houses was not possible in the Province of Quebec because of the unusually high capacity required, and also because of the low revenue of such a seasonal load. The facts and figures contained in this report demonstrate that the average well-insulated house can be heated by adding only 5 or 6 kw. to what is already needed to serve that same house domestically. The annual revenue received from these 5 or 6 additional kw. exceeds by $13.63 (average of 10 cases) the revenue per kw. that

TABLE 2. Results of a test conducted by the Murfreesboro Board of Utilities on a group of ten electrically heated homes (1), served by one 50-kva. transformer.

	Avg. Maximum 30-Min. Demand Per House	Avg. Energy Used Per House	Max. 60-Min. Demand at Trans. Per House	Diversity at Transformer	Lowest Min. Temp. for Period	Degree Days for Period Base 65°F.
September	8.1 kw.	617 kwh.	4.0 kw.	49.5%	42°F	24
October	9.0	762	4.7	52.5%	39	64
November	12.8	2,230	6.8	53.0%	28	538
December	14.9	3,010	7.8	52.3%	19	756
January	15.2	4,158	9.8	64.4%	−4	1,102
February	15.3	2,419	9.6	63.5%	10	673
March	15.3	1,822	8.0	52.2%	23	356
April	12.0	1,178	4.7	39.0%	36	131
May	11.2	580	3.8	33.8%	43	46
June	7.7	491	1.7	22.1%	50	0
July	6.8	486	1.4	21.8%	—	0
August	6.4	450	2.1	33.0%	—	0
TOTAL	—	18,203	—	—	—	3,690

(1) Average Installed Heating Load Per House ..... 12.8 kw.
Average Other Connected Load Per House 12.5

Average Total Connected Load Per House ..... 25.3 kw.

It is estimated that the average installed heating capacity per house is 35% in excess of the amount required for the design temperature at 0°F. These houses are heated with radiant-convection unit heaters.

TABLE 3. The effect on the primary feeders of a large space heating load (132-kw) Test conducted by the Atlantic Electric Co. in Northfield, N.J.

Primary Feeder	A.M. Hours	Reading (F)	P.M. Hours	Reading (F)	Fx 200 kw.	0/0 kw. 400.0
Jan. 30	6:00	.63	—	—	126	31.5
Feb. 1	7:00	.49	—	—	98	24.5
" 14	7:45	.60	—	—	120	30.0
" 15	7:00	.62	—	—	124	31.0
" 25	7:30	.51	—	—	102	25.5
March 1	9:15	.63	—	—	126 (Heavy snow storm)	31.5
" 7	8:15	.58	—	—	116	29.0
" 15	6:00	.52	—	—	104	26.0
" 25	7:45	.43	—	—	86	21.5
" 27	7:15	.45	—	—	90	22.5
Apr. 7	—	—	1:00	.37	74	18.5
" 10	3:00	.37	—	—	74	18.5
" 19	6:15	.40	—	—	80 (Outage of ¾ hr.)	20.0
" 27	—	—	7:00	.37	74	18.5
May 5	—	—	6:15	.27	54	13.5
" 8	—	—	4:45	.30	60	15.0
" 19	6:00	.25	—	—	50	12.5
" 25	—	—	12:45	.24	48	12.0

Connected Load — 132.2 kw. in Space Heating
20 Ranges, 20 Hot Water Heaters, 50 kw. Misc. — TOTAL - 268 kw. } Total 400 kw.

TABLE 4—Comparison of demand, etc., with and without space heating.

	Total Billing for the Year	Demand at the House	Revenue per kw. of the House	Demand at Transformer	Revenue per kw. at Transformer
(A) Without space heating	$100	7.5	$13.33	3.5	$28.57
(B) With space heating	$325**	12.0	27.08	8.4*	38.69
Increase in revenue at the transformer					$10.12

*We use a diversity of 70 per cent instead of 64.4 per cent, as obtained in Murfreesboro, to compensate for colder weather.

**This figure is the actual total billing at the Ste. Adele house, under the Gatineau Power rate.

the power company actually gets from non-heating customers.

2. Among the several new appliances being introduced in the modern house, the heating load is one of the few loads having a consumption that is proportionate to the demand it creates. An equitable rate structure should take into consideration the incremental demand only due to the space heating load, and also the additional consumption during off peak hours, during night and day.
3. In all cases, the graphs show that it is possible to prevent the heating load from being superimposed on the domestic load by using proper load regulators. Therefore, the conclusion can be drawn that it is the load regulator, combined with individual thermostats, that makes the *controlled* electric space heating a profitable load. A special discount in proportion to the increase in revenue should be given to the customer using a load regulator, because he is helping to serve more people with less capacity.
4. As long as the annual load factor and revenues of the electrically heated home are satisfactory, it would seem that power distributors should not discriminate between one kwh. used to dry clothes and one kwh. used to heat objects in space. Until the controlled electric space heating load was introduced, it is interesting to note that some impressions were given that to heat by electricity when other sources of energy, such as wood, coal or oil, are available, was a misuse of electricity. This is manifestly incorrect, as the use of electricity is nationally encouraged to dry our clothes and cook our meals, despite the fact that wood, coal, oil or gas could be used for these purposes.
5. The tests made this year in the Province of Quebec have the same trend as those made in the U.S.A. and other parts of Canada, (viz., British Columbia) except that the results indicate still more remuneration for the power companies, because the average consumption per kw. of incremental demand is still higher due to climate conditions, in the colder areas.

Acknowledgment

The foregoing report was made possible through the co-operation of the Engineering Heating Committee of Glassheat of Canada Limited. √

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

The ASME Boiler Code

Except to the few men still living who took an active part in the development of the ASME Boiler Code, this remarkable segment of the history of the American Society of Mechanical Engineers has been available as a complete story only in the records of the Society.

The long and arduous campaign to establish the Code; the skepticism as to its probable success; the four decades of continuous work by hundreds of engineers; its acceptance by manufacturers, users, insurance companies and government inspection services; and its final adoption and continuous improvement as a vital and up to date document, make up a record of interest and inspiration to the younger generations of engineers.

To the end that the significance and tremendous importance of the ASME Boiler Code should become a matter of permanent record, the ASME Boiler Code Committee enlisted the services of Arthur M. Greene, Jr., who had been closely associated with the Committee almost from its start, to write the history of the Code.

Publication of a series of articles was commenced in the July 1952 issue of *Mechanical Engineering*. To acquaint Canadian engineers with the subject, a digest of these articles is being published in several issues of the *Journal* of The Engineering Institute of Canada.

Golden Anniversary

The South African Institution of Civil Engineers with its headquarters in Johannesburg, celebrated its fiftieth anniversary in September.

The Institute is being represented at the celebration by W. O. MacLaren, M.E.I.C., of Johannesburg. Unfortunately the distance is so great that it was not possible to have an officer of the Institute there to do honour to the occasion.

A message has gone to the Institution on behalf of the Institute and it is published herewith so that, to that extent at least, the members may participate in this notable event.

Gentlemen:

The completion of fifty years of service to a profession is a noteworthy achievement. The celebration of a semi-centennial by the South African Institution of Civil Engineers is an event of importance not only in South Africa but to all engineers.

The president and officers of The Engineering Institute of Canada are delighted to join with engineers everywhere in extending to you congratulations on your past achievements and hopes for your future success.

World conditions today make the work of professional societies increasingly important. Not only do the rapidly increasing technical developments require this type of service more than ever, but the accompanying social changes enlarge greatly the opportunities for service on a personal and on a national basis. Under these circumstances the value of stability and enterprise of societies such as yours cannot be overestimated.

It is on the experience of the past that we build the future. The record of your organization for the past fifty years is a clear indication of the success which will attend it in the future. We, of the Engineering Institute of Canada, hope that we may be privileged to continue our happy association with you throughout the future fruitful years.

Yours respectfully,

R. L. Dobbin, *President.*
L. Austin Wright,
General Secretary.

Cover Picture

The cover picture shows the NRX Reactor at Chalk River, Ont., prior to the breakdown of December 12, 1952. The article on page 1269 of this issue of the *Journal* describes the methods by which the reactor was dismantled and a more powerful reactor reconstructed.—*Photo courtesy Atomic Energy of Canada Limited.*

The Forty-sixth Branch

Friday, September 11, saw another branch inaugurated, another step taken toward the long time objective of fifty branches, another agency established for service to the profession. With Orillia as its centre, the Huronia Branch started its career under excellent circumstances. One hundred members and their ladies assembled at the Fern Cottage Hotel on Lake Couchiching to see the president of the Institute, Ross Dobbin, present the charter to the first chairman, Frederic Alport.

The branch is formed almost entirely out of territory previously included in the Toronto Branch. Therefore it was appropriate that John Hall, chairman of the Toronto branch, should be on hand to wish the newest branch good luck and to offer the assistance of his branch during the teething period and the early formative years. To emphasize greetings from Toronto, he presented a cheque for a substantial sum, and an Institute banner.

Mr. Garth Wade, chairman of the neighbouring Peterborough Branch, presented a lectern which he hoped would aid a long series of speakers to present excellent papers to the branch.

To these greetings, Mr. Alport replied appropriately. He stated that it was his conviction that a branch in that area could do excellent work for the engineers and for the community. He said that the committee was determined to see that the branch made the most of its opportunities.

The president joined the others in wishing the newest member of the Institute family the great success that its sponsors were so confident it would enjoy. He reminded his listeners that this was the occasion of another inauguration as well — his own. This was his first branch meeting and he hoped it was a good omen for him that the two inaugurations should coincide.

Other speakers were past president Stirling, who has taken a special interest in the branch because its charter had been authorized during his presidency, the vice-chairman of the new branch, Ross MacKay, L. G. McNiece, Colonel L. F. Grant and the general secretary.

After dinner, the group moved to the dance hall on the edge of the lake, where the music of an excellent orchestra inspired everyone to "tread a measure" until a late hour.

Council Meets

In the afternoon preceding the inaugural dinner, Council held a

Above: Part of the council meeting, at which 13 branches were represented. Left to right: E. A. Cross, E. R. Graydon, and M. McMurray, Toronto; J. G. Hoba, Windsor; S. Sillitoe, Belleville.

Upper left: J. Herbert Smith, president of the Ontario Association of Professional Engineers, greets the new branch, while Mrs. Alport listens attentively.

Lower left: Head table at the inaugural dinner. Ross MacKay, Mrs J. G. Harvie, A. L. Killaly, Mrs. Stirling, I. R. Tait.

Centre: Mr. Alport receives the charter from President R. L. Dobbin.

Right: J. B. Stirling, Mrs. Tait, L. F. Grant, and Mrs. Ross MacKay.

regional meeting with president Dobbin presiding. A long agenda of interesting subjects was completed in exactly three hours by a group of thirty-five people representing thirteen branches. It was one of the best meetings in a long time, and proved again the wisdom of holding such meetings in different parts of Canada. Those in attendance were: L. F. Grant, Kingston; J. B. Stirling, Montreal; A. E. Berry, Toronto; I. R. Tait, Montreal; P. E. Buss, Thorold; C. R. Davis, Toronto; E. R. Eaton, Sudbury; T. Foulkes, Ottawa; E. R. Graydon, Toronto; A. R. T. Hailey, Peterborough; J. G. Hoba, Windsor; A. S. Rutherford, Montreal; S. Sillitoe, Belleville; E. R. Smallhorn, Montreal; T. G. D. Whillans, Kapuskasing; E. V. Buchanan, London; E. P. Muntz, Hamilton; E. A. Cross and C. F. Morrison, Toronto; H. R. Sills, Peterborough; J. G. Hall, M. McMurray, E. R. Davis, R. H. Self and George Estey, Toronto; C. R. Whittemore, Belleville; G. S. Wade, Peterborough; W. E. Wakefield, Ottawa; F. Alport and H. C. Bates, Huronia Branch; J. Herbert Smith and T. M. Medland, Association of Professional Engineers of Ontario; A. L. Killaly, Peterborough; and J. A. Ogilvie, Toronto.

To the officers of the new branch, the visitors were indebted for many things; first of course the lovely summer weather, then the location of the meeting, but most of all for their friendly hospitality. The idea of having a meeting in a summer resort hotel has been tried before — and usually with success — but the combination of surroundings, weather and people which was experienced on this occasion proved beyond any doubt that such meetings can add something to Institute life that cannot be secured otherwise. It would be interesting to see it tried on many other occasions in many other places.

The Hydraulics Convention

Minneapolis, the site of the University of Minnesota's St. Anthony Falls hydraulics laboratory, was host to the joint convention of the International Association for Hydraulic Research and the Hydraulics Division of the American Society of Civil Engineers from September 1 to 4 last.

Canada has a very special interest in hydraulics, more than that of most countries, what with its great hydro-electric industry, its lesser activities in irrigation and drainage and its impending power and navigation development of the St. Lawrence river, so it is natural that the convention should have been attended by some Engineering Institute members. F. L. Lawton, M.E.I.C., was chairman of a session on sediment transportation and of another on waves, beach erosion and shore structures. T. Blench, M.E.I.C., presented a paper on regime theory equations applied to a tidal estuary, and W. D. Baines and I. D. Smith, of the National Research Council, described a new gauge for the measurement of surface waves. In addition to the sessions presided over by Mr. Lawton, others dealt with density currents and with air entrainment by flowing water.

All papers, by 75 authors from some 20 countries, including Japan and Yugoslavia, were published in full in advance of the meeting in a book of 576 pages with 543 illustrations. Of course, no discussions could be included in such an advance publication; it is to be expected that these will appear separately in due course, as discussion is often the best part of a paper. This volume can be purchased of the secretary, International Hydraulics Convention, St. Anthony Falls Hydraulics Laboratory, Minneapolis 14, Minn., for $6.75.

Dr. Lorenz G. Straub, the president of IAHR, describes the convention as "most successful" and said that the next meeting of the Association will be held in 1955 in Delft, the Netherlands, no doubt with the Rijkswaterstaat providing a good deal of the program.

The just preceding one-day meet- of the section of hydrology of the American Geophysical Union brought some to the convention who would otherwise probably not have attended. Its sessions dealt with such matters as the transmission of water through snow, microbarography, tree growth and rainfall and city drainage.

Relatively small conventions such as this, attended by those whose interests are closely related, seem to be often productive of more useful technical results than the larger, more general, meetings. Perhaps as time goes on, the Institute may be able to increase the number of

Nominees for Office

The report of the Nominating Committee, as accepted by Council at the meeting held on September 11, 1953, is published herewith for the information of all corporate members as required by Sections 19 and 40 of the by-laws:

President .....

President .....

*Zone B (Province of Ontario)	B. G. Ballard	Ottawa
*Zone C (Province of Quebec)	J. O. Martineau	Quebec
*Zone D (Maritime Provinces)	N. B. Eagles	Moncton

Councillors:

†Cape Breton Branch	H. A. Marshall	Glace Bay
†North Nova Scotia Branch	J. L. Cavanagh	New Glasgow
†Moncton Branch	W. D. G. Stratton	Moncton
†Northern New Brunswick Branch	E. C. Bannerman	Bathurst
†Quebec Branch	Georges Demers	Quebec
§Montreal Branch	G. N. Martin	Montreal
	R. B. Wotherspoon	Montreal
†Cornwall Branch	D. Ross-Ross	Cornwall
†Ottawa Branch	J. J. Green	Ottawa
†Peterborough Branch	A. R. T. Hailey	Peterborough
‡Toronto Branch	J. G. Hall	Toronto
†Niagara Peninsula Branch	P. E. Buss	Thorold
†Kitchener Branch	M. A. Montgomery	Kitchener
†Hamilton Branch	N. A. Eager	Hamilton
†Huronia Branch	F. Alport	Orillia
†Sarnia Branch	E. W. Dill	Sarnia
†North Eastern Ontario Branch	C. W. Boast	Kapuskasing
†Sault Ste. Marie Branch	D. C. Holgate	Sault Ste. Marie
†Winnipeg Branch	C. P. Haltalin	Winnipeg
†Saskatchewan Branch	Junius Jonsson	Prince Albert
†Calgary Branch	H. R. Hayes	Calgary
†Lethbridge Branch	J. M. Campbell	Lethbridge
†Edmonton Branch	N. J. Allison	Edmonton
†Vancouver Branch	S. H. de Jong	Vancouver

* One vice-president to be elected for two years.
† One councillor to be elected for two years.
‡ One councillor to be elected for three years.
§ Two councillors to be elected for three years each.

regional meetings, or of get-togethers of those of its members who have similar interests. In any event, it is a good thing for engineers, more often introverts than extroverts, to rub shoulders with their friends — and competitors — whatever increase of technical knowledge may result.

Canadians attending the conference were: W. Douglas Baines, Ottawa, T. Blench, Edmonton, John B. Bryce, Toronto, E. Kuiper, Winnipeg, W. Victor Morris and N. Mudry, Winnipeg, G. W. Parkinson, Regina, E. G. Pleva, London, C. N. Simpson, Niagara Falls, C. D. Smith, Regina, E. W. Vaughn, Toronto, F. L. Lawton, Montreal, R. L. Clinch, Niagara Falls.

Engineering Education's Pains

The Engineering College Administrative Council, made up both of engineering teachers and representatives of industry and operating under the aegis of the American Society of Engineering Education, has sent us a copy of its annual report for 1952-53. A good deal of it covers matters which do not concern us in Canada, such as the effect of compulsory military service on the number of engineering graduates and the means for recruiting aides for foreign assistance programs from among engineering teachers without disrupting college staffs, but there are some parts of it in which we should be interested.

The Council is concerned about the teaching of mathematics and the physical sciences in the secondary schools from which the colleges draw their engineers-to-be. So are we. Only too often do we find that our first-year students have retained little of the teaching in these subjects to which they have presumably been exposed before we get them. Perhaps much of the trouble is the students' own fault, but some of it, this writer is sure, is the result of poor teaching. The Council's remedy? Increase both the number and the standing of secondary mathematics and science research and industry and try to persuade the colleges and universities that they have some responsibilities in this matter.

Summer employment of the kind suggested should do something to orient these teachers. As it is, many of them do not realize that mathematics, physics and chemistry are the basis of all engineering, that the fundamental facts are the really important ones and that it is far more necessary that they give future engineers a sound grasp of these than that they cover a wider, perhaps more attractive field, more thinly. Some experience working with engineers might show the teachers what is important and what is not.

In general, we believe that Canadian engineering faculties keep in pretty close touch with the secondary schools and are always glad to do anything that they can by way of helping with advice on curricula, teaching methods and the like; we do recognize our responsibilities.

In the United States, labour organizations are making a determined effort to unionize engineers. Engineers and Scientists of America claims a membership of some 40,000 and professes to speak for ten times as many. It maintains an active lobby in Washington and plans to establish chapters in the colleges. The prospect of collective bargaining, therefore more pay and "better working conditions", a phrase which generally means less work, is probably the bait which attracts the younger engineer to this and similar organizations.

Naturally, the colleges and the national engineering societies regard engineers as professional men, not as mere artisans, and hence are as bitterly opposed to any such unionization as is the Institute. It is argued that union methods as we know them would strangle initiative, lead to the regimentation of the individual, to the typing of positions and the levelling of salaries, damage and perhaps destroy professional prestige and stifle advancement and recognition. Judging from what one hears of goings on in the union world, it could do all of these and more.

No unprejudiced engineer denies that the unions have done much that needed to be done for their members, but to the same engineer there is much that is unlovely in the union picture—wildcat strikes, violence, shakedowns, a callous disregard of the rights of the public and the general attempt to "soak" employers by demanding higher and higher wages for less and less work, a process that, if not halted, will result in lower rather than higher living standards for workers. When labour has cleaned house so that all unions are as well and intelligently led as are the best of them now, then it may be that they can attract engineers who are a much more canny and wise lot than their present membership.

The unionizing of engineers has not made much progress in Canada, though a few attempts have been made to stir up enthusiasm for it. We are fortunate in having in Canada a single national society, which any qualified engineer may join, no matter what his specialty. It has on many occasions represented the profession, when the national point of view was required. Its relations with the smaller specialized groups are excellent, partly because of widely overlapping membership.

The Administrative Council's appraisal of the employment situation for engineering graduates for the next few years is proportionately much like our own, although compulsory military service enters into the United States picture, but not into Canada's. Shortages of graduates are expected for some time to come. These may be partly reduced by the larger number of students entering engineering courses, attracted no doubt by the prospect of immediate and well-paid employment on graduation. One wonders if quality may not fall off. A boy who studies engineering merely because it promises a good living is less likely to be markedly successful than the one who chooses an engineering career because it is the one he is sure he wants to follow and for which he has the talent. Time will tell. Industry can always find a place for the less brilliant, but the effect on the less brilliant of failing to advance may not be happy.

The report discusses briefly the perennial question of how to improve engineering teaching. Many ideas, none of them novel, are presented, among them good leadership, a scholarly environment, adequate salaries, opportunity for research and for consulting practice, satisfactory living accommodations and the possibility of promotion.

Rating of teachers by both colleagues and students is recommended as useful. No doubt it is, if tactfully carried out, but it may result in heartaches or worse. This writer has been rated a number of times during his 40 years' teaching experience and survives; perhaps he is tougher than the average. Much of the comment of his raters was useful, some of it piffle.

Rating implies a rating scale. One suggestion awards 13 points out of a total of 36 for activity in research and for publication of technical papers. This seems out of all

proportion. We can all remember among our teachers, the very best, those who had no interest at all in research or writing. The three most highly-rated of the writer's colleagues were teachers, first and last, not research workers nor authors. Such overemphasis on research and writing leads but to the waste of time that could be used to better advantage in some other way. And it leads to half-baked theses and superficial articles, of which it has been the writer's misfortune to have to read too many.

As to the accrediting of engineering courses to see that they reach minimum degree standards, the report says little, other than that it would like to see standards raised. Accrediting has been carried out in the United States for many years, but the idea has not met with much favour in Canada nor does it seem likely to. The relatively few Canadian engineering schools do not find it hard to follow one another's developments and to maintain high standards. That they have been reasonably successful is shown by the readiness of United States employers, accustomed to accredited courses, to accept Canadian graduates.

On the whole, the report makes one feel happy that in Canada we are not beset by some of their difficulties nor are we likely to be, and gratified that many of those which bother us now or may bother us in future, are being so carefully studied.

The National Industrial Design Council

In view of its extended activities and the more permanent nature of its functions, the National Industrial Design Committee, which has now been in existence for five years, has been authorized to use the title "Council" in future. From July 1953 on it becomes The National Industrial Design Council, with headquarters in the Design Centre, Ottawa.

It still, however, maintains its link with the National Gallery of Canada, through which it receives its principal funds to promote industrial design in Canada. It also receives additional support from industrial groups and manufacturers.

The most important activity of the Council is its promotion of Design Awards, which go to products judged to be the most outstanding in design during the year. Entries are now being submitted by manufacturers for judging by the NIDC for the 1954 awards.

The 1953 Awards were announced last March and the 46 products were then given the right to carry prestige labels certifying this fact. These red "Merit Award" tags are now being widely displayed in retail stores throughout Canada where these products are on sale.

Objectives and Award Conditions

The Council's objective is to encourage better design in Canadian manufactured products, by granting suitable recognition through design awards, and giving publicity across Canada, both to manufacturers and producers whose products are selected as outstanding, and to designers whose designs, as produced, are selected each year as outstanding. The Council thus fosters competition amongst Canadian producers for design recognition as a promotional and advertising aid in their sales, and encourages the increased use of Canadian designers.

Design awards are limited to consumer goods produced in Canada for personal, household or office use, articles submitted must be for the most part manufactured (not merely assembled) in Canada, and must have been first marketed within the eighteen months prior to January 31 each year, and be currently available to the public through normal distribution channels. No awards for 1954 are to be given for articles of clothing, personal adornment, or graphic arts or products for industrial transportation or agricultural use such as machinery, heavy equipment, etc.

The basis for selection is that the articles judged must be pleasing in appearance, suitable for their purpose, simple and useful, suitable for the Canadian market, and must embody basic improvement on traditional design.

History of NIDC

The Industrial Design Division of the National Gallery of Canada was formed in June 1947. Parliament voted money for setting up a photographic and information record to serve as a permanent archives of the work of Canadian industrial designers and as a source of photographs for articles and publicity.

After the first exhibition in 1947-1948, and after the establishment of the Central Information Office at Ottawa, the National Industrial Design Committee (NIDC) was formed as a representative co-ordinating group drawn from industry, retail trade, research and educational organizations.

Its functions are to advise governments in industrial design; to develop new projects in co-operation with industry and education, and to help co-ordinate projects in industrial design and to give advice, on request, to industry and other organizations.

Fifteen scholarships for Canadian industrial designers have been set up at post-graduate level for study in the United States and Britain. A four-year product design course in industrial design studies has been introduced in the summer school of the University of Western Ontario. Film strips for use in technical schools and universities have been made by the National Film Board. Representative books on industrial design, as well as selections of photo displays, have been widely distributed to public libraries.

The first NIDC exhibition was the "Design Centre", erected in 1948 at the Canadian National Exhibition in Toronto, which was later re-erected in Montreal and Ottawa. Other public exhibitions have since been held in Vancouver, Winnipeg, Windsor, London, Edmonton, Calgary and Ottawa, as well as at many communities on the Western Canadian Art Circuit and the Maritime Art Circuit, and at the Universities of Manitoba, British Columbia, and McGill. More specialized presentations in trade showings were given at the International Trade Fair, Brandon Trade Fair, Canadian Furniture Mart, and National Home Show in Toronto, as well as to trade associations at various annual conventions.

A permanent centre for displaying Canadian designs of merit was opened in Ottawa in February 1953, on Elgin Street. Known as the Design Centre, this gallery contains a public reading room. Various design displays from countries other than Canada are shown from time to time. The building also serves as headquarters for the National Industrial Design Council. All Design Award items are entitled to a permanent place in the Canadian Design Index at the Design Centre

in Ottawa, identified by the Design Award insignia.

Design Conference at 1953 CMA Meeting

Addressing the Conference on Industrial Design in May 1953, held in Toronto during the general meeting of the Canadian Manufacturers Association, Floyd S. Chalmers, chairman of the Conference, pointed out that good design in manufactured products is a most important tool of salesmanship, and beyond that it is a tool of sound engineering and economical production. Canadians, he said, now realize we must do an increasing amount of our own design work in Canada. Manufacturers and retailers realize most products require to be designed to meet Canadian conditions, Canadian tastes, and Canadian production facilities. Encouragement of good design is thus much more than a matter of satisfying national pride.

To achieve the objective of good design, he added, industry itself must recognize the greater economies in production and the greater sales appeal of well designed articles. Retailers and the consuming public must be able to recognize what constitutes good design. Well trained, professional designers are needed both within industry and in general consultation work.

Explaining that the postwar upsurge of interest by Canadian business men about something they had formerly considered the affair of artists, Lt.-Col. Allan Burton, general manager of Simpsons Ltd., gave the reason. Many factories, he pointed out, were retooling then for peacetime production. Nearly all could look ahead to foreign markets as well as domestic, due to the world-wide shortage of consumer goods. Today neither manufacturer nor retailer could afford articles that are not readily saleable. A mistake is too costly because it is repeated on too large a scale.

Nations like Britain, Switzerland, Italy and Sweden, — countries that live largely by export, he said, have been using industrial designers for a long time. They had already proved that research and better design do make products easier to make, easier to use, easier to look at, easier to sell.

Donald B. Strudley, president of Imperial Furniture Manufacturing Company, and chairman, NIDC, himself one of the final judges for the competitions, told how committee members have gradually come to realize that the real keystone of the plan is the manufacturer himself; that projects that would enlist his co-operation by appealing to his self-interest would really accomplish more than anything else.

The manufacturer can do more to encourage public acceptance of good design by actually making and marketing well designed products, than can be done in any other way. Moreover, he observed, the manufacturer who develops a design department, or calls in consulting designers, is doing more to encourage Canadian design talent, than all the competitions we can have. If a demand for designers' services exists, our schools will find ways to train the designers needed.

It was out of this kind of thinking that the Design Award to Industry program developed. "Make it financially attractive to Canadian manufacturers to make good designs, and they will do so in increasing numbers," was the Council's viewpoint.

It had early been recognized that many Canadian products were of U.S. design by the parent company of the Canadian manufacturer. By eliminating these from competition, the Canadian manufacturer would lose interest. Furthermore, if Canadian designed products could not stand competition from outside designers it was better to find that out, too. The decision was made that *any* Canadian *made* products could compete.

The results of the first year's competition seem to have amply justified this decision. Three-quarters of the awards went to Canadian-designed products in open competition. Several manufacturers who had been importing designs have already considered the development of Canadian designs for the Canadian market.

The privilege of using the Design Award Seal as a tag or sticker on merchandise, he believed, will be an increasingly important sales aid. It will put the product in a select group, recognized by the Canadian consumer to be of superior value. The Seal can and should be used on local and national advertising, price tags, window displays and other sales-aids.

Recognition and appreciation of design quality by consumers is growing rapidly, he concluded, and activities of the NIDC have no doubt contributed to this. If Canadian manufacturers do not make positive efforts to improve the design quality of their products they are actually going backward, and losing ground in the competitive race. From now on no manufacturer can for long afford to neglect this problem.

E.I.C. Co-operates in Judging

The Engineering Institute of Canada is one of a group of eight associations or societies that have been called upon to assist the Council in rating articles for awards. The group also includes the Association of Canadian Industrial Designers, the Canadian Association of Consumers, the Canadian Manufacturers' Association, Canadian Retail Federation, Primary Textile Institute, Royal Architectural Institute of Canada, and the Sculptors' Society of Canada.

The following have consented to act as judges: R. C. Berkinshaw, president Goodyear Tire and Rubber Co.; H. G. Colebrook, president Canadian Retail Federations; John Bland, director, McGill School of Architecture; Mrs. W. R. Walton, Jr., national president, Canadian Association of Consumers; and D. B. Strudley, chairman NIDC. Advisory committees of technically qualified persons will assist the judges in rating the entries in the various categories.

Entry forms for articles to be entered in the competitions are obtainable through a wide range of manufacturing associations, or from the National Industrial Design Council, Design Centre, Elgin Street, Ottawa. Entries are required to reach the Design Centre not later than January 31, 1954.

"The Original Winged Victory"

From *The Gazette*, Montreal, September 5, 1953

In the United States, 1953 is being widely celebrated as the 50th anniversary of powered flight. Fifty years ago this December the Wright brothers made their first powered flight over the sand dunes of Kitty Hawk, North Carolina. That flight lasted 12 seconds and went 120 feet, half the wing-span of a B-36 bomber.

It is generally accepted that that flight was the beginning of man's conquest of the air. It was not. It was the most significant milestone that had been gained up to that

time, but it was not the first milestone by any means. It was the beginning of powered flight, but not the beginning of flight.

For centuries, men had sought to develop means to imitate the birds. Leonardo da Vinci designed a flying machine into which one of his assistants climbed. The man's arms moved the wings in a flapping motion. The results were disappointing.

In the years that followed, many men studied the flight of birds, seeking the aerodynamic laws which enable them to soar or glide or hang motionless in the air. It was the gliding birds particularly which intrigued them.

The greatest advances in the discovery of these laws were made by Otto Lilienthal, in Germany. The various machines he constructed enabled him to make hundreds of flights, during the last 20 years of the nineteenth century. It was the study of his reports which gave the two bicycle mechanics from Dayton, Ohio, Wilbur and Orville Wright, the groundwork for their experiments.

The Wrights built gliders and flew them for two years before they developed a machine which would support a motor and respond to controls. That was their triumph, not flight, for Lilienthal and others had already accomplished that, but powered, controlled flight.

Elections and Transfers

At the meeting of Council held at Orillia, Ontario, on Friday, September 11, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

W. E. Adkins, *Montreal.*
R. M. Aldwinckle, *Edmonton.*
J. A. Benard, *Montreal.*
R. Bernier, *Charlesbourg.*
M. J. Blaicher, *Toronto.*
H. G. Burchell, *Victoria.*
S. W. W. Carroll, *Montreal.*
E. A. Charlton, *Montreal.*
H. K. Collinge, *Montreal.*
W. F. Corkran, *Montreal.*
H. Corthorn, *Montreal.*
J. W. Davies, *Hamilton.*
E. W. Desmier, *Calcutta.*
H. B. Efsen, *Montreal.*
L. J. B. Forbes, *Toronto.*
A. E. Hanson, *Saint John.*
H. H. Kerr, *Toronto.*
M. W. Koslowski, *Calgary.*
R. A. Mangiarotty, *Montreal.*
J. A. Merchant, *Vancouver.*
A. D. Misener, *London.*
A. J. Nowakowski, *Montreal.*
M. Pona, *Toronto.*
M. Prorinsh, *Corner Brook.*
G. Riedl, *Toronto.*
K. C Schillebeeck, *Montreal.*
W. J. Sutherland, *Sherbrooke.*
J. L. Tekker, *Montreal.*
H. B. J. Tafelmacher, *Shawinigan Falls*
D. J. Wardle, *Toronto.*
J. A. Watters, *Montreal.*
C. R. Webster, *Montreal.*
G. P. Webb, *Peterborough.*
G. C. Widdup, *Vancouver.*
R. H. Wolfsberger, *Montreal.*

Juniors:

R. W. Cumming, *Montreal.*
C. P. Hedlin, *Guelph.*
T. D. Leaver, *Montreal.*
D. W. C. McEwen, *Cornwall.*
D. A. M. Norman, *Ottawa.*
J. T. Norris, *Toronto.*
T. P. Pumphrey, *Corner Brook.*
T. J. Shymer, *Montreal.*
C. R. Thompson, *New York.*
T. R. Walton, *Toronto.*
R. G. Waterfall, *Montreal.*

Transferred from the class of Junior to that of Member:

W. D. Beckett, *Ft. William.*
G. W. Bond, *Joliette.*
T. E. Chalmer, *Magog.*
V. R. Cox, *Winnipeg.*
R. N. Denluck, *Montreal.*
W. R. Elsey, *St. Thomas.*
M. M. Fainstat, *Montreal.*
A. B. Farnam, *Toronto.*
J. E. E. Guerrette, *Fredericton.*
G. E. Graham, *Saint John.*
B. W. Henkin, *Montreal.*
T. Lamb, *Calgary.*
E. I. Lexier, *Winnipeg.*
T. H. Nathanson, *Montreal.*
S. T. Murray, *Toronto.*
B. K. Ryan, *Montreal.*
J. F. Short, *Toronto.*
R. H. Tooley, *S. Ste. Marie.*
R. B. Wilcox, *W. Newton, Mass.*
J. F. Zimmerman, *Winnipeg.*

The following Students were admitted:

R. C. Balanse, *Univ. of New Brunswick.*
N. Bobey, *Univ. of Manitoba.*
H. N. Hoyle, *Vancouver.*
N. W. E. Lee, *Purdue University.*
R. L. M. Lord, *Montreal.*
J. W Slupsky, *Port Alice, B.C.*
R. Yacyshyn, *Univ. of Alberta.*

Applications through Associations:

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Members:

G. Downing
D. H. Dunphy — W. H. Price

Juniors:

G. E. Andrews — J. O. Wright
D. W. Smith

Junior to Member:

B. O. Barham — W. L. Lindberg
R. B. Carruthers — L. A. O'Morrow
W. A. Dexter — G. R. Shipley
Mary E. Dougherty

Student to Junior:

R. C. Miller

SASKATCHEWAN

Members:

J. W. G. Kerr — F. C. P. Sonnenfeld
W. R. McBride

Student to Junior:

M. J. Gavel

NOVA SCOTIA

Junior to Member:

J. B. Dicks — T. F. Heenan

NEW BRUNSWICK

Member:

E. J. Burgess

Junior to Member:

J. A. B. Brenan — A. W. Purdy

QUEBEC

Members:

R. Lessard — E. A. MacKenzie

Junior to Member:

L. A. Gottheil

CORRECTION

In the June, 1953 issue of the *Journal*, page 734, the admission of R. G. Curry and A. P. Kilroy as Students was listed. However, they are graduates of Trinity College, Dublin University, rather than University of Ireland, as indicated in the *Journal's* list of Students admitted at the meeting of May 19, 1953.

PRESTRESSED CONCRETE APPLIED TO ROOF JOISTS

(*Continued from page 1314*)

to the proper behaviour of the beam at working loads. They should be considered on the basis of their long term effect on plastic flow, crack resistance and deflections. Presently accepted working stresses should not be arbitrarily used in prestressed concrete, but should be reviewed in accordance with the circumstances, nor should they alone be taken as a guarantee of safe performance. With these principles in mind, beams can be designed with a proper balance between working loads and ultimate capacity.

The author wishes to mention the co-operation given in the development of these beams by the Commission's research and construction divisions and by Professor M. W. Huggins, M.E.I.C., of the University of Toronto. E. P. Muntz, M.E.I.C., was consulting engineer, with responsibility for the project under the general direction of Dr. R. L. Hearn, M.E.I.C., general manager and chief engineer, and Dr. Otto Holden, M.E.I.C., assistant general manager — engineering.

The *Journal* Thirty-five Years Ago

The Engineering Journal for October, 1918, was largely a report of the Third General Professional Meeting at Halifax, September 11, 12, and 13. Devoted to a consideration of the harbour and shipping problems of the Maritime Provinces, the meeting, it was reported, "was more than a mere success, it was an achievement of great moment to the profession."

In the *Journal's* editorial on the subject, it was noted that this had been the first professional meeting of the Institute to be held east of Toronto, and that for the first time in the history of the Maritime Provinces a convention of engineers from many centres gathered to discuss engineering problems, to get acquainted and establish a basis for friendship that would make impossible misunderstandings in the future.

It was also remarked that while this event took place in a city still suffering from the shock experienced nine months before (the disastrous Halifax explosion, December 1917) no murmur was heard of the suffering that had been experienced. The editor paid tribute to the admirable qualities of "the men who live down by the sea."

The registration at this gathering, which constituted the first Maritime Professional Meeting, was ninety-four.

Technical Program

On the program of the meeting were such subjects as "Some Notes on Preservation of Timber for Use in Salt Water", presented by C. E. W. Dodwell; "Economic Aspects of Halifax Ocean Terminals", by A. E. Macleod; "Town Planning, Halifax and Vicinity", by H. L. Seymour; "Diving Bell in use at Halifax Ocean Terminals", by J. J. MacDonald; "Saint John Harbour Works", by Alex Gray; "Saint John Railway Terminals", by C. C. Kirby; "Use of Reinforced Concrete in Harbour Work", by A. F. Dyer; "Halifax Ocean Terminal Railway", by R. H. Smith; and an illustrated address on the Quebec Bridge, by C. F. Porter, to which the public was invited.

The Lieutenant Governor of Nova Scotia, welcomed delegates to the meeting, and his address appears in the *Journal*, as well as full manuscripts or abstracts of the papers, with discussions which took place at the sessions. Those familiar with Halifax and Saint John today, would find these studies very interesting.

Active in the organization of the meeting were the respective chairmen of the Halifax and Saint John branches, F. A. Bowman and Alex Gray.

President H. H. Vaughan's luncheon address, designed to explain in five minutes the role of the Institute, was a terse summation of its aims and policies. He said in part, "The science of engineering is in such a constant state of change, such a flow of new discoveries and improvements, that nothing but years of practical experience and continual exchange of knowledge with his fellows can make a man a competent engineer. The facilities for this work are afforded by the engineering societies and this Institute, which is the national engineering society of Canada, is meeting now at Halifax to carry out a policy we have recently introduced of holding professional meetings in various parts of the country to enable the members to meet and discuss the problems they are particularly interested in, which vary to a certain extent in every district."

He went on, "You will, therefore, see that we are endeavouring to afford engineers in the various districts of the country an opportunity to come together and exchange information on the subjects in which they are particularly interested and this has been the function of engineering societies from the very beginning."

Identifiable in a group picture of the engineers in attendance are many well remembered personalities, and several who subsequently contributed much to the success of the Institute.

Editorial Comments

The October *Journal* in 1918 announced the inauguration of the Leonard Medal, giving the rules under which it would be awarded. It reported that the Canadian representative to the Interallied Aircrafts Commission Conference in England was Capt. R. J. Durley. In another item there was confidence expressed in the appreciation of the importance of experienced and qualified engineers in Federal Government employ, in view of expected departmental changes.

"Publicity as an Asset", was the subject of one editorial, which concluded with the statement, "It is not enough that we as engineers should know that the engineer has been the responsible, the pivotal figure in the great advance that mankind has achieved in its material progress in the past century, but it is a duty we owe ourselves to educate every man, woman and child to a realization of this fact, to educate them to a point where everyone has a distinct appreciation of how much his or her material comfort in everyday existence, depends on what engineers have done and are doing and to think of the engineer in a spirit of thankfulness for the benefits he has conferred on the human race." There is still much to be done along these lines, thirty-five years later.

Co-operation with the American Society of Civil Engineers was recorded in connection with the Society's offer that the Institute might publish in the *Journal* current engineering articles of interest.

There is a discussion in Correspondence of the importance of recognition of the engineering profession by legislation, and there is much interest reported by the Saskatchewan Branch in their proposed "Act respecting the Engineering Profession", then being discussed at branch meetings.

In the Personals were notes on the appointment of E. L. Cousins as deputy fuel controller for the Province of Ontario; and of Wm. McNab, as chairman of the valuation committee of Grand Trunk Railway. G. A. Mountain, representing the Government, had officially declared the Canadian Northern tunnel through Mount Royal open to traffic on September 20, thus inaugurating the new traffic service connecting Montreal with Vancouver. The daily service between Montreal and Toronto was to be inaugurated soon after.

C. A. Magrath was appointed director of coal operations of Nova Scotia and New Brunswick, as part of his powers as fuel controller, the *Journal* reported. Col. J. S. Dennis had received recognition for his valuable service with the British Canadian Recruiting Mission by having conferred upon him the order of Companion of St. Michael and St. George. Brig. General G. Eric McCuaig, C.M.G., D.S.O. with Bar, was commended for his distinguished service. He had been appointed a brigadier-general at the age of thirty-three. Howard Kelley, had been re-elected president of the Grand Trunk Railway System.

The Hamilton Branch of the Institute was opened on September 21, 1918, with a meeting at which P. M. Lincoln, a past president of the American Institute of Electrical

Engineers spoke on "The Development of Electric Power Transmission".

Employment

The Employment Section included a quotation from *Christian Science Monitor*, which reported engineering to be the best paying profession in the United States, excelling even that of law. It predicted that "after the war, when reconstruction generally sets in, the engineers bid fair to become a class of plutocrats." The title chosen for this note was, "Speed the Day". There were nine positions advertised as vacant. A mechanical engineer with good experience in laying out plants and installing machinery, was offered $250.00 per month; and another, to be an assistant chief engineer in the Irrigation Branch of the Department of the Interior, one with wide experience in the construction and operation of irrigation works, was to be paid $4,000.00 per annum.

News of Other Societies

L. E. Grinter, of University of Florida, was elected as president of the **American Society for Engineering Education** at the annual meeting in June last. Vice-presidents are B. Richard Teare, Jr., of Carnegie Institute of Technology, and William L. Everitt, University of Illinois. Other new officers are the secretary, William T. Alexander, Northeastern University; executive committeeman, Harold Flinsch, Mississippi State College.

The annual meeting of the Society next year will be held at the University of Illinois, Urbana, Illinois, June 14-18.

The annual meeting of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18) is scheduled for November 29 to December 4, 1953, at the Statler Hotel, New York.

News of developments aimed at promoting public health will be exchanged at the 81st annual meeting of the **American Public Health Association** (1790 Broadway, New York, N.Y.) to be held at the Hotels Statler and New Yorker, New York City.

The annual meeting of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17) will be held at the Hotel Jefferson, St. Louis, Missouri, December 13-16, 1953.

The 61st annual meeting of the **Society of Naval Architects and Marine Engineers** (29 West 39th Street, New York 18, N.Y.) will be held in New York City, at the Waldorf Astoria Hotel on November 11 to 14, 1953.

The 5th Canadian High Polymer Forum, sponsored jointly by the **Chemical Institute of Canada** (18 Rideau Street, Ottawa 2) and the National Research Council of Canada, will take place at the London Library and Museum, London, Ontario, November 19-20, 1953.

The Young Man in Business

From The Royal Bank of Canada Monthly Letter, Montreal, April 1953

Young men leaving school and university this year are starting now to reconnoitre, to survey, and to choose their places in the world.

They will, for the most part, be seeking ways to make their living, but that is not all they seek. Work is a large part of our living, and should be chosen so as to provide the greatest possible satisfaction. The man who enjoyed himself only in his leisure hours and during his annual vacation would have a skimpy time of it.

Parents find this season no less perplexing than do the youths themselves. They hesitate about using their influence, yet they feel that everything today is so complex that the young people cannot be expected to pick and choose sensibly.

This Monthly Letter will try to tell about one sort of work in a way that will help both young men and their parents to choose wisely. It does not pretend to give rules for success in the business world, but only to summarize points which have been observed by successful men.

Business is a strange amalgam of "practical common sense" and idealism. In it, a young man may perform his allotted task with consistent but dull efficiency, or by applying his imagination and using initiative he may make of it a great adventure.

The last thing desired in business is routine thinking. Business wants men who can not only find answers to problems, but can think up new ways of doing things better, thus producing problems to be solved.

Selecting Your Place

There are many openings in industry and commerce (for convenience we lump industry, commerce, finance and allied activities together as "business") and this year's graduates from high school and university are given a wide choice. Whatever ability they have can be used—mathematical or literary, artistic or scientific. They may be the office type or salesmen, introverts or extroverts.

Out of all these opportunities it may seem difficult to choose one which may provide the most satisfying life work. We don't want to flit blindly from one job to another, but neither do we wish to flutter like moths around the first bright light that catches our attention. Biologists tell us that after a chick hatches out of the egg it pecks at every small thing within its range. It has an instinct to peck, but it has no instinct to peck at the right things to eat.

Usually the fledgling in business life has an instinctive urge for three things: opportunity to advance, security, and satisfaction. There was a time when these three were harder to get together than they are today.

Security is not an obsessing problem to the ambitious young man, who knows that fulfilment of his aim will take care of it. There is no occupation that is guaranteed against all hazards of epidemic, flood, fire, war, depression and other cataclysms. But a reasonable caution should be observed to make sure of getting into something where every tiny upset of equilibrium does not bring on a crisis.

Satisfaction is not wholly dependent upon the type of business one is in, but more upon what one does in it. It is perfectly true that one job can be more interesting than another, but not nearly so true as that one mind is more interested than another. Care in selecting a

THE ENGINEERING INSTITUTE OF CANADA

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working place that gives scope for our abilities can be an important factor in ensuring that we can look back after years of work with happy recollections.

Deciding What To Do

It is not only in science, but in all life, that advantage is gained by stating problems precisely. The problem may be said to be half solved when its factors are clearly known.

In deciding what activity to follow through one's life, the rule holds. The factors are: what do I want? what can I do best? where can I find the opening?

Everyone has a certain foundation of good points, of assets, and of strengths. Some may not be particularly bright in book learning, but they have the knack of learning from experience. Some may not be forceful personalities, but they have a way of clarifying situations, of getting down to the nub of a problem, and of finding answers. Some may be diffident in writing, but forceful in personal contacts. The variety is infinite: sincerity and honesty are needed in making one's own appraisal of oneself.

The danger is, in many cases, one of over-estimating. Those who overestimate their knowledge and ability risk unhappiness. They are forever straining to live up to the false picture they have of themselves. They feel they are "failing", when in terms of their true ability they are doing very well. These are the really insecure people.

Making a Plan

Wherever a young man decides to go, he is starting from where he is now. The golden milestone in the Roman Forum, from which one could begin his journey to the four quarters of the globe, has its counterpart in every man.

The young men who plan with discretion and vision will be in positions to take advantage of every circumstance that will help them on their way: those who do not know clearly where they are going cannot even recognize opportunity when it comes to them.

Confucius put it this way: "In all matters success depends upon preparation; without preparation there will always be failure. When a line of conduct is previously determined, there will be no occasion for vexation."

Personal capability, personal tastes and capacity to meet requirements of a job need to be taken into account without exaggeration. But unless a man undertakes more than he possibly can do, he will never do all that he can do.

Planning must allow for change. One needs to persist in carrying out plans, or they are of no avail, but flexibility is wanted, too. A detour here and there may be a good thing, to gather or to share experience, so long as the general direction shown on the map is followed.

Ambition

Not nearly so many people as some imagine stand in the way of an ambitious man. We meet a great number who believe that things have been already settled for us, or that distinction comes from destiny, so when we show initiative —the ability to think and do new things—we often find a clear run in a broken field.

Ambition is not envy of successful men. It is no simple willingness to receive. It is the sharp hope of attainment, positive, purposeful, energetic, and creative. It is the spirit that digs through the layer of known and accepted ways of doing business to pioneer new frontiers. It is something that restrains a man from imposing upon himself bounds or limitations that prevent him from becoming the best he can become.

Ambition is not fretful. We became accustomed, during school and university days, to a great variety of experience and accomplishment. Those days were crowded with new things. But business demands a lot of repetition and sameness. Sales and deals and columns of figures have a way of following patterns. These things have to be done, and done well even for the thousandth time and even by the most ambitious man.

On Starting Small

Variety and thrills and great successes are not to be expected of the first job a young man gets in business. Some persons think that because they majored in commercial subjects at high school they should have preference, or that because they graduated in commerce from a university they should start several rungs up the ladder. Business is not like that.

The first job is a starting line. You are taken on the staff and given an opportunity to do certain things. Your first task is to perform well those designated duties and to gain the confidence of the men you will have to deal with. The right to move up to a higher level must be earned.

Every succeeding job provides a new opportunity to gather yourself together for another advance. Professor Erwin Haskell Schell, of Massachusetts Institute of Technology, says in *The Million Dollar Lecture* (truly a gold mine for young men starting in business): "The period of acclimation gives unique opportunity to master fundamentals and to develop skill, to study parts in relation to the whole, to grasp the problem of administration in its entirety — to learn. The period of acclimation gives unique opportunity to explore the entire terrain of an industry, to study at first hand its human resources—to survey. The period of acclimation offers unique opportunity to concentrate one's talents within a given area, to conquer difficulties largely unaided, to attain results of undeniable significance—to master."

As was remarked in our Monthly Letter *The Personnel Department*, it is to the interest of the personnel director to select the right person for a job, to fill his vacancies with people who are adaptable, qualified and keen. From there on, what a man becomes is dependent largely upon his own ambition and capacity.

One thing is sure: every job and every promotion and every success have a common ingredient—work. To praise hard work has a moonlight and madness sound, but it makes sense to a business man.

The person who has a job that interests him either because of its nature or because it is a step toward something bigger must scratch his head in wonder when he hears people lamenting the need to work.

There is, too, a value in work itself, regardless of what it accomplishes. A business man recognized this truth when he advised: "Do the wise thing if you know what it is, but anyway do something." Every business executive has seen studious youths spending their time reading *How to Get on in the World* and letting everybody pass them as they stumble along with their eyes on their books.

Efficiency

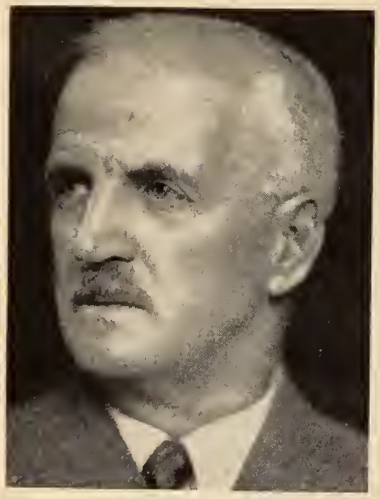
Efficiency pays. There would not be much fun in life if everyone received equal reward for unequal energy and ability.

Efficiency is not a thing in itself. It is preceded by principles and followed by work and developed by imagining roads to new efficiency.

(Continued on page 1428)

Personals

News of the Personal Activities of Members of the Institute



J. C. MacKenzie, M.E.I.C.

Dr. C. J. MacKenzie, M.E.I.C., has resigned as president of Atomic Energy of Canada Ltd., the Crown Corporation which handles the government's atomic energy activities. He will be succeeded by W. J. Bennett, president of Eldorado Mining and Refining Ltd., another Crown corporation.

Rt. Hon. C. D. Howe, HON.M.E.I.C., when making the announcement recently, recalled that last year, when atomic energy activities were organized under a separate Crown company, Dr. MacKenzie had resigned from the presidency of National Research Council, under which body the Canadian atomic energy project had been started, in order to supervise the reorganization of this complex undertaking.

With this reorganization completed, Dr. MacKenzie, having reached the normal retirement age, had asked to be relieved of his heavy administrative responsibilities, said Mr. Howe. He agreed, however, to continue his association with the project as a special consultant on atomic energy matters.

Dr. MacKenzie is a past president of the Engineering Institute, and a former dean of engineering of University of Saskatchewan.

L. K. Sillcox, M.E.I.C., director and honorary vice chairman of board of The New York Air Brake Company in New York, has been nominated for the presidency of the American Society of Mechanical Engineers.

He has been associated with the Society since 1916 and was named a fellow in 1943, and that same year, A.S.M.E. Medallist. He became an honorary member in 1946 and served as Director at Large in 1946-47.

Dr. Sillcox was born in Germantown, Pa., and received his engineering training at l'Ecole Polytechnique, Brussels, graduating in 1903. That year he began his engineering career as an apprentice with the New York Central and Hudson Railroad, and four years later, a foundry apprentice with McSherry Mannfacturing Company, Middletown, Ohio.

He came to Canada in 1909 to enter the Turcot Works of the Canadian Car and Foundry Company in Montreal, and subsequently joined the staff of the Canadian Northern Railway in Toronto. In 1916 he returned to the United States to enter the employ of the Illinois Central System, and two years later was named general superintendent of motive power for the Milwankee and St. Paul Railway in Chicago, a position he held until 1927 when he became first vice-president of The New York Air Brake Company in Watertown, N.Y. He was later named executive vice president, then vice chairman of the board, and has been a company director since 1948.

Dr. Sillcox has served as chairman on advisory committees for both American engineering organizations and universities, and as a lecturer in applied mechanics and on transportation.

He was granted a D.Sc. degree by the Clarkson College of Technology in 1932, and a D.Eng. degree from Cumberland University in 1941. He is an honorary member of the Railway Fuel and Travelling Engineering Association and the Institution of Locomotive Engineers, and a fellow of the American Physical Society and the A.I.E.E. He is also a member of many American and British engineering societies, as well as the Engineering Institute of Canada which he joined in 1926.

Dr. Sillcox is the author of "Mastering Momentum", published in 1941, and a contributor to many technical publications.

E. G. Cullwick, O.B.E., M.E.I.C., has received the degree of doctor of science (in engineering) from the University of St. Andrews, University College, Dundee, Scotland, for a thesis entitled "Essays in Electromagnetism".

Professor Cullwick is professor in the electrical engineering department of the University of St. Andrews, University College, Dundee, Scotland. He was first appointed to University College, as Watson-Watt professor of electrical engineering in 1949. This appointment followed service to Canadian engineering education — at the University of British Columbia and at the University of Alberta. At Alberta he was professor and head of the department of electrical engineering from 1936 until 1946. He was appointed then, director of the Electrical Engineering Division of the Defence Research Board at Ottawa, which position he relinquished, to take his appointment at University College, Dundee.

Frederick W. Cowie, M.E.I.C., a Life Member of the Institute, visited headquarters on August 26. Just recently he attained his ninetieth birthday. He has presented the library of the Institute with an autographed copy of his paper "Transportation Problems in Canada and Montreal Harbour" which was presented before the Institution of Civil Engineers in 1914. At that time Mr. Cowie was chief engineer of the Harbour Commissioners of Montreal. His paper promoted a great deal of discussion and for it he was awarded the coveted Telford Medal of the Institution of Civil Engineers.

Douglas Bremner, M.E.I.C., is mayor of the Town of Ile Cadieux, Que.

Mr. Bremner is president of Douglas Bremner Construction Limited, Montreal, and of Douglas Bremner Inc. He is a director of many companies.

Associated actively with the work of many Montreal hospitals and service associations and committees, Mr. Bremner is president of the School for Crippled Children and past president of the Queen Elizabeth Hospital.

He is a past president of the Builders' Exchange Inc. of Montreal, and a past vice-president of the Canadian Construction Association.

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V. A. Ainsworth, M.E.I.C., has been appointed general manager of the Newfoundland Light & Power Co. Ltd., at St. John's, Newfoundland.

Mr. Ainsworth is the former general manager of the Maritime Electric Co. Ltd., Charlottetown, P.E.I. He had been associated with that Company for many years, receiving the appointment as general manger in 1949, after serving as manager and as division superintendent.

K. O. Elderkin, M.E.I.C., is vice-president and general manager of Bowaters Southern Paper Corporation at Calhoun, Tennessee.

He was formerly manager of the Paper Division of Crossett Lumber Company, Crossett, Arkansas. He resigned this position in March, 1952 in order to build the Bowaters newsprint mill in Calhoun, which is expected to go into operation some time in 1954.

J. A. Izard, M.E.I.C., is the chairman of the Vancouver Island Branch of the Institute.

Mr. Izard is an associate professor of engineering at Royal Roads. He was born in Victoria, receiving his early education there at St. Michael's School and Brentwood College. He studied engineering at McGill University, interrupting his studies to serve from 1941 to 1945 as a lieutenant in the R.C.N.V.R. He graduated in chemical engineering in 1947 from McGill University. Mr.

J. A. Izard, M.E.I.C.

Izard worked first for Yarrows Ltd. as a draughtsman, and in 1947 became an assistant superintendent. The next year he went to Royal Roads as a lecturer. He is a member of the Association of Professional Engineers of British Columbia, transferring from chemical to mechanical engineering in 1951.

During the summer of 1952, he conducted the structural tests to destruction on the steel transmission line towers for the Kitimat project. These tests were carried out at Yarrows Ltd.

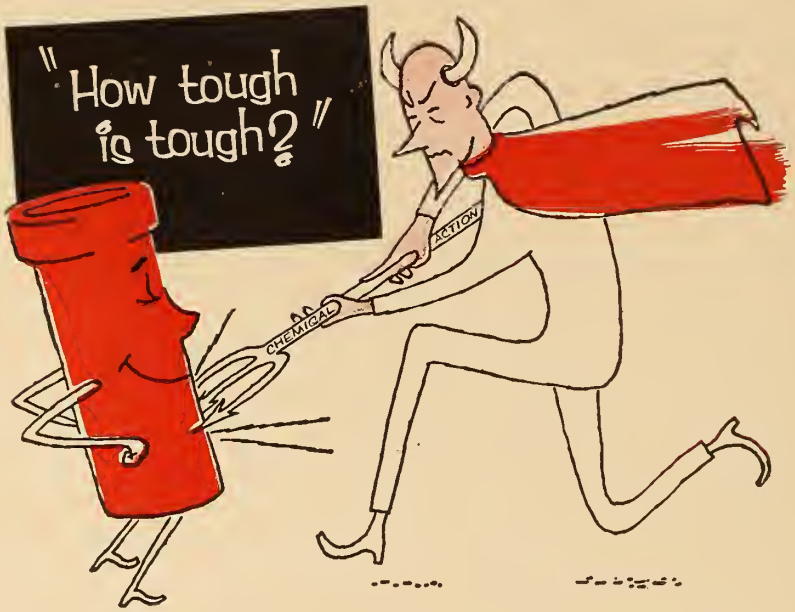
John C. Aitkens, M.E.I.C., project engineer with Ford Motor Company of Canada Limited in Windsor, Ont., is chairman of the Border Cities Branch of the Engineering Institute.

Mr. Aitkens was born in Boisserain, Man.. and received his early education in the public school there. In 1924 he entered the University of Manitoba and graduated with a B.Sc. degree in civil engineering in 1929. During the summer months of his university course he served as rodman, field draughtsman, instrumentman and assistant chief of party with the Dominion Topographical Surveys Branch. In the summer of 1928 he was employed as instrumentman in charge of party by the City of Winnipeg Hydro-Electric System on the preliminary survey of the Slave Falls Power Development.

Upon his graduation from the University of Manitoba, Mr. Aitkens entered the office of the engineer of the City of Winnipeg Hydro-Electric System where he was engaged on the construction of the Slave Falls hydro-electric plant.

In 1933 Mr. Aitkens was appointed inspecting engineer for the Department of National Defence at the Lac Seul Relief Project No. 5, and two years later entered the office of the engineer of the Water Development Committee of the Dominion Department of Agriculture.

He became a temporary assessor for the City of Winnipeg's assessment de-



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partment in 1936 and then in June of 1937 joined Madsen Red Lake Gold Mines Limited as mine engineer.

In 1942 Mr. Aitkens entered the engineering department of Ford Motor Company of Canada Limited as design engineer. He was appointed to his present position this year.

G. F. C. Bennett, M.E.I.C., managing director of Foulis & Bennett Electric Limited in Halifax, N.S., is chairman of the Halifax Branch of the Engineering Institute.

Mr. Bennett was born in Ottawa and received his early education at the public and high schools of that city. He entered McGill University in 1927 and obtained his B.Sc. degree in electrical engineering in 1931. During the summer months of his course he was employed as rodman for the Canadian National Railways on a railway construction survey in northern Saskatchewan, and as a levelman for topographical surveys.

After his graduation Mr. Bennett entered the graduate training course provided by the Canadian Westinghouse Company, and upon completion of this training in 1934, became engaged in engineering, apparatus and merchandise sales in the Company's Halifax office.

In 1946 Mr. Bennett entered into partnership in the firm of Foulis & Bennett Electric Limited in Halifax, and serves as the Company's managing director.

G. S. Wade, M.E.I.C., plant engineer with Canadian Nashua Paper Company Limited in Peterborough, Ont., is chairman of the Peterborough Branch of the Engineering Institute.

Mr. Wade was born in Duncan, B.C., and attended the Fernie Public School in Fernie, B.C., and the Kamloops Junior and Senior High School. In 1937 he entered the University of British Columbia and graduated with a B.A.Sc. degree in mechanical engineering in 1941.

He then entered the test department of Canadian General Electric Company Limited in Peterborough and Toronto, and in 1942 joined the staff of the engineering department of the Company in Peterborough. A year later he became associated with the armaments design department (carriages) of the Ministry of Supply at Fort Halstead in England.

Mr. Wade returned to the engineering department of General Electric Company Limited in Peterborough in 1944, and transferred a year later to the plant engineering department.

In 1946 he was appointed to his present position as plant engineer with Canadian Nashua Paper Company Limited in Peterborough, and in this capacity, is responsible for all building repair and construction, all machinery and equipment design, procurement, installation and maintenance, and power plant operation.

Mr. Wade is a member of the Association of Professional Engineers of Ontario and of the American Society of Mechanical Engineers.

W. L. Dutton, O.B.E., M.E.I.C., is chief engineer with the Ontario Steel Products Company Limited in Toronto. He is the former vice-president of F. E. Shaw Limited at Sarnia, Ont. Earlier he was operating manager for Union Gas Company of Canada Limited, Chatham, Ont., which Company he joined first as a student in the engineering department.

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GOODYEAR

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Brigadier R. D. Sutherland, M.E.I.C., has joined the Hydro-Electric Power Commission of Ontario at Toronto. Until recently, he was associated with Crosley Radio & Television at Toronto.

A former deputy adjutant general of the Department of National Defence, he was associated after World War II with Rogers Majestic Ltd.

Erratum

Lucien L'Allier, M.E.I.C., was mentioned in the July issue of the *Journal* as occupying the position of "director" rather than "assistant director" of the public works department of the City of Montreal. The director of this department is H. A. Gibeau, M.E.I.C.

Earl Fisher, M.E.I.C., of Canadian National Railways, has been appointed system superintendent of mechanical maintenance for the road transport department. He will establish and direct maintenance and repair procedures for all highway vehicles assigned to the road transport department.

Mr. Fisher graduated from the University of Saskatchewan in mechanical engineering in 1944. He served with the Royal Canadian Navy and in 1945 received his discharge with the rank of lieutenant.

G. H. Blumenauer, M.E.I.C., has been appointed Toronto district manager for the Otis Elevator Company Limited. He has been assistant district manager for the Company for the last three years.

G. H. Blumenauer, M.E.I.C.

Mr. Blumenauer is a graduate in mechanical engineering from the University of British Columbia.

He succeeds **D. D. Panabaker,** M.E.I.C., who returns to the head office of the Company at Hamilton, Ont., to undertake general organizational duties as administrative assistant to the president.

A. Meade Wright, M.E.I.C., has been appointed manager for Dow Equipment Company, Inc. in Rochester, N.Y. He was formerly assistant manager of the Atlantic Tug and Equipment Company, Inc., Syracuse, N.Y.

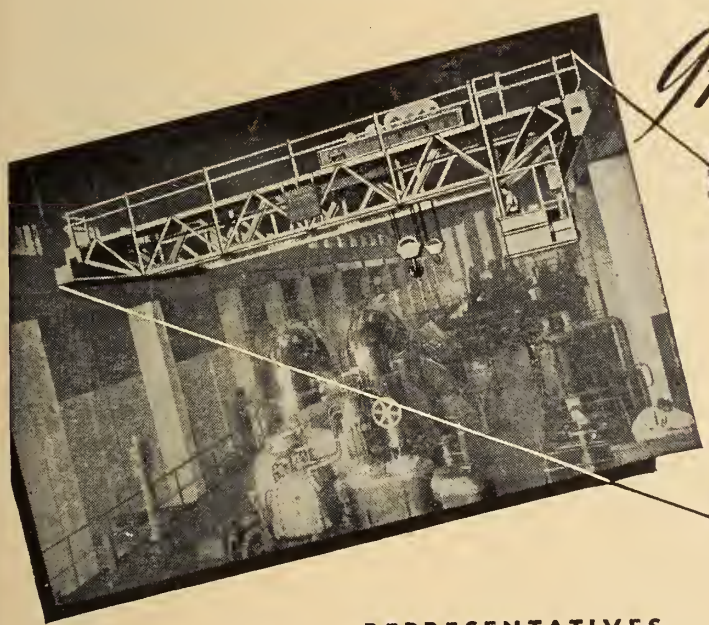
Mr. Wright graduated in electrical engineering from McGill University, class of 1941. Before going to Syracuse in 1949, Mr. Wright was with Construction Equipment Company Limited, Montreal, for two years. He was a field engineer with Foundation Maritime Limited in Saint John, N.B., in 1946, following service as a lieutenant in the R.C.N.V.R. during World War II.

V. J. Pimenoff, M.E.I.C., is an instructor in radio theory at the Communications School, "H.M.C.S. Cornwallis," Cornwallis, N.S.

He has been on the staff of the Canadian Broadcasting Corporation in Montreal, for several years.

Mr. Pimenoff graduated with a degree in electrical engineering from McGill University in 1949. He is a former member of the staff of the Department of Physics of the University of New Brunswick.

A. B. Barnes, M.E.I.C., has joined the Canadian General Electric Company Ltd., Downsview Works, as maintenance engineer, facilities engineering.



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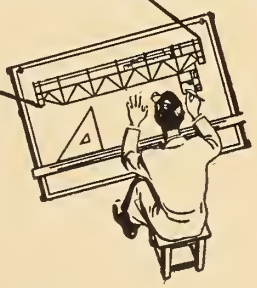

REPRESENTATIVES

QUEBEC. MARITIME PROVINCES & ONTARIO: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL, P.Q. (Walter M. Smith—President). Telephone: WEllington 7742. Telegram: "Marquipco". Montreal.

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Mr. Barnes was previously with Automatic Electric (Canada Ltd.), and earlier was associated with Phillips Electrical Works at Brockville, Ont.

F. W. Fraser, M.E.I.C., construction engineer with the McColl-Frontenac Oil Company Limited, has recently been transferred from Calgary to Montreal. Mr. Fraser has been with the Company since 1946, when he was discharged as a lieutenant from the R.C.E. after four years' service.

D. L. Sprung, M.E.I.C., has been appointed managing director of the McIntosh Industrial Equipment Limited in Calgary, Alta.

Mr. Sprung was formerly in Vancouver, a district development engineer for Canadian Liquid Air Co. Ltd.

Mr. Sprung graduated from the University of British Columbia in 1949, with a B.A.Sc. degree in mechanical engineering.

T. W. H. Stoddart, M.E.I.C., is now with the Rogers Majestic Electronics Limited in Toronto. He is manager of the commercial research department of the Company.

Mr. Stoddart worked previously with Exide Battery Company, and earlier with Northern Electric Co. Ltd. in Montreal.

Paul O. Freeman, M.E.I.C., has joined the Alexander Murray & Company Limited in Montreal as sales engineer. Previously, he was structural engineer for Fraser-Brace Engineering Co. Ltd at Montreal.

John Hulbert, M.E.I.C., is with The Foundation Company of Canada Limited in Toronto.

Mr. Hulbert was previously at Cornwall, Ont., a supervisor with T.C.F. of Canada Ltd.

Wm. F. Hughes, M.E.I.C., is now resident engineer in charge of design and construction of the Consumers Glass Company's new plant at Toronto.

Mr. Hughes was previously with Fairmount Glass Works Inc., in Indianapolis, Ind.

E. G. Ryley, M.E.I.C., is with the W. C. Brennan Contracting Company, Hamilton, Ont.

Mr. Ryley was previously with Dinsmore-McIntire Company, general contractors, at Windsor, Ont. Earlier he was with A. W. Robertson Company at Long Branch, Ont.

H. J. Racey, M.E.I.C., has been appointed a member of the board of directors of MRF Canada Limited.

Mr. Racey is vice-president of Racey, McCallum & Associates in Montreal.

H. J. Racey, M.E.I.C.

R. D. Rosser, M.E.I.C., has joined the Alberta branch of Brown Boveri (Canada) Limited in Calgary. He was formerly associated with the Canadian Westinghouse Company in Edmonton.

W. R. K. Coulthard, M.E.I.C., has been appointed resident consulting engineer for the Western School Zone Chairmen's Board at Kindersley, Sask. Previously, he was resident engineer with the Central Mortgage and Housing Corporation at Winnipeg.

E. H. Sangwine, M.E.I.C., has been appointed assistant reduction plant manager with the Kaiser Aluminum & Chemical Corporation in Chalmette, Louisiana. Until recently, he was associated with the Aluminum Company of Canada, Limited, in Montreal.

George Schuett, M.E.I.C., is with the T. D. K. Rooney (Quebec) Limited in Montreal. He was previously president and general manager of Schuett Construction Ltd.

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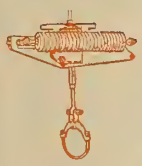

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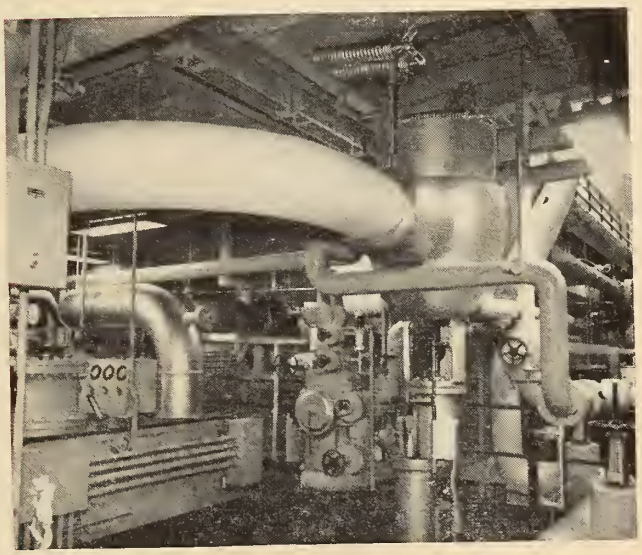
Twin Grinnell Constant Support Hangers provide uniform lift for steam turbine throttle valve to prevent stresses in piping as it moves from "cold" to "hot" positions.



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A. G. W. Lamont, M.E.I.C., has joined the Gunnar Gold Mines Limited, Toronto, Ont.

He was formerly with the Catalytic Construction Company in Philadelphia. Earlier he was chief engineer with Eldorado Mining and Refining (1944) Ltd., at Port Hope, Ont.

D. G. Hoskin, M.E.I.C., has been appointed development engineer at Schell Industries Limited, Woodstock, Ont.

Mr. Hoskin is a former waterworks engineer for the City of Saskatoon.

G. S. Crawford, M.E.I.C., has been appointed industrial engineer with the Research Council of Alberta, in Edmonton.

Mr. Crawford was previously an industrial research engineer with the Department of Natural Resources at Regina, Sask.

Edward A. Donovan, M.E.I.C., is civil engineering inspector for Imperial Chemical Industries of Canada Ltd., on the construction of their "Terylene" plant at Millhaven, Ont.

Mr. Donovan obtained his M.A. degree in 1952 and will have the degree of master of engineering conferred upon him at the commencements of the University of Dublin this fall. He has been working for C-I-L in Montreal.

William A. Dexter, Jr.E.I.C., has joined the firm of Haddin, Davis & Brown Limited, consulting engineers of Calgary and Edmonton, specializing in

W. A. Dexter, Jr.E.I.C.

sanitary engineering. He was formerly provincial sanitary engineer and director of the Division of Sanitary Engineering for the Province of Alberta.

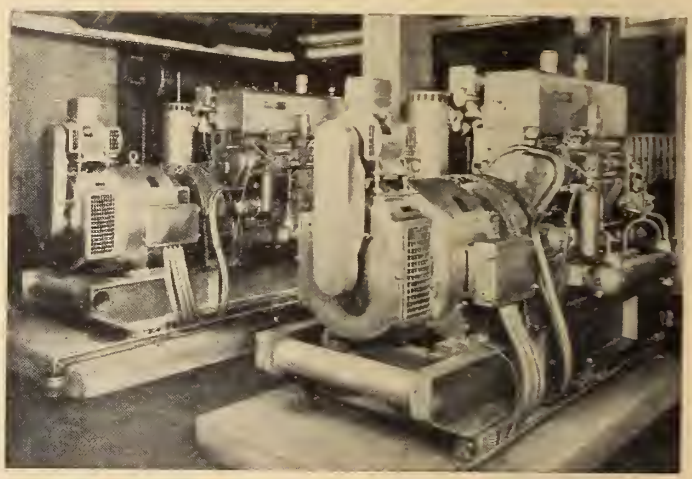
Mr. Dexter was born in Chinook, Alberta, and attended public and high school in Calgary. He enlisted in the R.C.A.F. in May 1941 and on January 2, 1942, obtained his pilot's wings and commission. After one year as flying instructor at No. 3 S.F.T.S. Calgary, he served two and one-half years in England and Europe and completed his tour of operations as night fighter pilot with 410 (Cougar) Squadron. He received his discharge in September 1945 with the rank of flight lieutenant.

Mr. Dexter graduated in 1950 from the University of Alberta with a degree in chemical engineering and in July of the same year joined the Division of Sanitary Engineering, Department of Health, Government of Alberta. Obtaining leave of absence in the fall of 1950 he took post-graduate work in sanitary engineering at the University of Toronto, receiving his master's degree in May 1951.

His initial work in the Division of Sanitary Engineering was on stream pollution surveys. Upon returning from the University of Toronto he was assistant sanitary engineer and was appointed provincial sanitary engineer in September.

A. M. Lount, Jr.E.I.C., has entered into partnership in the firm T. O. Lazarides, Lount and Partners, a consultants' office specializing in prestressed concrete.

Since his graduation in civil engineering from the University of Toronto in 1946, he had been on the staff of the Consulting Engineering Division of the Hydro-Electric Power Commission of Ontario, and during the past four years participated in the design work on prestressed concrete projects carried out by the Commission. One of these projects was the prestressed concrete roof in the garage in Islington in the A. W. Manby Transformer Station and Service Centre, which is believed to be the first pre-



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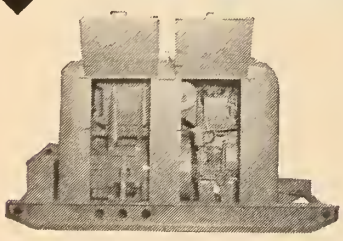

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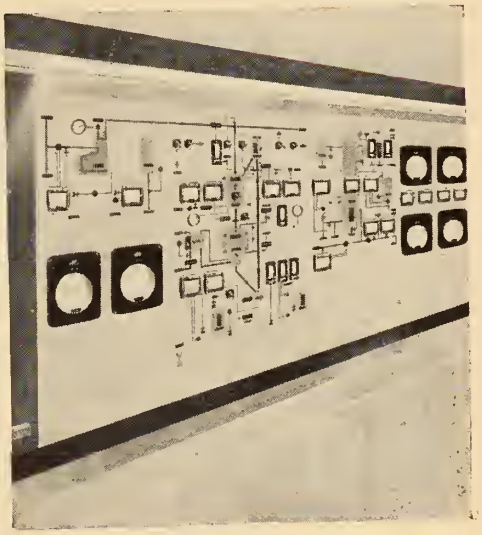

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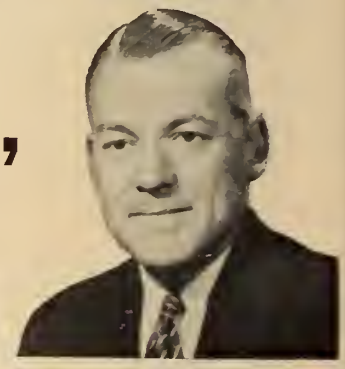

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stressed roof in Canada. Mr. Lount presented a paper on this project entitled "Prestressed Concrete Applied to Roof Joists" at the annual meeting of the Institute in Halifax this year.

J. T. Anderson, JR.E.I.C., has joined the sales department of the Power Electric and Equipment Co. Ltd., at Calgary, Alta. Previously, he was a draughtsman with the Barber Machinery Ltd. at Calgary, Alta., and earlier a junior design engineer with Dominion Engineering Works, Lachine, Que.

Mr. Anderson graduated from the University of Saskatchewan in mechanical engineering in 1950.

R. D. Donnelly, JR.E.I.C., is the director of the Division of Sanitary Engineering of the Department of Health and Welfare for the Province of Prince Edward Island. He has been with the Department since September 1952.

Mr. Donnelly graduated from the University of Saskatchewan in 1950. He took post-graduate training at the University of Toronto, graduating in 1951, and worked for the Department of Health of Saskatchewan before going to Prince Edward Island.

Gilles Lefebvre, JR.E.I.C., was awarded the degree of master of applied science in chemical engineering this year at l'Ecole Polytechnique. He is now doing further post-graduate work at McGill University towards a Ph.D. degree in chemical engineering.

Mr. Lefebvre is an assistant professor in the department of chemical engineering of l'Ecole Polytechnique.

Gilles Lefebvre, Jr.E.I.C.

G. E. Lamoureux, JR.E.I.C., is now employed by Hydro-Quebec as electrical engineer.

From 1942 to 1945 Mr. Lamoureux served as a wireless mechanic with the R.C.A.F., after which he studied at McGill University and graduated in electrical engineering in 1951. He has spent two years with Canadian Westinghouse Company, following the Company's graduate engineers' course.

Joseph Bourbeau, JR.E.I.C., of the Power Development Division of Quebec-Hydro, is stationed at Labrieville, as the cost engineer for the construction of the new Bersimis project.

Mr. Bourbeau graduated in civil engineering from l'Ecole Polytechnique in 1947. He worked for the Beauharnois Light, Heat & Power, at Beauharnois, Que., before going to Quebec-Hydro.

H. C. Clark, JR.E.I.C., is a construction foreman with the McColl-Frontenac Oil Company in Calgary, Alta. He has been associated with the Company since 1948, working as a draughtsman in Montreal and as a construction and maintenance engineer in Toronto.

Mr. Clark graduated in civil engineering from the University of Alberta in 1947.

R. Keith Vail, JR.E.I.C., is field engineer with E. G. M. Cape and Company at the R.C.A.F. base at Greenwood, N.S. He has been with the Company since October 1952. Previously, he was field engineer with the MacDonald Construction Company.

Mr. Vail graduated from the Nova Scotia Technical College in 1950.

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Thos. M. Thomson, JR.E.I.C., is with the Tahsis Logging Company Limited at Muchalat, B.C. He was formerly with the Ash River Division of MacMillan & Bloedel Ltd., Port Alberni, B.C. He has been associated with forestry work in British Columbia since his graduation in 1947 from the University of British Columbia in forest engineering.

A. I. Fjeldsted, JR.E.I.C., has joined the Department of Resources and Development, at Winnipeg, Man., as an engineer.

Mr. Fjeldstad received his B.Sc. degree in civil engineering from the University of Manitoba in 1950. He worked for the Greater Winnipeg Dyking Board in Winnipeg before joining the Department.

I. H. Rigler, JR.E.I.C., is with the staff of Timber Structures of Canada Limited at Peterborough, Ont.

Mr. Rigler graduated from McGill University in civil engineering in 1951, and has worked since in Montreal.

R. S. MacKay, JR.E.I.C., is with the John Inglis Company Limited, in Toronto, Ont., as a design engineer.

He was in England for some time with the English Electric Company.

Mr. MacKay graduated with a B.A.Sc. degree from the University of British Columbia, class of 1950.

Jean R. Audet, JR.E.I.C., assistant engineer in the transportation department of the Canadian National Railways has been transferred from Quebec City to Capreol, Ont.

Mr. Audet graduated in 1951 with a B.A.Sc. degree in civil engineering from l'Ecole Polytechnique.

C. J. Garland, JR.E.I.C., is an inspecting engineer with the Trans-Canada Highway Division of the Department of Resources & Development in Ottawa, Ont.

He received his B.Sc. degree in civil engineering from the University of New Brunswick, class of 1948. He worked for the Department of Mines & Resources at the National Park at Alma, N.B., before going to the Department of Resources & Development in Ottawa, in 1950.

Fred H. Papke, JR.E.I.C., is in the planning department of E. S. & A. Robinson (Canada) Ltd., at Leaside, Ont.

Mr. Papke is a 1951 graduate with a B.A.Sc. degree from the University of Toronto.

L. Griffith, JR.E.I.C., is now with the Canadian Chemical Company Ltd., in Edmonton, Alta. He was previously with the Celanese Corporation of America in Pampa, Texas.

Mr. Griffith graduated in 1950 in electrical engineering from the University of Alberta.

A. A. Vorres, JR.E.I.C., is working with Canadian Industries Limited in Montreal, as purchasing engineer.

Mr. Vorres is a chemical engineering graduate of Queen's University, class of 1950.

F. L. Leblanc, JR.E.I.C., is working for the Montreal Engineering Company Limited, at the Menihek Power Development at Mont Joli, Que.

Mr. Leblanc is a civil engineering graduate of Nova Scotia Technical College, class of 1950.

M. J. Chettleburgh, JR.E.I.C., has joined the Structural Engineering Services, Limited, at Calgary, Alta., as a designer. He worked as a surveyor for the Delto Exploration Company. Calgary, Alta., in 1952.

Mr. Chettleburgh graduated in 1952 with a B.Sc. degree in civil engineering from the University of Birmingham.

Robert Proudfoot, JR.E.I.C., is presently engaged as a design engineer for the Department of Public Works, of Alberta.

Mr. Proudfoot received a B.Sc. degree in electrical engineering from the University of Alberta in 1946. He was a lecturer at the University, and received the degree of M.Sc. in 1950.

H. T. Beare, JR.E.I.C., a design engineer with Dominion Tar & Chemical Co. Ltd., has been transferred by the Company from Calgary, Alta., to Montreal.

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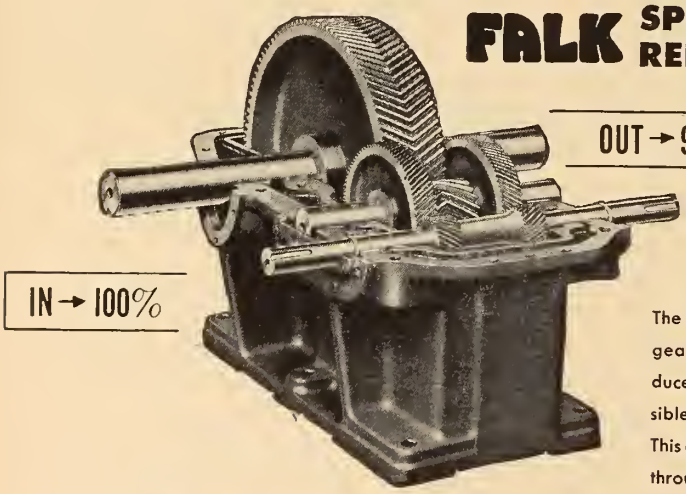

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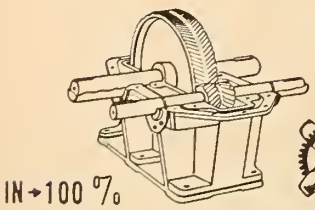

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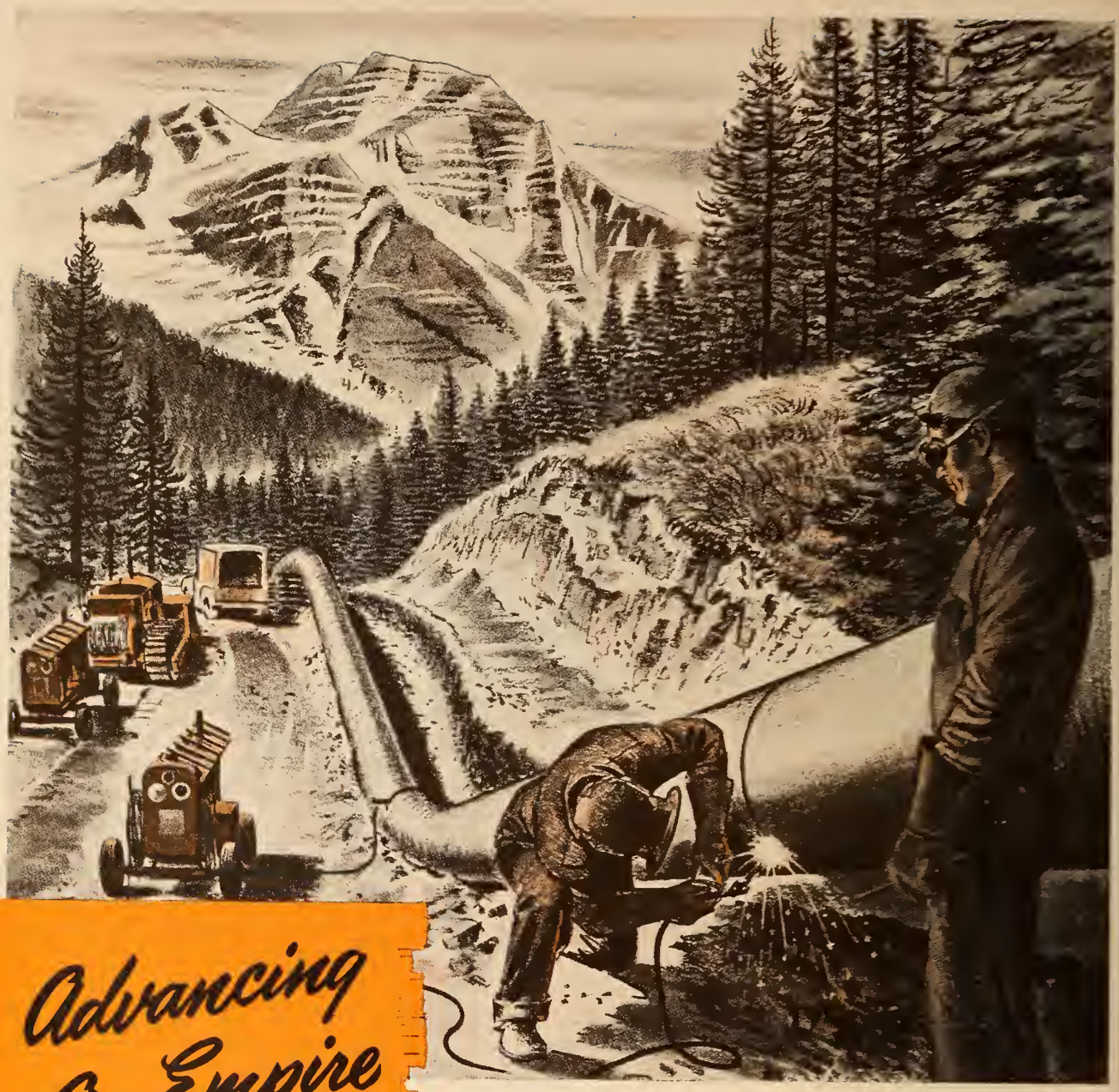

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Mr. Beare is a graduate from the University of Alberta having obtained a B.Sc. degree in civil engineering in 1950.

Harvey N. Burrows, JR.E.I.C., is a plant engineer with the Canada Cement Company in Port Colborne, Ont. He worked previously with Canadian Gypsum Co. Ltd., at Hagersville, Ont.

Mr. Burrows graduated in 1947 from the University of Saskatchewan, with the degree of B.Eng., in ceramics.

L. H. Vallee, JR.E.I.C., has been appointed an electronic engineer in the Department of National Defence, Ottawa. Previously, he was with the British Columbia Power Commission, at Terrace, B.C.

Mr. Vallee received his B.A.Sc. degree in electrical engineering from the University of British Columbia, class of 1950.

Yvan Hardy, JR.E.I.C., has been appointed assistant office engineer in the Power Development Division of the Quebec Hydro-Electric Commission in Montreal. Previously, he was an estimating engineer in the Subway Planning Division of the Montreal Transportation Commission.

Mr. Hardy graduated in civil engineernig from l'Ecole Polytechnique in 1951.

Jack Chisvin, JR.E.I.C., an electrical engineer, is now a partner of the firm, Dodington, Henderson & Chisvin in Toronto.

Mr. Chisvin graduated in 1949 in electrical engineering, from the University of Manitoba, and soon after became associated with E. L. Dodington, consulting engineers, Toronto.

M. J. Dolinsky, JR.E.I.C., has been appointed a supervising engineer with the Department of Highways, Alberta, at Edmonton.

Mr. Dolinsky graduated from the University of Alberta in the civil engineering class of 1948. He joined the Highways Branch of the Department of Public Works soon after graduating.

H. Chapman, JR.E.I.C., has joined the General Steel Wares Limited in Toronto, Ont., as metallurgical engineer for all their factories.

Mr. Chapman received his B.Sc. degree in metallurgical engineering in 1950 from Queen's University. He was a metallurgical engineer with The Photographic Survey in Toronto before taking his present position.

Hans Reicher, JR.E.I.C., is employed by Wallace, Carruthers & Associates Limited, in Toronto, Ont.

Mr. Reicher is an engineering graduate of Loughborough College. He received an M.Sc. degree (Structural) from Massachusetts Institute of Technology, in 1952. He has worked for Dominion Bridge Co. Ltd., in Lachine, Que.

Harry Newall, JR.E.I.C., has joined the Lago Oil & Transport Company, Aruba, Netherlands West Indies, as an engineer in the technical service department.

Mr. Newall received his B.Sc. degree in mechanical engineering from the University of British Columbia in 1951. He has worked since with Polymer Corporation at Sarnia, Ont., as a special projects engineer.

F/O B. P. Charbonneau, S.E.I.C., who graduated this year from l'Ecole Polytechnique as a mechanical engineer, is serving with the R.C.A.F. in Ottawa, Ont.

M. I. Danielson, S.E.I.C., is an engineering trainee with Canadian Gulf Oil Company at Calgary, Alta.

Mr. Danielson graduated in mechanical engineering from the University of Manitoba this year.

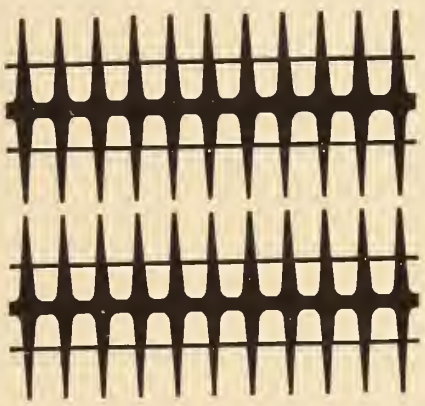
T. W. Creaghan, S.E.I.C., (B.Eng., civil engineering, McGill University, 1953) is now with the New Brunswick International Paper Company in Dalhousie N.B.

Lieutenant C. A. Leech, S.E.I.C., is serving with the Royal Canadian Engineers, in Chilliwack, B.C.

Lieutenant Leech graduated this year with a B.Sc. degree in civil engineering from the University of Manitoba.

Hans P. Brunger, S.E.I.C., is an assistant engineer in the signal department of the Canadian National Railways, at Winnipeg, Man.

Another Iron Curtain



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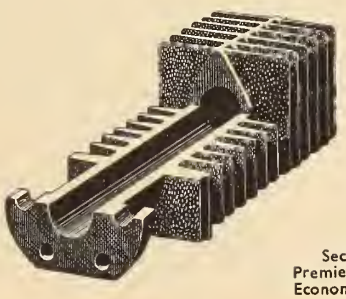

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Mr. Brunger received his B.Sc. degree in electrical engineering in 1952 from the University of Manitoba.

F. J. Cameron, S.E.I.C., is on the staff of the Department of Public Works, at London, Ont.

Mr. Cameron graduated from McGill University in civil engineering in 1952.

W. R. Hammond, S.E.I.C., has been working with Canadair Limited in Montreal as a junior engineer in the mechanical section of the design office since his graduation this year in mechanical engineering from the University of Toronto.

M. R. Jones, S.E.I.C., has joined the Trane Company of Canada, Limited, in Toronto, Ont., as sales engineer.

Mr. Jones received his B.Sc. degree in 1952 from the University of Saskatchewan, and was for a time associated with Canadian Westinghouse Company on the graduate student training course.

Robert L. Wimperis, S.E.I.C., who graduated in mechanical engineering this year from the University of British Columbia, is with the Algoma Steel Corporation in Sault Ste. Marie, Ont.

James Dean Collis, S.E.I.C., is a student engineer with the Otis Elevator Company in Hamilton, Ont.

Mr. Collis graduated this year with a B.Eng. degree in electrical engineering from the Nova Scotia Technical College.

Kenneth George Clarke, S.E.I.C., (B.Sc., 1953, Queen's University) has joined the engineering staff of the Shell Oil Company in Calgary, Alta.

Gordon Robert Younger, S.E.I.C., is a transitman with the Canadian Pacific Railway at Revelstoke, B.C.

Mr. Younger graduated in 1952 with a B.A.Sc. degree in civil engineering from the University of British Columbia.

Donald J. Stelliga, S.E.I.C., is working for Babcock-Wilcox and Goldie-McCulloch Limited, in Galt, Ont.

Mr. Stelliga graduated this year in mechanical engineering from the University of British Columbia.

Roland Boisvert, S.E.I.C., is working at a project of the R. E. Stewart Construction Corporation at St. Desire du Lac Noir, Que.

Mr. Boisvert graduated this year from McGill University in civil engineering.

G. M. Tuttle, S.E.I.C., is an engineering trainee with the Canadian Gulf Oil Company in Calgary, Alta.

Mr. Tuttle graduated this year with a B.Eng. degree from McGill University.

Thomas O. Smith, S.E.I.C., is with the Long Lac Pulp and Paper Company Limited, in Terrace Bay, Ont.

Mr. Smith worked with the Spruce Falls Power & Paper Co. in Kapuskasing, Ont., since his graduation from the University of Toronto in mechanical engineering in 1952.

Wm. T. Harrower, S.E.I.C., (B.A.Sc., 1953, mechanical engineering, University of British Columbia) has joined the Dominion Bridge Company Limited in Vancouver, as an assistant welding engineer.

James M. Kay, S.E.I.C., is with the Canadian Pacific Railway Company in Fort William, Ont., as a transitman.

Mr. Kay received his B.Sc. degree in civil engineering in 1951 from the University of Manitoba.

Marc Cimon, S.E.I.C., is with the Canadian Westinghouse Company Limited at Hamilton, Ont., where he is taking the graduate engineers' training course.

Mr. Cimon graduated in June 1953 with a B.A.Sc. degree in electrical engineering from Laval University.

E. J. Klein, S.E.I.C., joined the staff of the Canadian National Railways at Winnipeg, Man., as an assistant electrical engineer, after receiving a B.Sc. degree in electrical engineering from the University of Manitoba this year.

Leonard C. Sevick, S.E.I.C., is with the Imperial Oil Limited, at Redwater, Alta.

Mr. Sevick graduated from the University of Manitoba in civil engineering in 1952.

Irving G. Fraser, S.E.I.C., is on the staff of Shell Oil Company in Calgary, Alta.

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Mr. Fraser graduated from McGill University in 1952 as a civil engineer.

Cadet G. R. Fanjoy, S.E.I.C., of the Royal Military College, Kingston, Ont., won a third year electrical engineering scholarship of Ontario Hydro-Electric Power Commission this year.

G. H. Lachance, S.E.I.C., is a supervisor with the Aluminum Company of Canada, Ltd., at the Isle Maligne plant, Lake St. John, Que. Previously, he was with the Quebec Iron & Titanium Corporation, Sorel, Que., as an industrial engineer.

Mr. Lachance graduated in 1952 from Laval University with the degree of B.A.Sc. in chemical engineering.

Guy Duchesne, S.E.I.C., (B.A.Sc. 1953, Ecole Polytechnique) is an assistant geologist with the Barnat Mines Limited in Malartic, Que.

R. K. Latta, S.E.I.C., joined the Engineering Division of the National Harbours Board, at Ottawa, Ont., after graduating from the University of New Brunswick in civil engineering this year

Visitors to Headquarters

H. W. McKiel, M.E.I.C., Sackville, New Brunswick, August 17, 1953.

J. L. Feeney, M.E.I.C., Fredericton, New Brunswick, September 1, 1953.

E. G. Allwright, M.E.I.C., Ottawa, Ontario, September 2, 1953.

M. Eamer, Cornwall, Ontario, September 3, 1953.

Gail Hathaway, Hyattesville, Maryland, U.S.A., September 3, 1953.

O. H. Bentzen, Uganda, British East Africa, September 4, 1953.

R. L. Payne, M.E.I.C., Cambridge, Massachusetts, U.S.A., September 10, 1953.

C. B. R. Macdonald, M.E.I.C., Kingston, Ontario, September 10, 1953.

P. J. Heddema, Delft, Netherlands, September 14, 1953.

T. K. Hum, Hong Kong, China, September 14, 1953.

Major General G. R. Turner, M.E.I.C., Ottawa, Ontario, September 22, 1953.

Frank P. Vaughan, M.E.I.C., Saint John, New Brunswick, October 5, 1953.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Hugh Donald Cameron, M.E.I.C., formerly manager of the Locomotive Firebox Company in Montreal, Que., died on February 17, 1953, while visiting in Florence, Alabama. Mr. Cameron had been living in Winnipeg, Man., this year.

Mr. Cameron was born in Toronto, Ont., on September 23, 1879. He obtained his B.Sc. degree in mechanical engineering from McGill University in 1901, and that year entered the construction department of the Montreal Street Railway.

He was in railway work for some years after graduation, with Canada Atlantic Railway, the Grand Trunk Pacific Railway, the Colorado & Santa Fe Railway, and the Canadian Northern Railway in Winnipeg. With the Canadian Northern he was chief draughtsman and mechanical engineer from 1907-1913.

For many years Mr. Cameron served as the manager for Canada, for the Locomotive Firebox Company in Montreal, and after his retirement acted in an advisory capacity for Dearborn Chemical Co. Ltd., in Montreal.

Mr. Cameron joined the Institute as a Student in 1899. He transferred to Associate Member in 1913, and to Member in 1940. He attained Life Membership in 1945.

Lemuel Allan Wilmot, M.E.I.C., of Edwards, Ontario, passed away this year. Mr. Wilmot was formerly a director in the taxation department of the Department of National Revenue in Ottawa.

Mr. Wilmot was born in Victoria, B.C., on October 10, 1891. He graduated with honours from the Royal Military College, at Kingston, Ont., in 1911. He studied at the McGill University and completed his engineering education at the University of Wisconsin, Madison, in 1914, receiving the civil engineering degree.

He had worked for two years with the British Columbia Electric Railway on a power development on Vancouver Island. He continued to work after graduation on power development projects in the West, until his entry into the Canadian Army in December 1914. He served until May 1919, receiving his majority and being awarded the Military Cross. He had served as adjutant and later as second in command of the 28th Battalion, C.E.F.

Mr. Wilmot entered the Department of Customs and Excise, and was sent to London, England, as an investigator of values. He joined R. A. Lister & Co. Ltd., in Toronto, about 1929, as managing director, being appointed president in 1931. In 1940 he went to work for the Foreign Exchange Control Board, going to the Commodity Prices Stabilization Corp. Ltd., in 1942. Associated with the R.C.O.C. during World War II, he received the rank of Lieut.-Colonel, and Colonel.

Upon his return he worked as a technical advisor on foreign trade rulings in Toronto. He went to the Department of National Revenue in 1948.

Mr. Wilmot joined the Institute as an Associate Member in 1929, transferring to Member in 1940.

Alexander Munro Maclaren, M.E.I.C., died after a short illness, on July 22, 1953, at Bernhards Bay, Syracuse, N.Y.

Mr. Maclaren was born in November 1882, at Bridge of Allan, Scotland. After a millwright apprenticeship, and studies at Gordon's College, Aberdeen, he received the diploma in mechanical engineering in 1909.

He worked in design and inspecting at Stewarts and Lloyd, Airdrie, Scotland, and at Bradford Dyers Assoc., Bradford, England. For ten years from 1915 he was chief designer and supervisor of technical training of apprentices for Rowntree and Company, York, England.

Mr. Maclaren came to Canada in 1925 and was for six years a design engineer with H. G. Acres & Company, Niagara Falls, Ont. Later he worked on construction with the engineer of Niagara Township; as a design engineer with International Nickel; as a mechanical engineer for American Cyanamid. He was a design engineer for Hooker Electrochemical Company at Niagara Falls from 1946 to 1950.

At the age of 69 Mr. Maclaren entered for and passed his examination for admission as a Professional Engineer in New York State, and afterwards joined H. K. Ferguson & Co., consulting engineers in Cincinnati, Ohio. He joined The Engineering Institute as a Member in 1950.

Francis Jumis, S.E.I.C., of Vaudreuil, Que., died on July 11, as a result of a traffic accident.

Mr. Jumis was born in Latvia in 1919. He gained his education at the Government Technical High School, at the University of Riga, Latvia, and at the Chalmers University in Gothenborg, Sweden. In October 1952 he entered McGill University to complete his education in engineering. He had completed third year engineering in 1953.

He had done summer work as an instrumentman with Surveyer, Nenniger & Chenevert; as a draughtsman with the Canadian Industries Limited, and as an engineer with Campbell Chibougamau Mines Limited.

Mr. Jumis joined the Engineering Institute as a Student Member in January, 1953.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER for employment in the technical service department required for large pulp and paper organization in Newfoundland. File No. 4656-V.

QUALIFIED CHEMICAL ENGINEER with some chemical plant and or oil refinery processing experience. This person would be employed as technical sales representative covering the whole of Canada. Age range 35 years. Organization is a chemical plant and oil refinery construction company providing process engineering, design and construction services. Location Ontario. File No. 4659-V.

CIVIL

JUNIOR CIVIL OR mechanical engineer for product sales development work. Graduate with two or three years experience. Experience in pulp and paper, chemical plant or general construction would be an advantage. Location Montreal. File No. 4658-V.

CIVIL ENGINEER required by municipality in Province of Quebec with a population of 5,000. Applicants must be thoroughly bilingual with not less than two years experience. Duties include budget survey, preparation of estimates and the keeping up to date of a large scale plan of all municipal services, in cooperation with a committee to elaborate construction standards and a town planning program. Please give full particulars of age, education and experience in reply. File No. 4661-V.

ELECTRICAL

ELECTRICAL ENGINEER required for design of electrical installations in generating stations and substations. Will be responsible for layout, purchase specifications, scheduling and general supervision of installations and placing in service. Excellent fringe benefits including attractive pension plan. Apply stating salary required and giving full details of qualifications and experience. File No. 4655-V.

RESIDENT ELECTRONIC ENGINEERS required by company located in Montreal. Applicants should be Canadian with a degree in electrical engineering and 5 to 10 years experience on radar (ground radar) and communications work. File No. 4660-V.

ELECTRICAL ENGINEER required by army headquarters, Ottawa to assist and support an electrical engineer in connection with all electrical plant distribution and interior wiring systems-operation and maintenance. To carry out field work on a Canada wide basis in connection with all electrical facilities and appurtenances. Sixty percent of the work will be field liaison visits. To provide a continuous check of all electrical consumption and use of equipment to ensure maximum conservation. File No. 4662-V.

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training program of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers, and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4663-V.

ASSISTANT PROFESSOR REQUIRED in the department of electrical engineering of University located in Maritime Provinces. Preferably Canadian, under 35, and with at least two years experience. The course involves D.C. machinery, A.C. circuits and introductory electronics. File No. 4667-V.

MECHANICAL

MECHANICAL ENGINEER to engage in mill maintenance engineering including draughting and designing by large pulp and paper organization in Newfoundland. File No. 4656-V.

MECHANICAL ENGINEER required by Army Headquarters, Ottawa to assist and support a mechanical engineer in connection with all types of heating plants operation and maintenance. To carry out detailed field work on a Canadian wide basis in connection with all heating plants and appurtenances. Sixty percent of the work will be field liaison work. File No. 4662-V.

MECHANICAL ENGINEER preferably a 1952 graduate. The position is that of assistant to project and production engineer and the duties will embrace the conception and design of new products and the planning of tools, jigs, fixtures and production methods. Products include aluminum extrusions, roll formed and fabricated shapes in aluminum and other consumer products. Location Ontario. File No. 4668-V.

MISCELLANEOUS

TWO SALES ENGINEERS required by manufacturer of code testers, convector radiators, unit heaters, fluorescent and incandescent fixtures, etc. to contact architects, engineers, contractors, plumbers, and electricians, to prepare plans and estimates. Must be bilingual. Good salary and commission. File No. 4654-V.

CITY OF MONTREAL architects office offers permanent employment opportunities to engineers. Age must not be over 55 years at date of empoyment. Education: preferably graduation in engineering from a recognized university; must be a member in good standing of the corporation of professional engineers of Quebec at date of appointment. Post graduate studies; a compensation on the number of years of experience required will be alloted to candidates who have followed recognized post graduate courses. Experience at least 6 years practical professional experience or its equivalent, must have an extensive general formation in addition to proved administrative qualities, must be capable of taking the entire technical responsibility of a project. File No. 4657-V.

DIESEL ENGINEER (diesel electric) required in Montreal. Duties would involve the supervision of repair and maintenance on diesel power units. File No. 4660-V.

UTILITIES CONTRACT ENGINEER required by army headquarters, Ottawa to continuously develop more economical procurement of utilities and services (furnished by contract), such as electricity, steam, gas, water sewage disposal, boiler inspection, instrument repair, elevator maintenance, railroad siding maintenance, at Canadian Army installations. File No. 4662-V.

RECENT GRADUATES in metallurgical or chemical engineering for laboratory pilot plant and plant operations in the ore dressing and extractive metallurgical field. Location Ontario. Supply full particulars regarding qualifications to File No. 4664-V.

YOUNG ENGINEER to act as sales engineer. Age 25 to 35 years. Graduate with 6 months to 3 years experience. Manufacturers of finned tube and products manufactured from it. Although travelling is involved, it is not of a routinized nature. Periodic trips throughout Ontario and occasionally Quebec are required. The applicant should either have, or be interested in obtaining a knowledge of design and application of heat transfer treatment. The selected applicant will be expected to undergo a training period in London Ontario eventually locating in Toronto where he will operate independently. File No. 4665-V.

YOUNG GRADUATE ENGINEER preferably with manufacturing experience required by financial institution to make surveys of and write reports on indus-

trial plants in Eastern Canada. Permanent position. Salary according to qualifications. File No. 4666-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate with Bachelor's or Master's degree, for research in the engineering and development section of the division of applied biology, National Research Council, Ottawa. Immediate duty to assist in small scale fermentation pilot plant investigation. Interest in food preservation and refrigeration research desirable. Starting salary up to $4,400 per annum depending on qualifications. Apply in writing giving all relevant details, including experience, academic standing, and if possible, references. File No. 4669-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

SALES ENGINEER required by a Canadian manufacturer of vacuum washers and thickeners for the pulp and paper industry. Applicant must have five to ten years experience in a pulp and paper mill and preferably a graduate in chemical engineering. Excellent opportunity for engineer with sales aptitude. Salary open depending on qualifications. File No. 4613-V.

SALES ENGINEER required by Canadian manufacturer of continuous vacuum filters for the chemical metallurgical and industrial field. Applicant must have five to ten years experience in chemical metallurgical plants. A graduate chemical engineer with sales ability preferred. Salary open depending on qualifications. File No. 4613-V.

CHEMICAL ENGINEER required, bilingual with experience in food canning, specially meat canning. Work will entail management of Montreal plant production of present manufactured goods and of future products. Salary will depend on experience and qualifications. All replies will be held confidential. File No. 4650-V.

CIVIL

GRADUATE CIVIL ENGINEER preferably with graduate work in public engineering and some public health engineering experience, to do field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewage systems, stream pollutions, deficient drainage and other environmental factors. File No. 4617-V.

YOUNG RECENT CIVIL graduate, thoroughly bilingual for sale of concrete pipe and building units in the Montreal region. Salary open. File No. 4630-V.

PROJECT ENGINEER REQUIRED, for large Newfoundland manufacturer of pulp and paper products. Man selected would be responsible for complete follow up of progress on all construction work including costs, etc. Work would cover general construction, hydro-electric development, railway and port projects. Excellent opportunity for right man, would possibly be considered for senior position in organization within three or four years. Previous pulp and paper mill experience valuable but not absolutely essential. File No. 4632-W.

Wanted

Recent graduates in metallurgical or chemical engineering for laboratory, pilot plant and plant operations in the ore dressing and extractive metallurgical field. Supply full particulars regarding qualifications to

Personnel Supervisor
FALCONBRIDGE NICKEL MINES LIMITED
Falconbridge, Ontario

EXPERIENCED ERECTION ENGINEER, required by a medium sized steel fabricator located in Toronto. Supervisory ability and willingness to travel are important. Civil engineering degree preferred but not essential. Company offers pleasant working conditions, participating hospitalization insurance, pension plan, etc. Your resume should include a personality sketch, record of qualifications and past experience, and references. Salary open. Only experienced applicants will be considered. File No. 4641-V.

CIVIL ENGINEER preferably college graduate and registered professional engineer with at least fifteen years practical experience in a supervisory capacity, specializing in design of structural steel and reinforced concrete buildings, to supervise group of engineers and draftsmen in consulting engineer's office in Windsor. Please write giving full details including experience age, salary requirements, references, etcetera. Interview will be arranged. File No. 4649-V.

ELECTRICAL

ELECTRICAL SALES ENGINEER wanted in Toronto. Preferably experienced in design of rectifiers, control equipment and communication power systems. File No. 4612-V.

ELECTRICAL ENGINEER (power option) age 30-45 required by heavy electrical manufacturing company located in vicinity of Montreal with a minimum of 3 years experience for transformer electrical design, quotations and cost estimating on power transformers up to 10,000 KVA. Should be able to take over duties of department head in his absence. Salary commensurate with past experience and ability. Good prospects for advancement. File No. 4623-V.

ELECTRICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicants should have pulp and paper experience. Salary range $700. to $750. File No. 4653-V.

MECHANICAL

MECHANICAL GRADUATE with at least one year's draughting experience wanted for engineering department of a structural steel company in Southern Ontario. Permanent position with opportunities for advancement in engineering and contracting. File. No. 4610-V.

CHIEF ENGINEER home appliances. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design styling, standardization, lab, etc. Canadian engineer with experience in home appliances design, age 35 to 40 preferred. This is an excellent opportunity for creative engineering since this company is Canadian owned and wishes to produce Canadian designs for the Canadian market. Location Ontario. File No. 4616-V.

MECHANICAL ENGINEER, required as sales representative by machinery manufacturer. Recent graduate and preferably bilingual. Territory Montreal and Province of Quebec. File No. 4634-V.

JUNIOR MECHANICAL ENGINEER, required for design and general duties in machine works located in Montreal. File No. 4635-V.

DESIGN ENGINEERS, experienced in commercial vehicle design and production methods are required for general trailer design. In reply, state age, experience, references and salary expected to File No. 4636-V.

ENGINEERS, are required with previous experience in the design and construction of aluminum transport trailers. Replies stating personal history and salary required should be addressed to File No. 4636-V.

MECHANICAL ENGINEER, required by long established manufacturing firm, graduate mechanical engineer, preferably between ages 25-32 should have some experience in plant engineering duties. Position offers better than average possibilities of working into responsible duties in production. Apply by letter giving full information. File No. 4640-V.

SALES REPRESENTATIVE, over five years experience to industrial manufacturing plants. Successful proven sales record and the following: over thirty, mechanical background essential, preferably metal shop experience; knowledge conveyors, or dust collection or mixing, screening equipment preferred. Exclusive territory to acceptable representative opportunity American machine company with manufacturing facilities in Canada File No. 4648-V.

Wanted Immediately

A Qualified

ELECTRICAL ENGINEER

Direct replies to
Town Clerk,
P.O. Box 147,
Summerside,
P.E. Island.

ASSISTANT MECHANICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicant should have pulp and paper experience. Position will eventually lead to mechanical superintendent. Salary $700. to $750. File No. 4653-V.

MISCELLANEOUS

SALES ENGINEER required by Canadian manufacturer of mine hoist machinery. Some experience with mine hoist equipment desirable. Contact experience with Canadian mines essential. This position will lead directly to the management of the mine hoist division for the right man. File No. 4609-V.

MECHANICAL OR CHEMICAL engineer required for selling and servicing accounts by sound well-established Canadian paper company engaged in the corrugated and solid fibre box field. Splendid openings in both Toronto and Montreal are due to retirement of long-service personnel and also large scale expansion programme of manufacturing facilities. Thorough training will be given prior to assignment. Replies are invited from recent graduates as well as those with four years minimum selling experience. File No. 4611-V.

SALES ENGINEER bilingual and married preferred. Proven sales record, capable of handling mining and industrial equipment and supplies. Salary commensurate with experience and ability. Ideal living and education facilities. Bright future. Permanent position. File No. 4614-V.

AN ENGINEER $6,420-$7,200 for the Board of Transport Commission at Ottawa. Details and application forms at your nearest civil service commission office national employment office and post office. File No. 4618-V.

THE HEBREW INSTITUTE OF TECHNOLOGY, Haifa, Israel is seeking candidates to fill senior teaching posts in all facilities of the profession. Appointments will be made for three years, professorships may be permanent. Those interested are invited to write to UNESCO, 19 Avenue Kleber, Paris 16, for forms of application. File No. 4625-V.

METALLURGIST with approximately five years experience. Graduate of recognized University in metallurgy, capable of taking charge of electric furnace operation, iron cupola, and to supervise metallurgical laboratory. Location in Western Canada. Salary depending on experience and to be negotiated. File No. 4626-V.

AN ELECTRONICS SPECIALIST is required to study the design of electro-mechanical control systems and in particular to develop a reading unit applicable to either fluorescent or ordinary markings for sortation purposes. The work will be done by a team which will study all aspects of high speed mechani-

cal sortation systems and the aerodynamics of interference in the movement of papers at high speed. A knowledge of electronics and in particular pulse circuits is required. Graduation in applied science is a preferred qualification. File No. 4628-V.

IN THE PATENT OFFICE of the Secretary of State Department at Ottawa, six mechanical engineers are required to undergo training in patent law and patent regulations in force in Canada, and then to assume the responsibility for the examination of applications for patents in the mechanical engineering field with a view to making recommendations for the award or denial of patents. The desired qualifications include graduation at the bachelor's level with specialization in applied science and some experience in the production or research field having to do with mechanical problems. File No.4628-V.

COST ENGINEER, with 10 years practical experience preferably on hydro-electric projects. To train and supervise a small staff in the field to report and analyse costs. To assist in preparation of estimates, budgets and other similar work. Location in Sao Paulo, Brazil with frequent trips to camps in the vicinity of Sao Paulo and Rio de Janeiro. Age 35 to 45. File No. 4631-V.

RECENT GRADUATE, preferably with experience in the pump or oil refinery fields to act as sales engineer in the Vancouver area for expanding Western manufacturing operations. Salary and bonus arrangement for successful applicant. File No. 4633-V.

YOUNG CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance, preferably in the pulp and paper industry. Applicant should be fluent in either French or English and able to get along in the other. Replies should outline qualifications, experience, age and salary expected. File No. 4637-V.

OPENINGS ARE AVAILABLE, for mechanical and chemical engineers in a large Eastern Canadian paper mill. Single men preferred who have experience in the paper industry. Applicants please give complete detail of experience and personal history. File No. 4638-V.

GRADUATE CHEMICAL OR MECHANICAL ENGINEER, required. Preferably with some experience for Eastern Ontario food industry. Apply stating experience and salary expected. File No. 4642-V.

WELL KNOWN FIRM of Management Consultants is prepared to appoint additional engineers to their staff. Candidates should be Canadians, aged between 30 and 35, possessing engineering degree and several years executive experience with increasing responsibilities in manufacturing industry. Only those should apply who have a definite interest in management and who are well informed on present-day management techniques and general industrial trends. File No. 4643-V.

PROFESSIONAL ENGINEER, required to work on steam boilers and associated equipment. Applicants should have four to six years recent experience in this field and be capable of handling contract work, be conversant with heat transfer as it relates to steam power plant equipment. Location Toronto. File No. 4644-V.

THE DEFENCE RESEARCH BOARD, requires scientific information officers for employment in Ottawa, Canada. Bachelors degree in science with additional credits given for post-graduate study; preferably research experience; ability to work as an independent member of a scientific team; Canadian citizen or British subject. Vacancies; aeronautics and related subjects, physiology, biochemistry and bacteriology, electronics. Salary range $2,800.00 to $7,300.00 per annum. Competition No. 53-DRP-3. File No. 4645-V.

A GRADUATE ENGINEER, preferably civil or mechanical to develop, with assistance of economic research staff, industrial opportunity proposals for new industry and expansion of present industry. Must be able to meet the public. Post graduate experience required. Senior position with good opportunities for advancement. Location Regina, Saskatchewan. File No. 4646-V.

AGRICULTURAL ENGINEER, required by Eastern Canadian Agricultural College for teaching and field experimental work in farm power and machinery. Post-graduate training preferred but not required. Salary commensurate with experience and training, good prospects for advancement. File No. 4647-V.

ENGINEERING GRADUATE or equivalent, bilingual, with proven sales record to sell construction equipment, earth-moving machinery, diesel engines, electric sets and marine engines. Progressive company, good working conditions, salary, expenses and commission. Salary dependent on experience. Location Montreal. File No. 4651-V.

SALES ENGINEER bilingual for Quebec City area. Experience in water treatment beneficial but not essential. File 4652-V.

SALES ENGINEER for Eastern Ontario. Experience in water treatment beneficial but not essential. File No. 4652-V.

GENERAL SUPERINTENDENT required to take complete charge of paper mill for large organization with headquarters in Montreal. Salary $850 to $900. File No. 4653-V.

Situations Wanted

TOOL AND PRODUCTION ENGINEER, age 44, McGill 1931, fully qualified in production planning, supervision and organization requires position of a permanent nature which would utilize past experience. Preferably work on executive level as a Production or works manager. File No. 551-W.

MCGILL GRADUATE Jr.E.I.C. 1950, age 25. Experience consists of 2½ years consulting work in plumbing, heating and ventilation seeks employment in the air conditioning and ventilating field. Other experience in electrical switchgear and illumination. File No. 691-W.

CIVIL ENGINEER B.A.Sc. U. of T. M.E.I.C., age 49, married. Three years experience in road and municipal survey work. Over twenty years experience in steel, concrete and timber design. (municipal, industrial and office buildings, bridges, large sewers and tunnels, flat slab, rigid frames, equipment and conveyor supports, piles etc.) Considerable experience in inspection of construction, plant layout, and supervision of structural design and preparation of plans. Seeks responsible position with future possibilities—such as plant engineer. Preferably but not necessarily in South Ontario area. File No. 899-W.

MECHANICAL ENGINEER graduated 1930 age 37, married with 2 children. Has experience as manufacturing manager, superintendent, plant engineer, maintenance, construction, manufacturing methods, quality control and inspection in metal fabricating and process industries. Desires a job as manufacturing manager or superintendent, or plant engineer, in metal fabricating or process manufacturing preferably in Alberta, British Columbia or Ontario. File No. 1586-W.

MECHANICAL ENGINEER sound technical and administrative background gained through 15 years of practical engineering experience. Seeking position with greater scope than present senior supervisory position offers. B.Sc. in M.E. M.E.I.C., and P.E. of Ont. Canadian age 38. married. If there is a future in your organization for such an engineer please contact file number 2745-W.

CIVIL ENGINEER Jr.E.I.C., married presently employed, with over 5 years experience in all types of structural design, field work and some sales desires first class position with responsibility and real opportunity for advancement. Would prefer position where complete supervision of design, field work and/or sales is wanted. Any offer leading to partnership would be most desired. Locality is no barrier, although Montreal and vicinity would be most desired. File No. 3026-W.

CIVIL ENGINEER Jr.E.I.C., B.Eng. (McGill 1949) B.Sc. 1947, age 26. married. Four year experience as a structural engineer on bridges of all types in steel, reinforced concrete and timber. Desires position with future anywhere in Canada where design experience will be an asset. Available on approximately one months notice. File No. 3097-W.

CIVIL ENGINEER, Jr.E.I.C., B. Eng. McGill 1951, P.Eng. Quebec. Age 31 years, married, two children. Bilingual. Veteran 5½ years R.C.N. Familiar with West Indies, South America, South Africa, India, Egypt Britain. Experienced one and one half years city engineering, six months railway maintenance of way; two years supervision of construction of biofilter sewage treatment plant, water filtration plant, sewerage system, airport facilities, for consulting engineer. References and resume on request. Presently employed Montreal area. Seeks further opportunity in Canadian or foreign employment. File No. 3788-W.

CHEMICAL ENGINEER, B.Sc. Alberta 1949, P.Eng. Alberta, Jr.E.I.C., war veteran, married. Experience operation of municipal lime-soda softening plant and boiler water treatment high pressure turbo-generator plant. desires change to more progressive position where past experience may be applied. File No. 3897-W.

INDUSTRIAL CHEMICAL ENGINEER, P.Eng., M.E.I.C., married, family, 10 years experience at supervisory level in production, food chemistry, mine and mill metallurgy and design, safety quality and production minded. Seeking responsible and permanent position with established firm, situated in small city or town. requiring capable, energetic supervision for production or technical control work. File No. 3914-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc. (University in Austria 1944), good Canadian experience, age 36, married, development and research minded, extremely good knowledge of theoretical and applied engineering sciences, well founded machine shop practice and 8 years of engineering practice in development, research and designing of machinery, equipment and tools, wants a responsible position with good opportunities, or independent work. File No. 3990-W.

PROFESSIONAL ENGINEER, age 35. Married, B.Sc. Civil Engineering 1941. A.M.I.C.E., A.M.I. Struct. E. Specialist in design and construction of reinforced concrete framed and factory buildings and industrial plant structures including foundations, sound knowledge of structural steelwork design and soil mechanics. Seeks responsible position with firm of engineers or architects. Preferably with view to eventual partnership. File No. 4041-W.

EXPERIENCED VIBRATION ENGINEER, seeks part-time consultation work for solving industrial problems on vibration isolation and noise attenuation. File No. 4091-W.

MECHANICAL ENGINEER offers services as part-time consultant for design of special purpose machines and preparation of shop detail drawings. File No. 4091-W.

MECHANICAL ENGINEER. Jr.E.I.C., P.Eng., B.Sc. Sask. 1949, age 25, single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting, design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

METALLURGIST EMIGRATING October 1953 seeks appointment. M.Sc., Ph.D. (Manchester) with 14 years of experience in metallurgical fields. Experience includes five years conducting investigations in one of the largest iron and steel plant laboratories. Nine years in planning, administration and conductance of research in a newly built metallurgical laboratory as the official in charge. Desires position in industry or research organization on development work or in administration-cum-technical capacity. File No. 4274-W.

AGRICULTURAL ENGINEER 1942 graduate M.E.I.C., P.Eng., (Sask.) age 37, married. Ten years experience with oil companies. Process work, drafting, in the production department, drafting, designing, construction and maintenance in the marketing department. Desires position in West. Available on reasonable notice to present employer. File No. 4277-W.

CIVIL ENGINEER B.E. National University of Ireland. Arriving Montreal approximately August 15th. 2 years experience in structural steel design, and draughting of steel-framed buildings and various types of steel roofs. Also some surveying experience. Position in housing, road construction, sewer and water services preferred but willing to remain

Recent Graduates

('51, '52, or '53)

REQUIRED

Positions open in

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Technical Sales

Technical Service

Process Development

Process Supervision

For Details Write

Dow Chemical of Canada Limited

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Sarnia, Ontario

(Applications Confidential)

in same line if suitable employment offered. Location preferably Montreal or Eastern Ontario. Age 23, married. File No. 4283-W.

INSTRUMENT ENGINEER graduate chemical engineer, Jr.E.I.C. McGill 1950, with three years experience in instrumentation, desires a position in the chemical or petrochemical industries. File No. 4284-W.

MECHANICAL ENGINEER, University graduate. Age 54, married, 2 children Over 10 years experience as factory manager, 4 years experience as field engineer. Experience covers production, administration, maintenance, standards, plating ,etc., 1½ years working in Canada. Presently employed and available from the 1st of August. Fluent in French, German, Polish and Czech. Depending on nature of position would consider going elsewhere. Willing to start in junior position with the possibility of advancement. At present located in Montreal (Longueuil). File No. 4287-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc., 1950, B.Eng. 1952 McGill age 25, married. Experience: 2 years during summers, surveying, inspecting, 1 year in design group for a chemical plant. Desire a position with wider scope and responsibility, preferably with a small progressive firm either in engineering or sales engineering. Location preferred Montreal but not mandatory. File No. 4288-W.

CIVIL ENGINEER B.A.Sc. (Honors-Toronto) P.Eng., (Ont.) Jr.E.I.C., seeks a position with an aggressive company in Vancouver or vicinity that needs a man who is well experienced in all phases of bridge design, both reinforced concrete and structural steel, who has also served as resident engineer on a large road construction project, who has an abundance of energy and initiative. File No. 4289-W.

YOUNG ENGINEERING EXECUTIVE experienced sales and general management M.E.I.C., M.S.A.E., D.L.C. (Eng.), A.M. I.I.A., Grad. R.Ac.S. age 30. Experience covers production, research, sales—domestic and export, advertising, general management over a wide range of engineering products including job engines, air, oil and fuel filters, abrasives, fans and blowers, machine tools. Widely travelled in Canada, U.S.A., South America and Europe. Experienced in preparing technical articles, delivering lectures. Would like to join a progressive organization where drive, initiative and organizing ability would be utilized to the fullest extent. File No. 4295-W.

CHEMICAL ENGINEER graduate (1950) M.C.I.C., age 27, single. Three years production experience in large chemical factory including two years in production of caustic chlorine by electrolysis also experience in pulp and paper plant. Interested in production, pulp and paper, chemical, paint and varnish industry. Available on short notice. File No. 4299-W.

MECHANICAL ENGINEER P.Eng. M.E.I.C., M.I. Mech.E. experience includes apprenticeship 7 years draughting office and research, technical executive on foreign railways, 5 years works manager railway workshops. At present mechanical superintendent of sulphite pulp mill. Would prefer change to Ontario or Maritime Provinces. File No. 4302-W.

GRADUATE NOTTINGHAM UNIVERSITY, England, 1st class certificate in mining. Experience includes technical work as planner on major reorganization programme research engineer and chief safety engineer. One year in Canada engaged in design and plant engineering. Wishes to relocate in responsible position in production processes. File No. 4303-W.

GRADUATE MECHANICAL ENGINEER, married with family, requires employment. Diversified industrial experience. Purchasing, maintenance and machinery shop practice. Sound business training. Experience includes heating, sheet metal industries and general machinery equipment. Bilingual. Has good personality, enthusiastic, keen business acumen. Desires employment on production, sales or engineering administration. Location Montreal area. Available immediately. File No. 4300-W.

MECHANICAL ENGINEER, 25 H.N.C., G.I. Mech.E. Indentured apprenticeship; 4 years. Junior Development Engineer, production and prototype machinery; 2 years design office on diesel and gas engines, arriving September in British Columbia. Presently employed in Ontario. Seeks position in B.C. File No. 4311-W.

STRUCTURAL ENGINEER P.ENG. 3 years experience in steel and concrete wants part time employment from Hamilton-Toronto area. File No. 4313-W.

CIVIL ENGINEER, B.Sc. Queen's University, Belfast, 1951. Age 23, recently arrived in Canada, seeks position with structural engineering firm, location unimportant. Keen to tackle difficult problems. Experience in structural steel and reinforced concrete design, estimating, preparation of bills of quantities, and model testing. Also some surveying experience and at present on building construction work in Toronto. File No. 4314-W.

MECHANICAL ENGINEERING DESIGNER, A.M.I.Mech.E. A.F.R. Ae.S., English immigrant, seeks position in Ontario, Montreal or West. Experience on gas turbines, axial flow compressors and reciprocating aero engines. Will consider wide range of activity, including design, sales or testing. Presently employed in Maritimes. File No. 4315-W.

CIVIL ENGINEER, Jr.E.I.C. Nova Scotia Tech., 1951. Age 30 (married, two children). Experience includes field and office work with Maritime contractor on bitumen paving, water and sewer installation. Past two years as assistant engineer with public Works Department of Tanganyika, East Africa. Experienced in all phases of engineering concerned with the development and maintenance of roads, airports, buildings, water supply and sanitation. Desires position with consultant or contractor with opportunity of advancement. Location preferably Toronto or area Available early February 1954. File No. 4316-W.

ELECTRONICS ENGINEER, Jr.E.I.C., B.A. Ottawa, 1943. B.A.Sc. Laval, 1949 Age 30, married with children, bilingual. Four years experience in radio physics, equipment design and basic research. Desires job offering good advancement possibilties. File No. 4317-W.

CIVIL ENGINEER, graduate Delft Technological University, Holland (specialization; hydraulics, dikebuilding), age 28, 1½ years experience in reinforced concrete structures and surveying; interested in prestressed concrete. Presently employed as instrumentman in Western Canada. Desires position with possibilities for advancement. Available on about one week's notice anywhere in Canada. File No. 4318-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. N.S.T.C., age 23, single. Considerable experience in housing projects and timber construction Some architectural experience, concrete form design on large hydro-project, pipe design and field supervision. Interested in isolation work in Northern Canada or South America, but will consider other foreign positions. Minimum salary for isolation jobs $7500. I would like experience and do not mind responsibilty. Available on short notice. File No. 4319-W.

MECHANICAL ENGINEER, 52 graduate. Single. Desire position in research and development, automotive or allied fields. Presently employed in the pulp and paper industry. Bilingual. Preferred location Montreal or Ottawa area. File No. 4320-W.

YOUNG MAN engineering physicist, S.E.I.C., B.Sc. Georgia, 1950 (Psychology with chemistry) B.Eng. North Carolina, 1953 (physics with Methematics) English & French languages. Two years general practical electronics, three years univercity teaching experience. Canadian army veteran. Desires permanent position with opportunity of furthering interests in research organization. Location anywhere in Canada. File No. 4321-W.

MECHANICAL ENGINEER, Jr.E.I.C., B. Eng., N.S.T.C., 1951, age 24, single, experience includes 16 months pulp and paper industry. 8 months materials handling. Desire permanent position with opportunities for advancement. Location preferably Maritime Provinces. File No. 4322-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill, 1950, also graduate in management and business administration (McGill 1953). Age 28, married, one child. Three years experience with large Canadian manufacturing concern. Duties have included product design, cost reduction work, Product engineering and engineering liaison with all manufacturing department and suppliers. Requires responsible position with broad scope for an engineer with production and business administration ability. File No. 4323-W.

CIVIL ENGINEER B.Sc. M.E.I.C., P.Eng., age 30 with five years engineering experience. Presently employed on the completion of a large expansion program in the paper industry. Desires position in the paper industry with greater responsibility and opportunity for advancement. File No. 4327-W.

MECHANICAL ENGINEER Jr.E.I.C., veteran, married, 28 years of age, graduated in 1950 from University of Saskatchewan. Have 3rd class stationary

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CANADA

The Division of Building Research has an opening for a

CIVIL ENGINEER OR ARCHITECT

for work in the

BUILDING CODE SECTION

and to assist with technical work on the

NATIONAL BUILDING CODE

Location: Ottawa

Age: Preferably below 35
Knowledge of French desirable
Good academic standing
Some building experience desirable
Work will involve some travel
A challenging opportunity in an expanding field, closely allied with research into problems of building design, maintenance and operation
Salary will depend on qualifications and experience
Applications should be mailed to:

Employment Office
National Research Council
Ottawa, Canada

Civil and Mechanical Engineers

A large oil company requires a Civil and a Mechanical Engineer for its Montreal Head Office Engineering Division. Positions involve structural steel and reinforced concrete design; pressure vessel and pipe design. Recent graduates, with 2 or 3 years' experience desired, preferably with experience in same or related fields. Good possibilities for promotion. Attractive employee benefit plans. Salary commensurate with experience. File No. 4673-V.

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engineering papers. Have been doing plant engineering work for large mining company. Good knowledge of machine shop practice. Desire position with opportunity. Location not important. File No. 4328-W.

MECHANICAL ENGINEER, P.Eng. Jr.E.I.C., Jr.A.S.M.E., Canadian graduate of Toronto, married, desires position preferably in mechanical production or maintenance with opportunities for progression. Geographical location is of relatively minor importance but prefer one with access to sportsman's facilities (natural). Possess natural mechanical ability and seven years experience in automotive and aircraft maintenance; drainage equipment production; steel plant maintenance; motor vehicle parts manufacture; synthetic rubber plant pressure vessel, boiler and production equipment inspection, maintenance and senior development engineering. File No. 4329-W.

CIVIL ENGINEER Jr.E.I.C., P.Eng., B.Sc. (Queen's 1951) with one year's experience in country engineering including O.L.S. surveying; two years in heavy building construction including precision surveying. Particularly interested in work in the west or in foreign assignments. File No. 4330-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc. Mt.A. 1946, B.E. (Civil) Nova Scotia technical college 1948. Age 30, married with two children. Five years experience in the construction field on harbour works, industrial plants and municipal works. Desires a permanent position with good prospects for the future. Will consider any offer and can furnish good references. File No. 4331-W.

CIVIL ENGINEER B.Sc. University of Manitoba 1933 age 42, married, one child. Has experience in various fields of construction. Past 15 years employed by large Rhodesian Copper mine holding positions such as mine engineer and assistant underground manager. Recently returned to Canada to seek permanent employment and have open mind regarding suitable positions available. File No. 4332-W.

CIVIL ENGINEER, BA.Sc. M.E.I.C., P.Eng.(Ont.) aged 39, married with one child. Experience comprises 8 years on railway location and construction, track design and layout, subway layout, supervision of construction, and finally in charge of engineering maintenance of a division of 600 miles of track. Military service for 4 years as officer. Last 4 years and at present employed on railway inspection and arbitrating problems between railways and municipalities and detailed reporting of same. Has travelled through Europe and very extensively throughout Canada. Now desires position with engineering or architectural company on administration or with firm of solicitors advising on engineering matters or any other position where above experience would be an asset. Preferable location — Southern Ontario. File No. 4337-W.

CHEMICAL ENGINEER, B.Sc. 1948, M.Sc. 1952, P.Eng., M.E.I.C., age 26, married with 2 children, experience in production control engineering research, presently employed in fuel research but desires change to more progressive position in production development or control work preferably in Alberta. Available on reasonable notice to present employer. File No. 4336-W.

GRADUATE CHEMICAL ENGINEER, Jr.E.I.C., 27, married 1 child, requires employment. Two years laboratory supervision experience in large chemical factory. Desires a position with wider scope of responsibility in laboratory or production. Location anywhere in British Columbia. File No. 4338-W.

GRADUATE CIVIL ENGINEER, Delft University. Age 35. Married. Experience in steel and concrete structures. Arriving Canada October 1953. Seeks employment contacts. File No. 4339-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age 25, Queen's, 1951, experience includes 2 years of design and field work on construction and maintenance at Montreal oil refinery and 6 months of control and layout field work at Alcan Power House construction in British Columbia. Desires design and field work in concrete, steel and piping with firm in Montreal area. Available December. File No. 4340-W.

GRADUATE COMMUNICATIONS and electronics engineer, diploma U.H.F. techniques Norway Institute of Technology, Trondheim, Norway. Experience: Europe, 2 years in communications work, transmitters, receivers, telephone equipment, etc. Canada, 2 years on test set design telephone circuitry, industrial electronics. Desire new position preferably in the U.H.F. or related field where possibilities are good for advancement. File No. 4341-W.

Attention, Members

Please telephone in advance and make an appointment if you propose using the Institute's Employment Department.

This will result in a better service to everyone concerned.

TELEPHONE PLATEAU 5078

Except in special cases all interviews will be arranged between the hours of 9 and 12.

Civil Service

(Federal)

A Co-ordinator of Basic Material Practices

$6,420 - $7,200

Competition 53-583

and

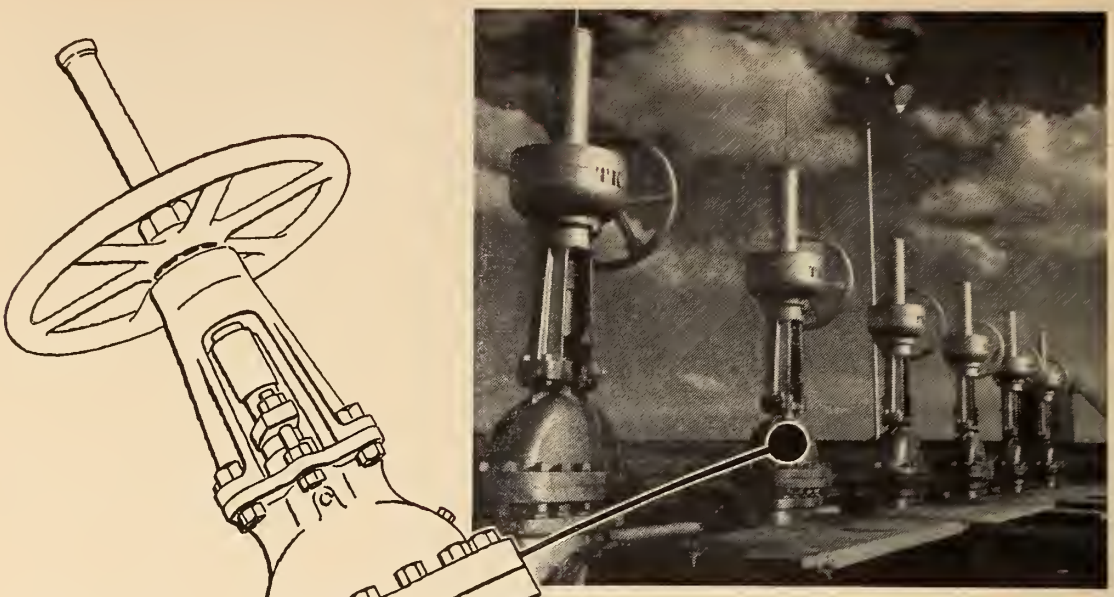
An Assistant Co-ordinator of Basic Material Practices

$5,640 - $6,360

Competition 53 - 584

for the Department of National Defence at Ottawa

Full particulars on posters displayed at your nearest Civil Service Commission Office, National Employment Office and Post Office. Application forms, obtainable thereat, should be filed IMMEDIATELY with the Civil Service Commission, Ottawa.



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Deloro Stellite, a non-ferrous alloy of cobalt, chromium and tungsten, can make your mechanical parts last from 300% to 1000% longer when wear is caused by corrosion, abrasion, erosion or high temperatures: supplied as castings, as hardfacing rod and on leading manufacturers' equipment.

Deloro Stellite on wear surfaces provides low cost insurance against equipment shutdowns. It was the choice for the seats and discs in these pipe line valves located miles out on the Canadian prairies . . . just one of hundreds of industrial applications throughout the world.

For information on how to protect your equipment from wear, send today for booklet B9E.

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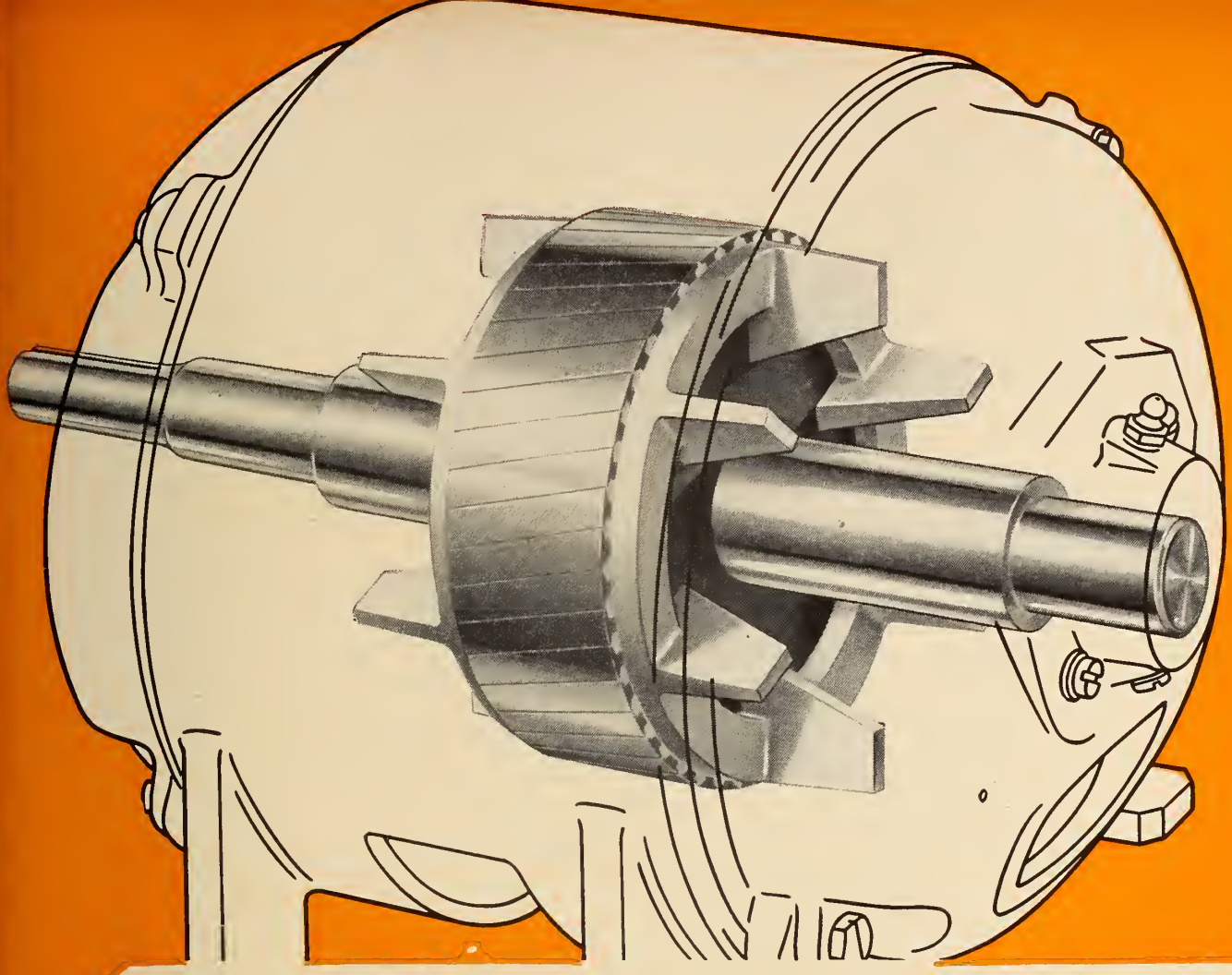

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G-E INDUCTION MOTORS

G-E pioneering and research developed and produced this one piece cast-aluminum rotor winding, which has virtually eliminated rotor failures in induction motors.

Rotor is indestructible in service because the bars, end rings, and fans are a "one-piece" casting. No brazed joints, no fabricated fans to come apart.

Rotor inertia is reduced by the lightness of the aluminum, thus raising efficiency and allowing easier starting, stopping and reversing.

The motor runs cooler because integrally cast fans dissipate heat faster.

Operation is smooth and quiet due to the dynamic balancing of the rotor which also reduces bearing wear and material fatigue.

Long rotor life is one more reason why C-G-E Induction motors last longer—give you more reliable service and greater operating economy.

Order induction motors today from your nearby C-G-E motor dealer, or from the C-G-E office nearest you.

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Motors

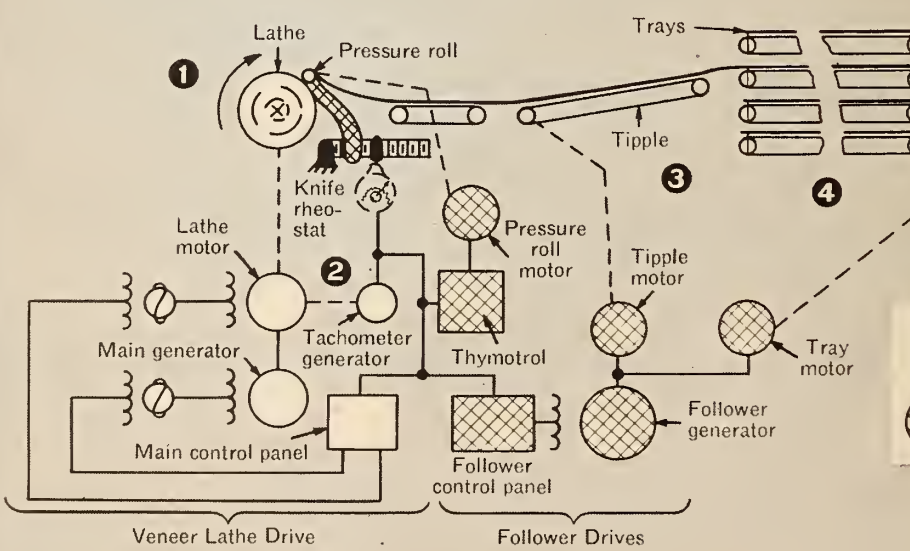
ANADIAN GENERAL ELECTRIC COMPANY LIMITED

Head Office: Toronto—Sales Offices from Coast to Coast

AAD-149

View of the 135" Coe Lathe cutting veneer from large Douglas Fir Log. The operator (centre) has complete control of the drive through the master switch. Simply positioning the master switch will control the speed of the drive in either the forward or reverse directions. Designed for a maximum speed of 450 fpm the G-E drive has boosted the lathe's cutting speed to approximately 550 fpm

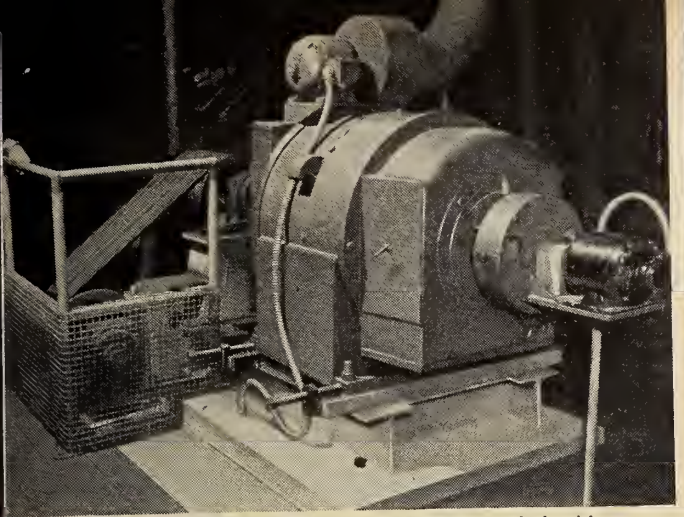
Co-ordinated G-E Lathe drive improve



Amplidyne-controlled veneer lathe drive and proposed co-ordinated materials handling system at Canadian Western Lumber Company's plywood plant. Provision has been made at these points for addition of co-ordinated follower drives at later date.

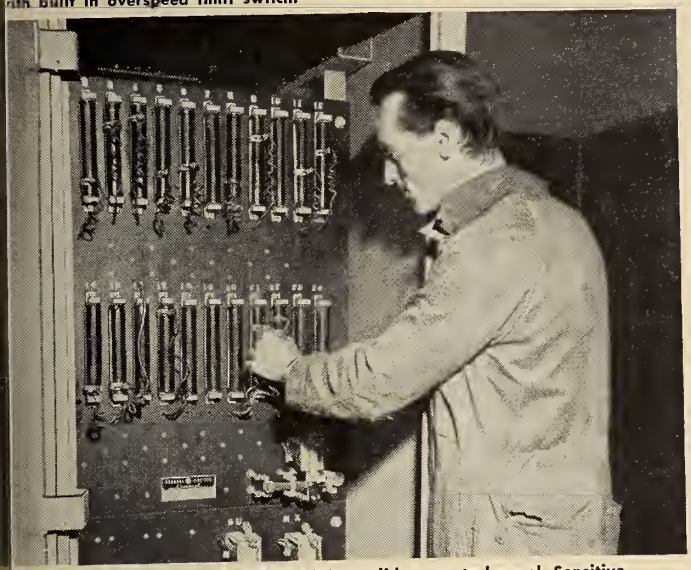
APPARATUS DIVISION

CANADIAN GENERAL ELECTRIC COMPANY LIMIT

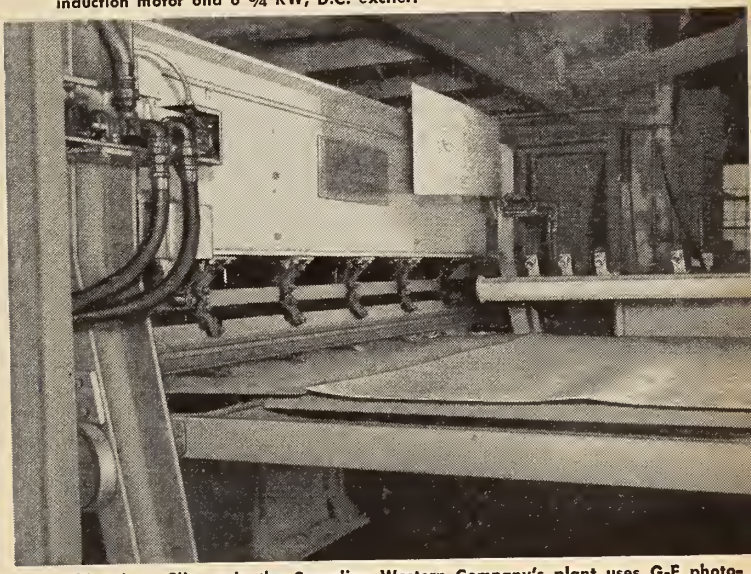


l Richter, Electricol Superintendent, observes the G-E Veneer Lothe drive his motor is o type CD-1441Y, 75/100 H.P., 230 Volt, shunt wound D.C. ith built in overspeed limit switch.

Plant electricion odjusts brushes on the main M.G. set. This set consists of 100 KW, 1800 RPM open (drip-proof) D.C. generator, o 150 H.P., open (drip-proof) induction motor ond o ¾ KW, D.C. exciter.



e adjustment is made to the CR4898-Y1 amplidyne control panel. Sensitive ne control makes it possible to accurately preset the lathe speeds, controls tion and deceleration and governs the veneer sheet speed holding it t from maximum to minimum log diometer.



This Victor Clipper in the Canadian Western Company's plant uses G-E photo-electric relays to control the sheet cutting knife while the air valves are actuated by G-E industrial type solenoids.

neer mill quality, ups production

B.C. PLYWOOD MANUFACTURER INSTALLS G-E VENEER LATHE DRIVE TO INCREASE CUT, IMPROVE QUALITY, REDUCE WASTE

The installation of D.C. Amplidyne controlled General Electric Veneer Lathe Drive at Canadian Western Lumber's Plywood Plant has improved the quality of this product, cut operating costs and increased production appreciably. The new equipment, installed on a 135″ Coe Lathe, will cut up o 80,000 ft. block scale of high quality veneer per 8 hr. hift, depending upon the grade of logs.

Product quality improvement has been credited to the moother operation of the D.C. drive, resulting in more even turning of the logs and less "chatter" at the knife. The ustomer anticipates lower maintenance costs and longer quipment life than with the formerly used steam engine lrive and operating conditions have been considerably mproved owing to the cleaner, quieter nature of the D.C. lrive.

An important feature of the G-E equipment, from the ustomer's standpoint, is the fact that the control equipment provides for the future addition of a co-ordinated materials handling system. This "follower drive", including separate D.C. pressure roll, tipple and tray motors and control, will completely synchronize the drive from Lathe to Clippers. This assures uniform, unbroken veneer and reduces waste to the absolute minimum.

G-E co-ordinated drives similar to that installed at Canadian Western Lumber can be system-engineered to suit your needs. For information, write to your nearest C-G-E office or to —

GENERAL ELECTRIC
CO-ORDINATED
EQUIPMENT

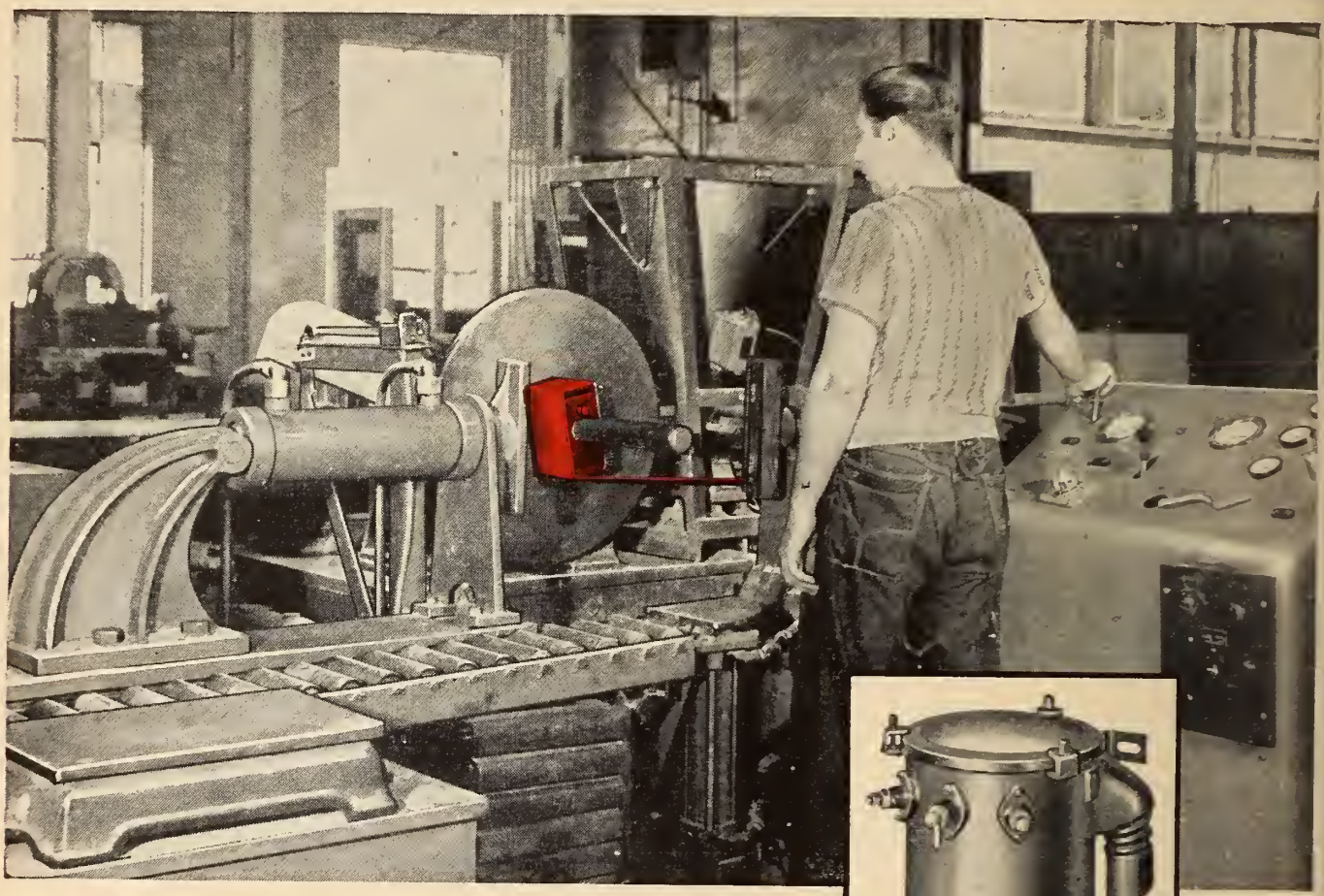
AAD-12801

EAD OFFICE: TORONTO—SALES OFFICES FROM COAST TO COAST

RECTANGULAR

SPIRAKORE TRANSFORMERS

now available up to 200 kva



• In Canada, only G-E brings you the complete range of Rectangular Spirakore Transformers with ratings from 3 to 200 kva.

The Spirakore principle revolutionized transformer design when introduced by G-E in 1938. But, the cores were circular and as the kva rating increased, the height of the winding increased faster than the width. This meant that the Spirakore design could only be applied in ratings up to 5 kva. However, these were smaller and lighter than conventional transformers. To meet the demand for smaller, lighter transformers in higher kva ratings, General Electric has now developed the Rectangular Spirakore Transformer which allows the use of this design up to 200 kva.

G-E Rectangular Spirakore Transformers have many advantages including less weight and smaller size for ease of handling, better impulse characteristics, lower exciting currents and better thermal performance. Result: users now get improved performance, more economical operation and lower maintenance costs. For further information, consult your nearest C.G.E. office or write — Canadian General Electric Company Limited, 212 King Street West, Toronto.

GENERAL ELECTRIC SPIRAKORE TRANSFORMERS

AAD-138

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

News of the Branches

Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings

Halifax

W. A. Logan, M.E.I.C.,
Secretary-Treasurer

W. A. Devereaux, M.E.I.C.,
Branch News Editor

Halifax Meetings

Before summer commenced, the Halifax Branch completed an active program of meetings for the first part of the year.

An interesting talk on the Lion's Gate Bridge in Vancouver was given by Hugh H. L. Pratley, son of Dr. P. L. Pratley, the consulting engineer who designed the bridge. This was a very timely talk because of the similarity between this bridge and the Halifax-Dartmouth Bridge which is now under construction; Mr. Pratley is resident engineer in connection with this project. The talk was illustrated with slides showing various phases of construction and how these would be used in connection with the new bridge in Halifax.

A talk entitled "History Of Engineering in Canada" by R. M. Richardson of Saint John, N.B., was given at a meeting in April. He traced the history of the Institute commencing with the Canadian Society of Civil Engineers. The formation of the various provincial Associations by a committee of the Institute was outlined as well as the Model Act which this committee prepared. Mr. Richardson pointed out how the profession as a whole could benefit from closer co-operation between all the Associations and with the Technical Societies.

The Branch welcomed the president of the Institute on his official visit to Halifax. This was a dinner meeting to which the ladies were invited. A reception preceded the dinner. The president and the general secretary gave interesting talks on current affairs of the Institute.

The Annual Meeting was a particular occasion for the Branch this year. R. F. McAlpine headed a very able committee which did considerable work during the preceding months in preparation for this meeting. It provided a wonderful opportunity for all Branch members to attend an Annual Meeting and to meet other Institute members from various parts of Canada. The Branch was delighted to be host on this occasion.

With the conclusion of summer, preparations are being made for the fall program. This will commence with a meeting which is to be held in one of the towns located in the Annapolis Valley.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.,
Branch News Editor

Engineers Guests of Stelco

An estimated 200 members of the Engineering Institute of Canada and their guests enjoyed the hospitality of the Steel Company of Canada on Thursday evening, Sept. 17, during a tour of portions of the Stelco works. Whether familiar with steelmaking or not, all engineers present agreed the inspection was a highly interesting and profitable one, including as it did many of Stelco's newest installations.

Following supper in the Company cafeteria, A. H. Smith, assistant general superintendent, welcomed his fellow engineers.

The concluding feature of the evening was the showing of the film "Steel for Canadians", made in the Hamilton Works of Stelco. In it the visitors recognized and received additional enlightenment on many of the processes they had witnessed at close range only a few minutes before.

Sincere thanks of the Branch were conveyed to the Steel Company by W. A. Dawson, Hamilton Branch chairman.

Third Development Program Launched

The third annual Professional Development Program of the Hamilton Branch was launched in September. One of the pioneer efforts of its kind on the continent, the Course presents lectures and discussion sessions on important but often overlooked phases of engineering, business, finance, and personal and cultural development. The course is presented at four levels simultaneously, with instruction on such fundamentals as letter and report writing and the social graces to the junior members of the profession; while the older branch members participate in the organization of an imaginary corporation and take up problems of high level management.

Moncton

V. C. Blackett, M.E.I.C.,
Secretary-Treasurer

Shediac Bay Cruise

On Saturday afternoon, July 18, members of Moncton Branch, and their wives, enjoyed a four-hour cruise on Shediac Bay, as guests of Mr. and Mrs. R. L. Parsons, on their ocean-going motor yacht. Perfect weather and water conditions combined to ensure the comfort and pleasure of even the most susceptible to *mal de mer*.

After encircling the Bay, the yacht anchored, for a time, off Shediac Island, and the party was treated to an exhibition of fancy diving by Keith Leighton and Bob Weir. A buffet luncheon was then served, special refreshments being available at cost. At first,

the honour system was given a trial, each member entering his purchase on the sheet provided. This system, however, was abandoned when the branch teetotaler loudly complained that he had been charged with six beers.

Considerable excitement was caused while homeward bound, by a helicopter, engaged as an attraction by the Shediac Lobster Festival. The aircraft made an unexpected appearance and, as expressed by one member, "accidentally on purpose" hovered low overhead, the wind from the propellers creating consternation among the ladies.

As the voyage ended, branch chairman, R. T. Sansom, called for attention and said he had been experiencing motions all afternoon. Now, he was going to make one of his own. He then called upon Councillor N. B. Eagles who extended to Mr. and Mrs. Parsons the thanks of the Branch for their kindness and hospitality.

Montreal

R. J. Harvey, M.E.I.C.,
Secretary-Treasurer

S. T. Rudkin, M.E.I.C.,
Publicity Vice-Chairman

Montreal Program Planned

During the two and a half month period between the beginning of activities in October and the Christmas holidays, over thirty meetings of various kinds are planned for the instruction and entertainment of Montreal Branch members. Included in this busy schedule will be the presentation of numerous papers of interest, panel discussions, and plant visits. An innovation this fall will be a Ladies' Fashion Show sponsored by the Junior Section. (Men will be most welcome, but we suggest those of married status review the state of their finances against possible wifely depredations arising from this particular "meeting".)

The majority of the meetings, however, will be of a technical nature, and are the responsibility of the program committee, this year under the chairmanship of J. E. Hurtubise.

To obtain diversification of subject matter to cater to the varied interests of the different classifications of practising engineers, each major classification such as Electrical, Civil, Chemical, Mechanical, Transportation, Management, Junior and Special, is represented by a committee of several members. The chairman of each such special committee is a member of the program committee, and is responsible for his own portion of the year's program, including the choice of suitable speakers, subjects, etc.

Broadly speaking, the Thursday night meetings are planned to be of a general nature, with a certain appeal to all types of engineers, whereas the Monday and Tuesday meetings are of a more specialized nature, having a special appeal to smaller groups in the particular field of the subject under discussion.

The plant visits are consistently popular with a large proportion of the membership and it is planned to have at least one bilingual meeting for the fall and spring sessions.

To acquaint the branch membership with a few of the members actively engaged in the formulation and carrying out of the year's program, the chairmen of the various sectional committees are: Special section, R. A. Phillips; Electrical section, D. Danylkiw; Chemical section, H. G. Burbidge; Civil section, R. H. Quintal; Mechanical section, E. S. Yuill; Management section, W. C. Luscombe; Transportation section, J. D. Sylvester; Junior section (Program), G. L. McLean.

The lighter side of the program, covering such features as the Joint Oyster Party and the Annual Dance, are the responsibility of the entertainment committee, under the chairmanship of Leo Scharry.

Saguenay

C. C. Louttit, Jr.E.I.C.,
Secretary-Treasurer

Annual Meeting, Sept. 16

The combined annual meeting for the Branch and Junior Section was held in the Saguenay Inn, Arvida, on September 16, 1953, under the chairmanship of D. F. Nasmith. Thirty-one members were in attendance.

After opening the meeting Mr. Nasmith turned the chairmanship over to C. C. Louttit for the transaction of Junior Section business. The secretary's report was presented by J. R. Ledwell in the absence of H. Erku who resigned as secretary of the Junior Section as he was returning to college. W. W. Robertson, treasurer, presented the treasurer's report, which had been previously audited by G. Perry, C.A.

The election of officers for the Junior Section for the season 1953-54 took place next. As there were no nominations from the floor, the slate of officers, as proposed by the nominating committee under the chairmanship of R. Alexander, was elected on a motion by J. S. Taylor, seconded by P. W. Douglas Tourner. The officers of the Junior Section are as follows: chairman, S. T. Solinski; vice-chairman, W. W. Robertson; secretary, J. R. Ledwell; treasurer, G. M. Gilbert; and committeeman, R. V. Norman. This concluded the Junior Section business.

D. F. Nasmith resumed chairmanship of the meeting. W. A. Armstrong, secretary-treasurer, read the minutes of the last Annual Meeting. These were adopted as read on a motion by J. Dyck, seconded by K. W. Campbell. Mr. Armstrong then read the secretary's report. This was adopted as read on a motion by F. T. Boutilier, seconded by E. N. Coulthart. Mr. Armstrong then read the treasurer's report which had been previously audited by J. Flyn, C.A. This was adopted as read on a motion by F. A. Dagg, seconded by S. T. Solinski.

It was moved by H. J. Butterill and seconded by G. K. Clement that the Branch show its appreciation in some fitting manner to J. Flyn for auditing the financial statement for the season 1952-53. It was then moved by K. W. Campbell and seconded by P. Schopflocher that the motion be amended by replacing the words "in some fitting manner" with the words "by issuing a cheque for $5.00".

D. F. Nasmith, as retiring chairman, then addressed the meeting. The mixed dinner meeting held last year was the first of its kind and was well supported. Plans are laid to have a similar meeting this year. The Student Guidance Night was well received and supported by both students and teachers alike. It is planned to extend this program to include the French schools this year. Regarding the decrease in membership the greatest change took place in the number of Student members which can be attributed to the ending of construction work in the district. This carries with it the fact that there will be a decrease in funds available in the coming year. Mr. Nasmith concluded his remarks by thanking the executive for the support it gave him during the year with special thanks for his assistance to W. Armstrong, who was retiring as secretary-treasurer.

It was moved by G. K. Clement and seconded by C. C. Louttit that a special vote of thanks be extended to W. Armstrong for his work as secretary-treasurer for the past two years. This motion was heartily carried by all the members.

The nominating committee report on the election of officers was read by Mr. Nasmith. The executive for the season 1953-54 is as follows: chairman, G. K Clement; vice-chairman, F. A. Dagg; committee members, A. B. Sinclair, B. F. Booth, E. N. Coulthart, K. W. Campbell and J. E. Dyck; ex officio members of the executive are H. R. Fee, branch councillor; D. F. Nasmith, past chairman; C. C. Louttit, secretary-treasurer; and S. T. Solinski, chairman, Junior Section. Mr. Nasmith then turned the meeting over to G. K. Clement, incoming chairman.

On a motion by E. N. Coulthart a hearty vote of thanks was extended to the retiring members of the executive.

Mr. Clement then opened the question of increasing the representation of the Junior Members in the Branch affairs by electing three Junior members to the Branch executive as committeemen, thus having three Corporate members and three Junior members as committeemen. This was held in abeyance for further presentation at another meeting.

Concerning the coming year's activities Mr. Clement indicated that there might be fewer regular meetings to give place to more activity along the lines of Professional Development and Student Guidance and E.I.C.-C.P.E.Q. activities. Student Guidance is one way to obtain increased recognition for the engineering profession by the general public.

Informal discussion of the financial outlook for the coming year ended in the acceptance by the members of the proposal that the budget should be made up with the view of retaining a bank balance of $500.00.

The recommendations of the informal "E.I.C.-C.P.E.Q. Relationship Committee" were adopted on a motion by F. T. Boutilier, seconded by W. W. Robertson. The motion was carried.

It was moved by F. T. Boutilier and seconded by P. Schopflocher that a hearty vote of thanks be extended to the retiring Junior executive for their services during the past year and that the Junior executive be further drawn into Branch activities by inviting them to sit in on Branch executive meetings.

It was then moved by F. A. Dagg and seconded by A. B. Sinclair that the meeting be adjourned at which time coffee and sandwiches were served.

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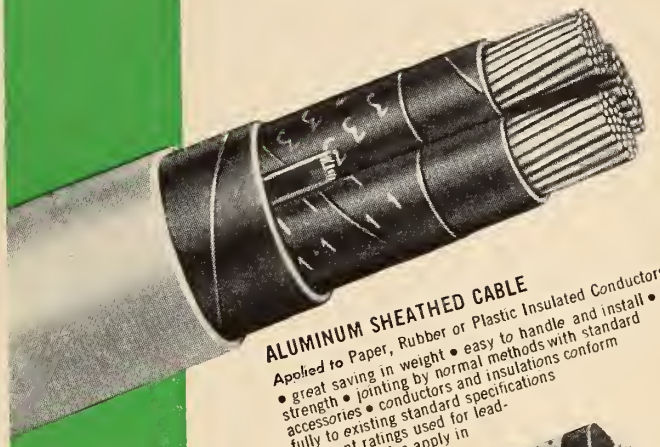

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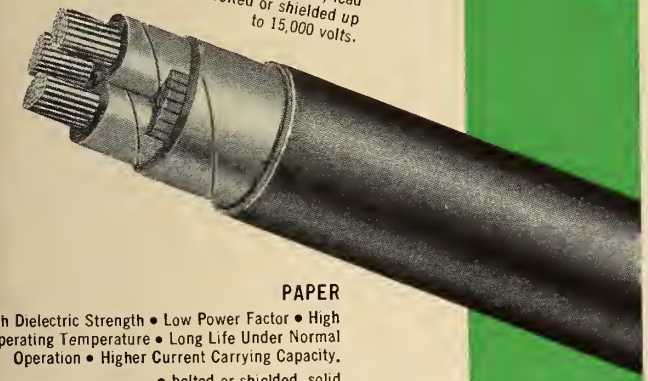

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BOOK REVIEW

Shopping centers: design and operation. Geoffrey Baker and Bruno Funaro. New York, Reinhold, 1953. 288 pp., illus., $12.00 (U.S.)

The fact that the two authors of this book are also the designers of Montreal's Norgate Shopping Centre may help to make it of more than passing interest.

But besides this, the modern trend is certainly to shopping centres in all the cities on this continent. It seems to be an outcome of the general urge toward decentralization, both of domestic building, and of industry, which has gradually taken possession of the population.

The authors present their findings opening with a discussion of the shifting of population, the increased use of autos and buses, and the general organization of a planned centre.

Market analysis, and the prerequisites for a suitable site, including possible costs per acre of a site, are discussed, along with the potential types of shoppers, and the demands which they may present, both from the pedestrian's point of view, and also from that of the driver, and of the parking facilities which will be needed.

The separation of freight and customer traffic, the creation of attractive service courts, and size and allowance for expansion are all covered in the overall picture.

Following this is a two hundred page section of sixty-three shopping centres of diversified sizes, complete with plans, pictures, and store list in considerable detail. In addition, all the stores described in these foregoing pages are then listed in a table of store sizes, which includes the type of store, and the square feet of area.

In all the two hundred eighty-eight pages of the book, a random check shows only one page devoted to garbage collection, half a page to nurseries, or any provision for the care or keeping of children while the mother is shopping, and even the controversial subject of zoning receives less than a page of discussion. In the case of nurseries or playgrounds, the writers state that the care of someone else's children is too great a risk to organize, except where a community demands it. However, what the authors have included is all up to date information of practical value. The illustrations are many and excellent, both the photographs and the plans, and the volume is indexed.

—E.K.

BOOK NOTES

Prepared by the Library

The Engineering Institute of Canada

Architectural and engineering law. Bernard Tomson. New York, Reinhold, c1951. 424 pp., $7.00 (U.S.)

Although the basic foundations of Civil Law over most of this continent are based originally on the British practice, customs and regulations vary in the United States and Canada, and also in the several provinces and states. In ARCHITECTURAL AND ENGINEERING LAW, Bernard Tomson cites thirteen hundred cases that have come before the American courts involving architects and engineers in one way or another.

It is divided generally into seven parts, namely, License laws; Architect, engineer relations; Architect, engineer, owner relations; Certificates; Compensation; Liability to owner; and Property in plans.

The author is a member of the New York and Massachusetts bars, and is admitted to practice before the New York Federal Courts and the United States Supreme Courts. Besides this, he has lectured before the American Institute of Architects, and Massachusetts Institute of Technology.

The thing to be borne in mind by our members is that this book is of practical reference value only in the United States, but for purposes of study it will interest a large number of you.

Calcul des conduits d'eau avec cheminées d'équilibre, vol. 1. Aldo Ghizzetti. Paris, Gauthier-Villars, 1953. 79 pp. Section diagrams. $3.75.

A new method, as approved by the Institute national pour les applications du calcul (Rome) of measuring flow of water in a hydro-electric installation with stand pipe, is here described. Columns with both constant and variable constants are considered. Folded diagrams come in a separate section and are referred to in the text. The book is translated from the Italian, and is the first in a series MANUELS DE CALCULS TECHNIQUES to be published by Gauthier-Villars.

Canadian trade index, 1953. Toronto, Canadian Manufacturers' Association, 1953. 1,126 pp., $7.50.

The appearance of the new edition of the Trade Index needs no more than an announcement. The several sections are all the same as last year, and a slight increase in paging indicates the same increase in firms represented.

The cathode ray oscillograph in industry. W. Wilson, 4th ed. rev. London, Chapman, Toronto British Book Services, 1953. 273 pp., illus., $7.25.

The fact that this book is now in its fourth edition is evidence of its value and of the public's continuous demand for it.

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Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

Please give as much detail as possible when requesting information of either type.

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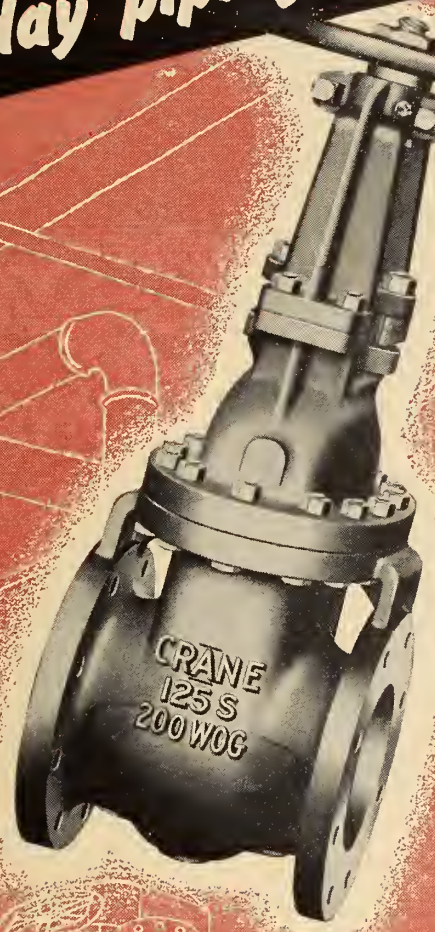

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This edition has been particularly re-written in the section on fluorescent screens, and figures have been added for the luminous efficiency of each screen.

Radio location information, formerly in the appendix, has here been transferred to the body of the book, and a new appendix has been added describing important developments in the metal-tube instrument in Switzerland.

Practically all of the electron microscope information has been re-cast, and five new illustrations have been added.

An obvious criticism of the book is the frequent fuzzy reproductions of the photographic illustrations, which detract from its general appearance.

Also, the bibliographic references do not seem to have been revised along with the rest of the text. A quick search reveals only three references since nineteen forty-five, one in nineteen forty-nine, one in nineteen fifty, and one for nineteen fifty-one; the others all ranging from nineteen thirty-nine to nineteen forty-five.

The repetition of the chapter title in each page of the chapter greatly adds to the ease of this book for reference, as do also the fairly detailed index pages.

City planning in Soviet Russia, with an interpretative bibliography. M. F. Parkins. Chicago, University of Chicago press, Toronto. Gage, 1953. 257 pp., $6.00.

In his introduction to City planning the author states that the study is limited in that he was unable to check official Soviet sources and conclusions with the actual city-planning practices in the U.S.S.R.

As only a small fraction of the Russian territory is available for living, urban planning really had its initial start in seventeen seventeen.

In nineteen twenty-one, the Gosplan was instituted, the highest economic central planning body, although the development of city planning has been a continuous business over many long years.

During the period from nineteen twenty-two to nineteen twenty-eight, the communal house had its birth, with bachelor, couple, or small family apartments, with communal kitchen and sanitary facilities, designed to ease both the housing shortage and the space shortage.

Nineteen thirty-three to nineteen thirty-five saw the reconstruction of Moscow, nineteen thirty-eight to nineteen forty-two, the third five year plan, and nineteen forty-four to nineteen fifty the Reconstruction Stage.

In spite of the 257 pages of this book, only 120 of them are actual text, the rest being an extensive and useful bibliography to all our readers interested in the subject.

A detailed index completes this very interesting and very "different" book.

Commercial A.C. measurements, 3rd ed. rev. G. W. Stubbings. London, Chapman, Toronto, British Book Service, 1953. 377 pp., $10.00.

Written primarily for testing engineers and senior students specializing in electrical measurements, the author's aim in this volume is to provide a combination treatise on both theory and practise of the measurement of current, voltage, power, energy and power-factor in A.C. circuits.

This fourth edition has been enlarged since the nineteen thirty-seven one, there is a new chapter on the measurement of maximum demand, and additional information is provided on instrument transformers and power factor measurements.

An appendix lists sixteen references, but five of them are undated and carry no bibliographical detail. The book is indexed, and well illustrated with diagrams.

Fatigue of metals. R. Cazaud, tr. A. J. Fenner. London, Chapman, Toronto, British Book Service, 1953. 334 pp., diagrs., $12.00.

"It has been known for a very long time that certain machine components, subjected to loads which vary or are repeated a large number of times, may break abruptly . . . The cause of this mysterious type of failure, to which any metal may be prone is subjected to varying loads, has been given the name of FATIGUE."

Original fatigue tests appear to have been done in Germany in eighteen twenty-nine, and British railway engineers carried out further experiments in eighteen forty-three and eighteen forty-nine.

Characteristics of failure, tests, machines, conditions of applications of stress, surface conditions, structural joints, to mention only some of the angles treated, indicate the extent and practical value of this work.

Photographic illustrations and line drawing figures, along with extensive bibliographies with each chapter, and an author and detailed subject index will make this book an invaluable reference volume for all of our members interested in this important subject.

Industrial relations handbook. Rev. ed. London, H.M.S.O., 1953. $1.15.

Put out by the Ministry of Labour and National Service, this is an account of the organization of employers and workpeople in Great Britain; collective bargaining and joint negotiating machinery; conciliation and arbitration; and statutory

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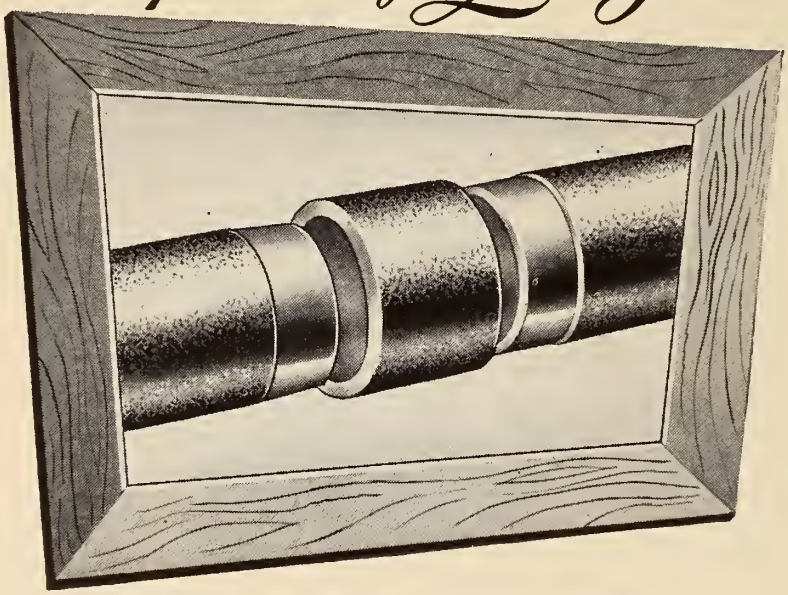

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regulation of wages in certain industries. Individual cases are cited, a good bibliography is included, and the book is indexed. This will prove an invaluable little manual for labour relations discussions.

Newnes practical engineering series. Electricity supply engineering. 164 pp., illus. **Power transmission engineering.** 180 pp., illus. London, Newnes, Toronto, British Book Service, 1953. $4.00 each.

These are the second and third volumes in this series to be received in the library, although they seem to bear no numbers. The general editor is E. Molloy, and the contributors all specialists in their field.

The first of these volumes carries ten papers treating of the various aspects of electricity supply engineering, with an introductory survey of power generation, transmission and distribution as operated under average modern conditions.

Seven contributors compose the second of these titles, in which the layout, construction and maintenance of overhead lines is treated from the point of view of construction layout, erection, testing and maintenance of these lines, cables, and sub-station equipment.

Both books are adequately indexed and illustrated.

Power station work. E. Molloy, ed. London, Newnes, Toronto, British Book Service, 1953. 164 pp., illus., $4.00.

Amounting really to a symposium, this book is the result of the combined efforts of nine men, all of them fully qualified electrical engineers, and each one a specialist in his own field. The treatment is that of electrical power generation with particular emphasis on the aspects of operation and maintenance, including a paper on the steam raising plants.

Photograph and diagram illustrations, plus a detailed index add further to the book's value.

Psychology of industrial relations. C. H. Lawshe. Toronto, McGraw, 1953. 350 pp., $6.60.

In addition to the co-ordinating author listed above from the staff of Purdue University, there are six co-authors of this volume, only one of which is actively engaged in academic psychology. Of the other five, three represent the three branches of the American armed forces, and two are from large industrial companies.

The purpose of this book is to present some findings in non-technical language, which will be of practical value to people in industry who have not necessarily had a formal training in either academic or industrial psychology.

The technical terminology of the specialized psychologist is avoided as much as possible, and practical problems are discussed by people in business who have themselves had first hand experience with the situations in the various chapters.

References accompany each chapter, and sources are referred to by number in the text.

Choice of employees, general training for specific jobs, including discussion of visual aids, employee supervision, rest periods, diversity of operations, complaints, establishment of equitable wage rates, organization and communication, and relations between employer and employee, are all discussed from a very practical angle.

The book is well indexed, and should be a valuable addition to the bookshelf for the shop, plant, or office manager, who wants something practical, and not too technical.

Radiation suppressing coatings for metals at elevated temperatures. A. H. Sully, E. A. Brandes, and R. B. Waterhouse. Stoke Poges. Fulmer Research Institute, 1953. (Special report no. 1). 15/-.

A refractory coating of low thermal emissivity for application to alloys used in gas turbine constructions, and capable of withstanding severe operating conditions of thermal shock and vibration, was the object of this piece of research.

It is illustrated with figures and photographs and includes references.

Radio engineers' servicing manual. E. Molloy, ed. London, Newnes. Toronto, British Book Service, 1952. 760 pp., illus., $8.50.

"The duties of the radio service engineer can be broadly defined as the installation and maintenance in correct working order of radio and allied electronic apparatus, and the tracing and repair of faults when they arise." And to achieve this opening sentence, this volume has obviously been written.

Following the information on general routine servicing, the makes and types of radios are all listed with their own technical description and alignment procedure.

These are afterwards indexed by type of receiver alphabetically, along with a brief general index to the whole book.

The title is fully descriptive of the information here presented.

The science of flames and furnaces. M. W. Thring. London, Chapman, Toronto, British Book Service, 1952. 416 pp., diagrs., $8.50.

For practical purposes the term furnace has been limited in this volume to industrial appliances constructed to heat a ma-

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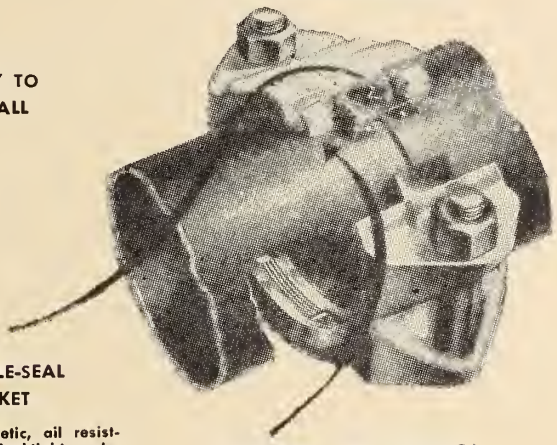

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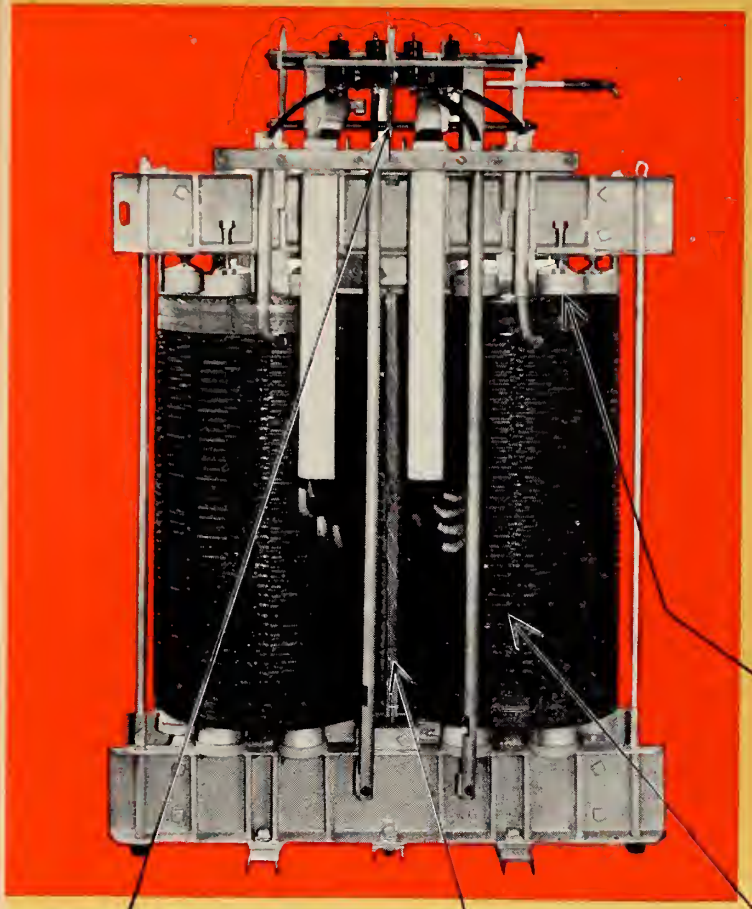
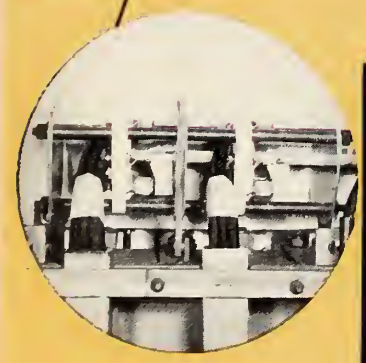
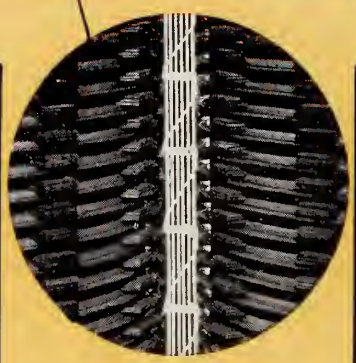


In the design and construction of Smooth-a-Surge Power Transformers no efforts or materials are spared to supply apparatus that will meet the needs of the customer and provide reserve capacity for emergencies under severe service conditions.

The core and coil assembly here illustrated is the interior of the transformer illustrated on the preceding page. In addition to these internal features, Supreme Smooth-a-Surge transformers possess noteworthy external advantages. Four channel stiffeners welded to the flat sides of the case ensure against leaks due to stress and strain of shipping, hoisting and installation. A skid-type base permits rolling of the transformer in either direction. Where design calls for demountable radiators, these are supplied with Supreme shut-off valves to allow removal without lowering oil level in the transformer.



One of the many advantages of the side-operated tap changer is that it allows the tap leads to go directly to the tap switch. This is superior both electrically and mechanically.



Note generous clearances and substantial insulating barrier between windings. Adequate impulse levels are thus assured.

Smooth-a-Surge Power Transformers are designed with disc type windings of which a close-up is shown. This eliminates layer stresses and reduces to a minimum local heating or "hot spots" within the coil. The result is a high overload capacity.

Spaced around the er collar of the windings a a number of compressic rings of high insulatic value which compress th windings.

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terial through a cycle involving temperatures exceeding four hundred degrees centigrade.

Roughly three different aspects of the subject are treated; stress of the gap between physics, chemistry and physical chemistry and design and use of industrial furnaces; diagnosis of the ailments of existing furnaces; presentation of the problems of furnace heating that they may be of interest both to the academic scientist and to the engineer in charge of the design and operation of furnaces.

Bibliographies are contained in footnotes, and in addition to the index, the text is followed by a table of conversion factors.

Work measurement: new principles and procedures. Adam Abruzzi. New York, Columbia University press, 1952. 290 pp., $6.00.

"Experimental studies can scarcely be carried on without the problem of designing suitable scales of measurement." This sentence, taken from the introduction, will introduce the theme of this book, which claims to make available objective procedures and criteria for deciding when a process can be considered standardized, and how to develop production standards known to be attainable by the workers. The means to this end fall into two categories, namely, laboratory, and situational, or even a combination of these two.

Degrees of variability and stability, the design of a research program on industrial productivity, the development of standard data, work method comparisons, delay factors, etc., are all considered, and are supported by eight pages of bibliography.

The whole work seems to be a genuinely sincere effort towards a fair evaluation of work to be done and the best methods to get the best out of people.

Its detailed index is a joy to use.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Aluminum in iron and steel. S. L. Case and K. R. Van Horn. New York, Wiley, 1953. 478 pp., $9.35.

The first of a new series of Alloys of Iron Research monographs, this book gives an exhaustive critical review of research on aluminum in modern ferrous metallurgy. It summarizes for the practical metallurgist, engineer, and foundryman essential information scattered through hundreds of journals and books in many languages. The first part provides data on the effect of small additions of aluminum to molten steel as a deoxidizer; the second part correlates research on the effect of aluminum as an alloying element in steel.

1952 Book of A.S.T.M. standards, including **tentatives.**

Part 1: Ferrous Metals. 1,602 pp., $12.00.

Part 2: Non-Ferrous Metals. 1,359 pp., $10.00.

Part 3: Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, and Soils. 1,666 pp., $12.00.

Part 4: Paint, Naval Stores, Wood, Fire Tests, Sandwich Constructions, Building Constructions. 1,182 pp., $10.00.

Part 5: Fuels, Petroleum, Aromatic Hydrocarbons, and Engine Antifreezes. 1,282 pp., $10.00.

Part 6: Rubber, Plastics, and Electrical Insulation. 1,488 pp., $12.00.

Part 7: Textiles, Soap, Water, Paper, Adhesives, and Shipping Containers. 1,334 pp., $10.00.

American Society for Testing Materials, 1916 Race Street, Philadelphia 3, 1953. $76.00 per set of seven parts. (U.S. prices).

Now covering more than 2,000 specifications, tests, etc., this new combined edition contains all of the standards, adopted and tentative, as of the present date. In order to accommodate the increased number of items the present edition is in seven volumes instead of six. Each volume is complete with detailed subject index, both classified and numerical lists of standards, and arranged to provide technologists and others with as usable a book as possible.

Design of machine elements. M. F. Spotts, New York. Prentice-Hall, second edition, 1953. 504 pp., $9.65 (U.S.).

Beginning with a survey of prerequisite theory, this book continues with separate chapter treatments of individual machine elements. Methods based on rational analysis are utilized. Well-known basic theories are presented as well as some of

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the newer methods. Illustrative examples and problems are extensively used, but design data such as are usually obtained from catalogs are omitted.

Handbook of material trade names. O. T. Zimmerman and Irvin Lavine, Dover, New Hampshire, Industrial Research Service, 1953 edition, 1953. 704 pp., $20.00 (U.S.).

This alphabetical list of some 15,000 trade names of commercial materials gives brief information concerning compositions, properties, and uses as well as the name of the manufacturer or distributor. A wide range is covered including metals, plastics, chemicals, pharmaceuticals, etc. Distinguishing symbols indicate registered and unregistered trademarks and common names. A Directory Section provides addresses of manufacturers, and a new classified section lists materials according to major use or composition.

Introduction to solid state physics. Charles Kittel. New York, Wiley, 1953. 396 pp., $7.70.

Solid state physics is a wide field concerned particularly with the special properties exhibited by atoms and molecules because of their association in the solid phase. This introductory text covers crystal structures, thermal and dielectric properties of solids, paramagnetism, ferromagnetism, superconductivity, the free electron and band theories of metals, semiconductors, and imperfections in solids. Theoretical concepts and models of solids are emphasized as being applicable to a wide range of problems.

Physical constants of some commercial steels at elevated temperatures. Edited by the British Iron and Steel Research Association. Butterworths Scientific Publications, Toronto, Butterworth, 1953. 38 pp., Spiral binding, $3.50.

Total and specific heats, coefficients of thermal expansion, electrical resistivities, thermal conductivities, densities, and mean thermal diffusivities are tabulated at 50° intervals from 50°C up to about 1,200°C. for pure iron and a selection of low and high alloy steels. Total heat-temperature curves and expansion-temperature curves are shown, and there is a summary of the methods used in determining the physical constants.

Wind-tunnel technique. R. C. Pankhurst and D. W. Holder, Toronto. Pitman, 1952. 702 pp., $11.50.

A systematic account of the experimental methods employed in both low- and high-speed wind tunnels. Major topics include wind-tunnel design, flow visualization methods, measurement of fluid velocity, tunnel interference effects, model construction, and the reduction of observations. Auxiliary apparatus and experimental analogies are discussed, and there is a separate chapter on special measurements such as stability and control, turbulence, and flutter. Extensive chapter bibliographies are provided.

Refractory hard metals. Paul Schwarzkopf and Richard Kieffer, Toronto, Macmillan, 1953. 447 pp., $11.00.

This volume deals with the structure, preparation, and properties of the pure carbides, borides, nitrides, and silicides. An introductory section discusses the history of hard metals and their crystal and electronic structures. Separate sections are devoted to each of the materials under consideration, and a final section discusses their use as high-temperature materials. Bibliographical footnotes are included. Cemented carbides will be treated in a subsequent volume.

BOOKS RECEIVED

Aircraft propulsion; theory and performance. A. W. Morley. Toronto, Longmans, Green, 1953. 221 pp., diagrs., $5.00.

CABMA Register of British products and Canadian distributors, 1953. London, Iliffe, 1953. 820 pp., $7.50.

The characterization of organic compounds, rev. ed. S. M. McElvain. Toronto, Macmillan, 1953. 303 pp., $4.50.

Circuit theory of electron devices. E. M. Boone, New York, Wiley, 1953. 483 pp., illus., $9.35.

Coastal engineering, Proceedings of the third conference. Berkeley, Calif., Engineering Foundation Council on Wave Research, 1953. 343 pp., illus., $4.50 (U.S.)

Concrete mix design. L. B. Mercer. Melbourne, Melbourne Technical College Press, 1953. 59 pp., 5/–.

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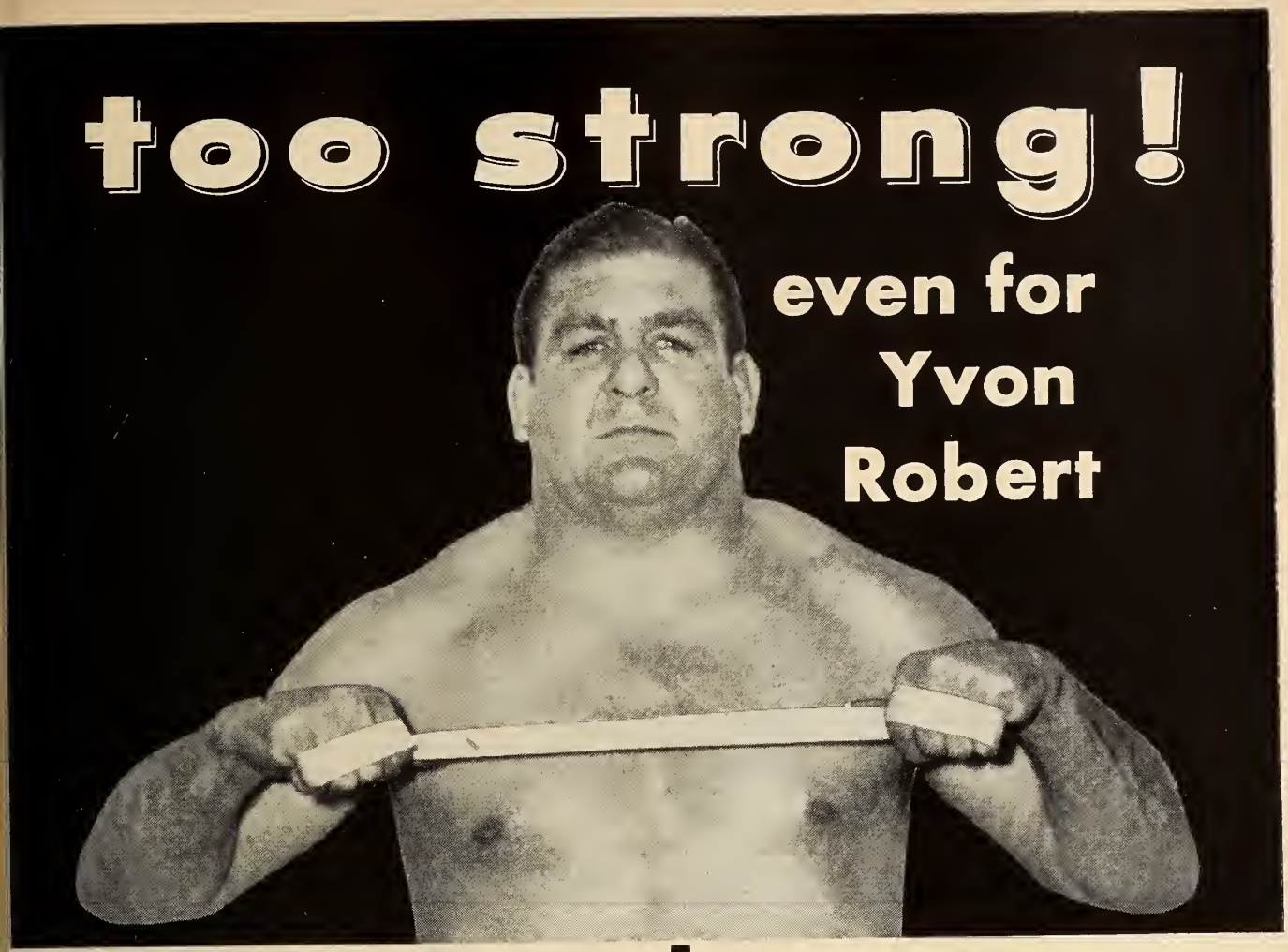

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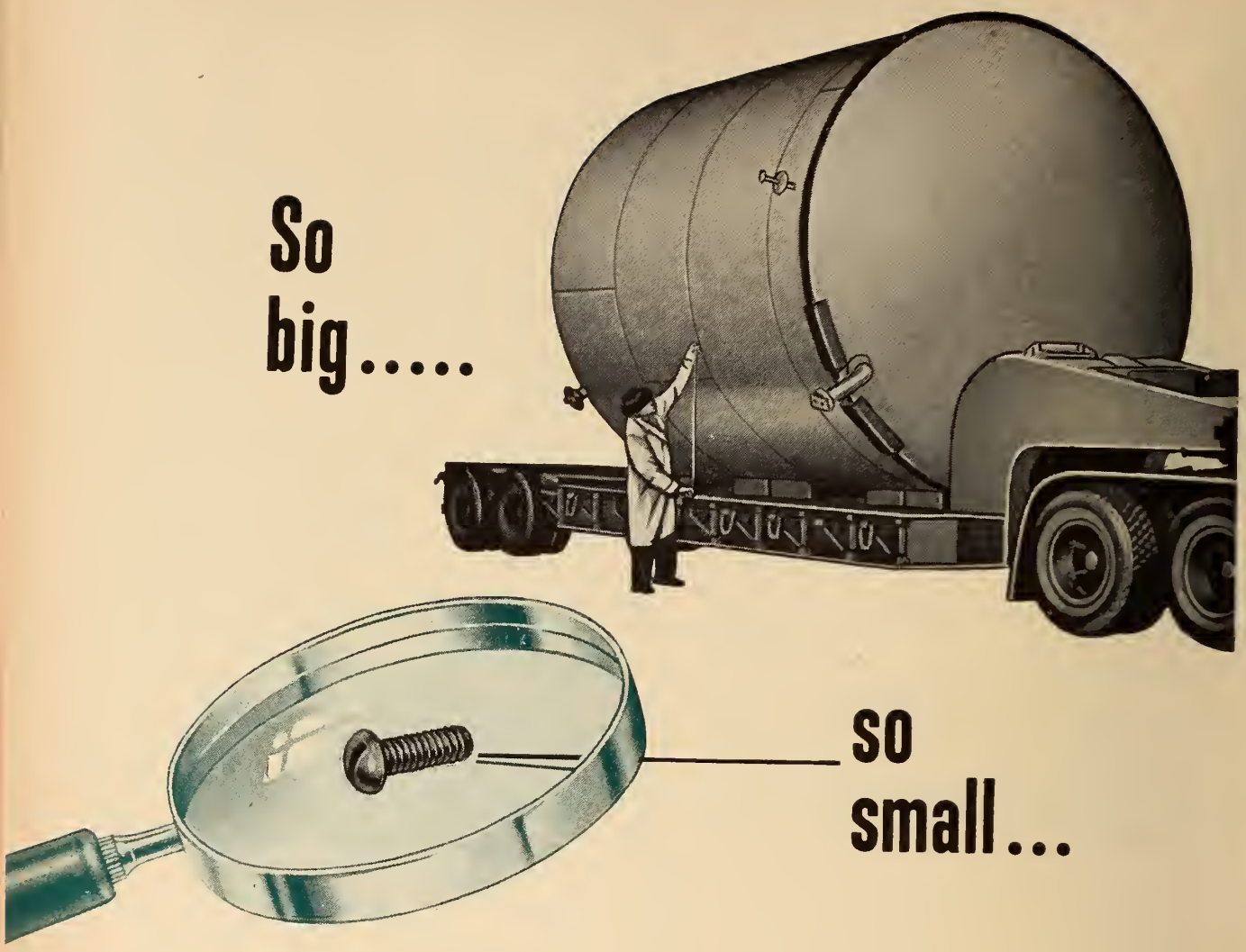

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Corrosion testing procedure. F. A. Champion. London, Chapman & Hall, Toronto, British Book Service, 1952. 369 pp., illus., $7.25.

Diesel engineering handbook, 8th ed. New York, Diesel Publications, 1953. 827 pp., illus., $8.50.

The dimensions of engineering drawings. W. Abbott. London, Blackie, 1953. 186 pp., figs., $2.00.

The electrical manufacturers, 1875-1900. H. C. Passer. Toronto, Saunders, 1953. 412 pp., illus., $8.00.

Elementary engineering science. Arthur Morley. Toronto, Longmans, Green, 1953. 300 pp., diagrs., $1.10.

Eléments de construction à l'usage de l'ingénieur, v. 10 Moteurs à combustion interne, 2nd ed. G. Lemasson & A. L. Tourancheau. Paris, Dunod, 1953. 156 pp., diagrs., 420 fr.

Engineers as writers. W. J. Miller & L. E. A. Saidla. Toronto, Van Nostrand, 1953. 340 pp., $4.50.

La fabrication et l'utilisation des tuyaux en béton armé et non armé. A. Guerrin & G. Daniel. Paris, Eyrolles, 1953. 136 pp., illus., 1,200 fr.

The instrument manual, 2nd ed. London, United Trade Press, 1953. 628 pp., illus., £4.4.0.

Introduction to engineering economy, 2nd ed. B. M. Woods & E. P. De Garmo. Toronto, Macmillan, 1953. 519 pp., illus., $6.00.

La Machine-outil. A.-R. Metral, ed. v. 1. **Généralités. Machines-outils et usinage.** Paris, Dunod, 1953. 336 pp., illus., 4,400 fr. v. 4. **Usinage par outils en translation.** Paris, Dunod, 1953. 352 pp., illus., 4,600 fr.

The measurement of particle size in very fine powders. H. E. Rose. Toronto, Longmans, Green, 1953. 127 pp., illus., $2.00.

Measurement techniques in mechanical engineering. R. J. Sweeney. New York, Wiley, 1953. 309 pp., diagrs., $6.05.

Metal industry handbook and directory, 1953. London, Louis Cassier, 1953. 456 pp., £3.5.0 (with a subscription to Metal Industry).

Moteurs et turbines à combustion interne. M. Seiliger. Paris, Dunod, 1953. 298 pp., illus., 2,950 fr.

Outlines of structural geology. E. S. Hills. London, Methuen, Toronto, British Book Service, 1953. 182 pp., illus., $3.00.

Properties of metallic surfaces: a symposium. London, Institute of Metals, 1953. 368 pp., illus., $5.50. (Institute of Metals Monograph and Report Series no. 13).

Radio engineering, v. 2. E. K. Sandeman. London, Chapman & Hall, Toronto, British Book Service, 1953. 613 pp., illus., $11.00.

Railroad engineering, v. 1. W. W. Hay. New York, Wiley, 1953. 483 pp., illus., $8.25.

Résistance des matériaux. G. Manuel. Paris, Dunod, 1953. 258 pp., illus., $3.25.

Rewinding and repair of electric motors. Karl Wilkinson. London, Spon, Toronto, British Book Service, 1952. 208 pp., illus., $4.25.

Techniques of plant maintenance and engineering, 1953. New York, Clapp & Poliak, 1953. 288 pp., $6.00 (U.S.)

The writings of the Gilbreths. W. R. Spriegel and C. E. Myers, eds. Homewood, Ill., Irwin, 1953. 513 pp., $7.35 (U.S.).

STANDARDS REVIEWED

ASTM specifications, American society for testing materials. 1916 Race Street, Philadelphia 3, Pa.

ASTM manual on measurement and sampling of petroleum and petroleum products. $1.50.

This second edition of the manual presents the latest and most practical methods of measuring and computing oil in storage tanks, and of obtaining typical samples. It has been prepared by a special division of ASTM Committee D-2, after 10 years of investigation and research. The manual comprises 7 ASTM Standards,

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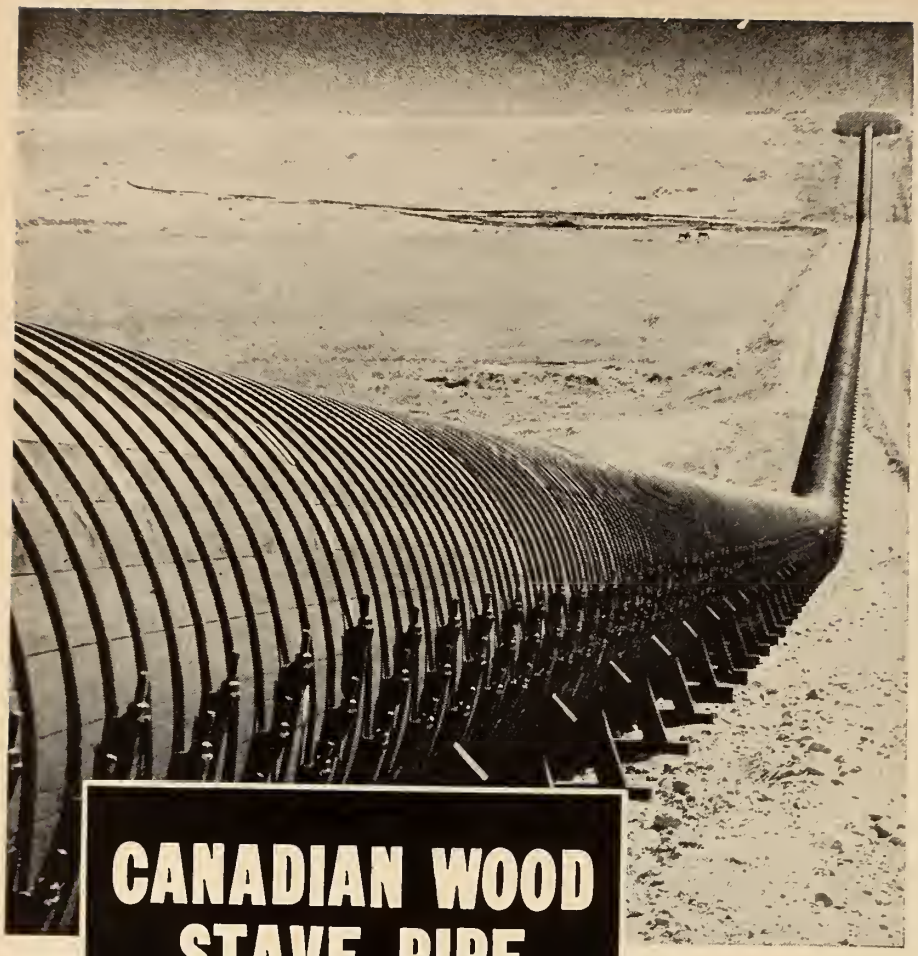

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with considerable additional explanatory and descriptive material. The seven standards are: Gaging petroleum and petroleum products; Measuring the temperature of petroleum and petroleum products; Volume calculations and corrections in the measurement; Water and sediment by means of centrifuge; Gravity; Sampling; Sampling natural gas. In each section of the book, following paragraphs on Scope, Outline of Method, and Terminology, the apparatus is described with special instructions and precautions, and other essential information and data.

American welding society, 33 West 39th Street, New York 18, N.Y.

C1.2-53T — Recommended practices for spot welding aluminum and aluminum alloys (Tentative). $1.00.

These recommended practices are offered as a guide for setting up welding schedules to be followed, which should be modified according to the specific fabricating conditions and production requirements involved; the schedules are not the only possible conditions for welding the materials and thicknesses shown. The book includes a table giving the combinations of aluminum alloys which can and cannot be spot welded, and also a section on cleaning methods for the removal of surface oxide and foreign matter prior to welding. Complete welding schedules are given for frequency converter machines; electromagnetic and electrostatic stored-energy machines; and standard a.c. machines. The electrical and pressure characteristics of these machines are illustrated and suggestions provided for altering the welding schedules for specific applications. There is also a chapter on weld defects, illustrated by photographs, and a bibliography of articles on specific aspects of aluminum spot welding.

British Standards, British standards institution, 24-28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 378: 1953 — Solid drawn copper and copper alloy tubes for condensers, evaporators, heaters and coolers. 2/6.

This revised edition of B.S. 378 supersedes the 1941 edition, and includes tubes in copper, aluminum brass, copper-nickel and aluminum bronze (7 per cent aluminum) in addition to solid drawn 70/30 brass and 70/29/1 brass tubes covered in the earlier edition. The requirements for tubes for screwed glands, and screwed glands for condensers included in the previous have, however, been omitted, and will be issued as a separate standard.

B.S. 1924: 1953 — Methods of test for stabilized soils. 12/6.

This standard supplements B.S. 1377: 1948 'Methods of test for soil classification and compaction' and describes additional tests for stabilized soils, and covers all types of stabilizers which are in common use, and all types of soil of which 80 per cent or more of the particles pass a $1\frac{1}{2}$ in. B.S. sieve. Included in the standard are the following methods:—preparation of samples; determination of moisture content; dry density/moisture content relationship; determination of dry density; unconfined compressive strength; and the cylinder penetration ratio. The California bearing ratio is not included, but a test termed the cylinder penetration ratio test is included. This test is intended to give a measure of the stability of the stabilized soil, and is not intended to be used in con-

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junction with curves for pavement design purposes, is similar to the California bearing ratio test with certain differences. The Appendix includes typical forms illustrating how results may be calculated and recorded.

B.S. 1987: 1953 — Classification of diamond powder in the sieve and sub-sieve ranges. 2/6.

The purpose of this standard is to specify the particle size and purity of diamond powder in sieve and sub-sieve sizes so as to provide a uniform method of specifying this material. The classification applies to diamond powder, whether produced by sieving or other methods.

B.S. 1990: 1953 — Wood poles for overhead lines (Power and telecommunication lines). 2/6.

The sizes specified in this standard, which supersedes B.S. 139 'Red fir wood poles for telegraph and telephone lines', and B.S. 513 'European larch poles for transmission lines', range from 18 ft. extra light poles to 85 ft. stout poles. The standard emphasizes the importance of good preservation which can be achieved by pressure creosoting, after the timber has been seasoned and all fabrication completed. As it is difficult to lay down and work to precise requirements on all aspects of a natural product, it is recommended that the acceptance of poles and the supervision of the seasoning test should be placed in the hands of experienced, qualified inspectors. Two appendices describe the method of determining moisture content, and of the crippling loads of stayed and unstayed poles.

B.S. A.102 — Steel bolts (Unified hexagons and UNF threads) for aircraft. 4/–.

B.S. A.103 — Steel nuts (Unified hexagons and UNF threads) (ordinary, thin, slotted and castle) for aircraft. 3/–.

B.S. A.104 — Corrosion-resisting steel bolts (Unified hexagons and UNF threads) for aircraft. 3/6.

B.S. A.105 — Corrosion-resisting steel nuts (Unified hexagons and UNF threads) (ordinary, thin, slotted, and castle) for aircraft. 3/–.

B.S. A.106 — Aluminium alloy bolts. (Unified hexagons and UNF threads) for aircraft. 3/6.

B.S. A.107 — Aluminium alloy nuts (Unified hexagons and UNF threads) (ordinary and slotted) for aircraft. 2/6.

B.S. A.108 — Steel bolts (Unified hexagons, UNF threads and close tolerance shanks) for aircraft. 3/–.

This series of standards provides a range of bolts and nuts, of ¼ in. nominal size and above, with UNF threads and with hexagon dimensions agreed on for use in aircraft between representatives of the American, British and Canadian services and industries. This series of hexagon sizes differs from that of the 'normal' series of Unified precision hexagon screws and nuts for general engineering purposes (covered by B.S. 1768: 1951) in providing common dimensions for the hexagons of bolts and nuts of the same nominal size, and in the dimensions of hexagons for ¾ in., ⅞ in., and 1 in. nominal size bolts and nuts.

Canadian standards, Canadian standards association, National research building, Ottawa, Canada.

C.S.A. C22.2 No. 61-1953 — Construction and test of electric ranges. 2nd ed. $1.00.

This specification applies to domestic electric ranges for potentials up to and including 250 volts between conductors, designed to be employed in accordance with the rules of Part I of the Canadian Electrical Code. It does not apply to portable ranges (rangettes) or commercial electric ranges. The requirements for portable ranges (rangettes) have been transferred to C.S.A. C22.2 No. 64. The details covered in the specification concern general requirements and construction items such as frame and enclosure; ventilating and other openings; terminal parts; wiring; automatic controls, etc.

C.S.A. C22.2 No. 75-1953 — Construction and test of thermoplastic-insulated wires and cables. 3rd ed. $1.50.

The changes from the second edition concern primarily the addition of aluminum conductors and a new type of wire, type TWU. The specification covers single-conductor wires in B and S gauge sizes from No. 14 to 4/0, also in circular mil areas from 250,000 to 2,000,000 which

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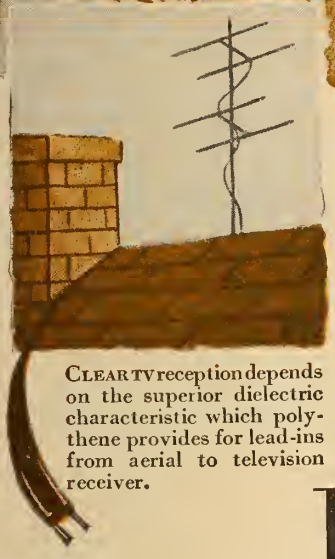


CLEAR TV reception depends on the superior dielectric characteristic which polythene provides for lead-ins from aerial to television receiver.

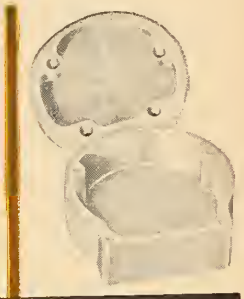
underground...
...overhead

polythene...

protects communications

THIS TELEPHONE cable is safe from moisture and from soil chemicals because it is sheathed in polythene. It's lighter, more flexible, too.

PRECIOUS POUNDS are saved in jet planes by these access door covers made of tough, resistant polythene. No danger of cracking or weakening in sub-zero upper air.



POLYTHENE SINK STRAINERS, food containers, house wares of all kinds are safe with food, pleasant to handle, will not break, are unaffected by acids or alkalies.

These, plus polythene's other advantages, add up to a material offering more useful combinations of properties than any other plastic... a material ideally suited to a wide range of uses, from housewares to packaging, from electrical insulation to piping.

Polythene stays strong and flexible at sub-zero temperatures ...does not weaken or deteriorate with age... has high impact strength...is chemically inert... an excellent moisture vapor barrier... provides superior all frequency insulation...is pleasantly soft and warm to the touch... can be made in all colors.

And you gain polythene's unique advantages at low unit cost: pound-for-pound economy is assured by this, *the lightest solid plastic known.* Call or write for full information, technical service that will help put versatile polythene to work for *you.*

CANADIAN INDUSTRIES LIMITED

Suppliers of plastic raw materials

C-I-L Plastics
SERVING CANADIANS THROUGH CHEMISTRY

POLYTHENE DIVISION

P.O. Box 10, Montreal

have a thermoplastic resin insulation recognized for use only at 600 volts or less, and at a maximum working temperature of 60C (140F). The details and tests covered by the specification concern conductors, insulation, finish, electrical properties of thermoplastic insulation, workmanship, and markings. Appendix A covers the mechanical properties of aluminum conductors.

TECHNICAL BULLETINS RECEIVED

Aluminium Limited.
Aluminium panorama. 1953.

American public works association. Special reports:
No. 14 — Pre-calculation of the annual tonnage that a refuse-incinerating plant can burn.

American society for engineering education.
Review of current research and directory of member institutions 1953.

American society for testing materials. Special publications:
No. 142 — Symposium on exchange phenomena in soils.

American society for testing materials. Special technical publications:
No. 131 — Symposium on direct shear testing of soils.
No. 134 — Symposium on the use of radioisotopes in soil mechanics.
No. 136 — Symposium on recent developments in the evaluation of natural rubber.

American water works association. Standard specifications:
AWWA C400-53T — Tentative standard specifications for asbestos-cement water pipe.

British electrical and allied industries research association. Technical reports:
No. A/T137 — An examination of self-supporting films of cellulose triacetate, cellulose acetate butyrate and polythene. No. A/T138 — The permanent effect of water on varnished coils. No. G/T270 — Breaking capacity tests of 440 V, 150 A, and 75 A three phase contactors. No. G/T276 — Flameproof electrical apparatus: flanged joints, one half-inch in radial breadth, in mixtures of ethylene and air. No. G/T277 — Flameproof electrical apparatus: flanged joints, one half-inch in radial breadth, in mixtures of ethyl ether vapour and air. No. G/T279 — Flameproof electrical apparatus — re-assessment of values of statistical maximum safe gap on the basis of the integral curve of a normal distribution. No. G/T279 Supplement — Flameproof electrical apparatus: re-assessment of values of statistical maximum safe gap on the basis of the integral curve of a normal distribution. No. L/T268 — Stabilization of impregnated-paper capacitors: pilot scale tests with azobenzene. No. L/T279 — The torsional vibrations of long-chain molecules - III. No. O/T10 — Examination of a defective creosoted pole after remedial treatment by the cobra process. No. V/T108 — Detection of incipient failure of insulation by observations of non-linearity. No. V/T115 — Design and performance of a portable a.c. discharge detector.

British engineers' association inc.
Classified handbook of members and their manufactures, 1953 edition.

Canada. Dept. of Mines and Technical Surveys, Geographical branch. Foreign geography information series:
No. 6 — Indo-China; a geographical appreciation.

Canada. National research council. Canadian government specifications board. Specifications:
1-GP-16A — Shellac varnish. 1-GP-43 — Stain, shingle; linseed oil type, for sidewalls and roofs. 20-GP-2A — Bottles, hot water, rubber; for general use. 20-GP-10— Rubber, sponge (chemically blown); sheets and molded shapes. 39-GP-10 — Handles; tool, striking. 42-GP-17 — Trays, serving; aluminum. 42-GP-18 — Pans, steam table; aluminum covers, steam table; aluminum. 42-GP-19 — Strainers; china cap, aluminum. 42-GP-20 — Measures; aluminum, institutional. 42-GP-21 — Funnels; aluminum. 42-GP-22 — Scoops; aluminum. 42-GP-30 — Aluminumware, domestic. 45-GP-1 — Drills; pneumatic, portable.

Canadian standards association. Approvals laboratories.
List of approved oil-burning equipment. 1953.

Connecticut. University. Engineering experiment station. Bulletins:
No. 9 — Some electronic analogue computer techniques, by E. J. Robb and H. L. Heydt.

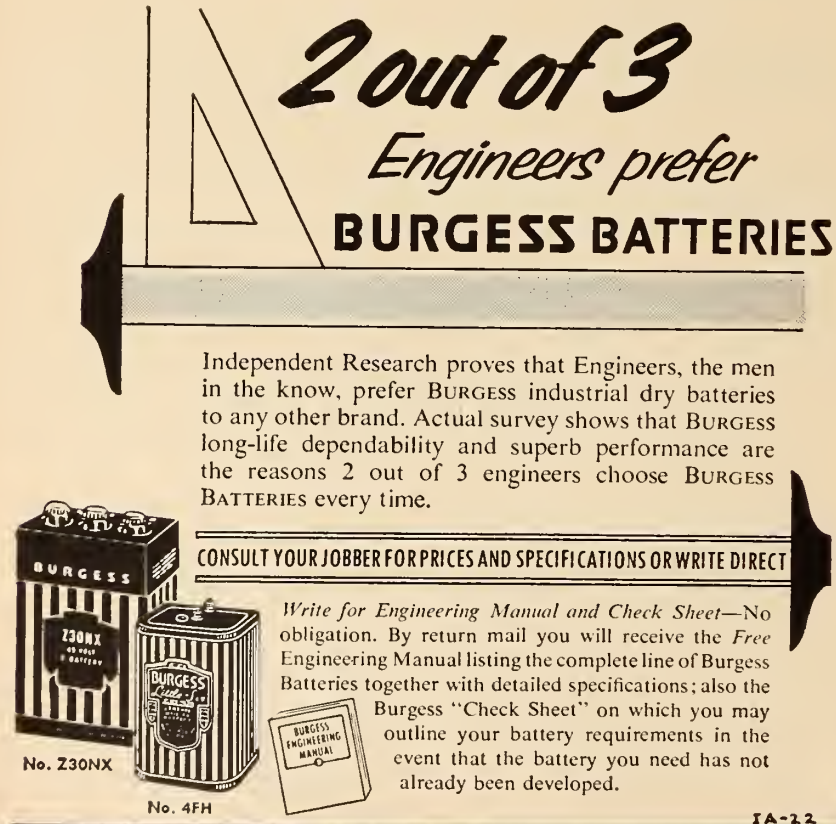
Edison electric institute. EEI-NEMA standards:
EEI-TDJ-135 NEMA-122 — Street lighting poles used in street and highway lighting. EEI-TDJ-139 NEMA-126 — Materials, finishes, and performance tests for equipment used in street and highway lighting. EEI-TDJ-140 NEMA-127 — Metal head and reflector interchangeability (enclosed luminaires) used in street and highway lighting. EEI-TDJ-142 NEMA-129 — Open reflector mountings used in street and highway lighting.

Institution of metallurgists. Lectures delivered at the Institution's refresher courses:
1951 — The joining of metals. 1952 — The metallurgy of the rarer metals.

International joint commission.
Report on the preservation and enhancement of Niagara Falls. 1953.

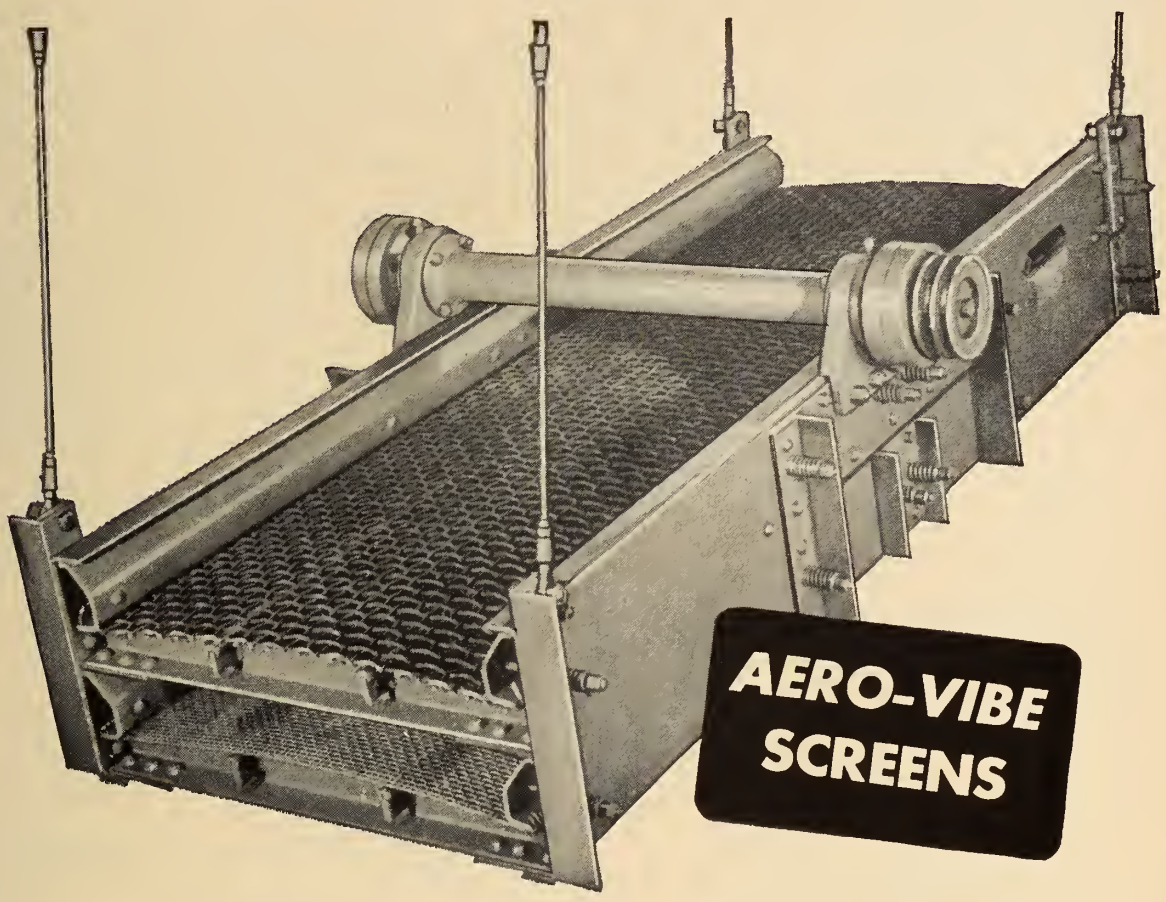
Massachusetts institute of technology.
Abstracts of theses accepted in 1951-1952.

The packaging catalogue of Great Britain, 7th ed. 1953.



Low Cost Screening...

For Fine to Medium-Coarse Materials



YOU'LL GET profitable fine to medium-coarse screening with *Aero-Vibe* screens — low in first cost and low in operating cost! The self-contained, two-bearing vibrating mechanism has fewer parts — results in easy maintenance and lower power costs.

Aero-Vibe screens are so efficiently designed and sturdy they've been operated successfully at speeds up to 2000 rpm! High speed gives you a spanking vibration that puts more fines through your screen — with less in the oversize. And, vibration is easily adjustable — you just change the position of circular counterweights at shaft ends.

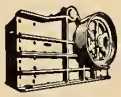
Whether sizing or rinsing sand and gravel, crushed stone, coal or a variety of ores, *Aero-Vibe* screens give you low cost screening. Built in 2 x 4 to 5 x 10 ft. sizes, open or enclosed, *Aero-Vibe* screens are available with 1 to 3 decks. For complete information, contact your nearest CA-C Sales Office or write Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Quebec for Bulletin No. 07B6099. 53-CAD-3

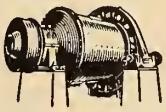
Aero-Vibe, Pulverator and *Texrope* are Allis-Chalmers trademarks.

CANADIAN ALLIS-CHALMERS

Pulverators

Vibrating Screens


Jaw Crushers

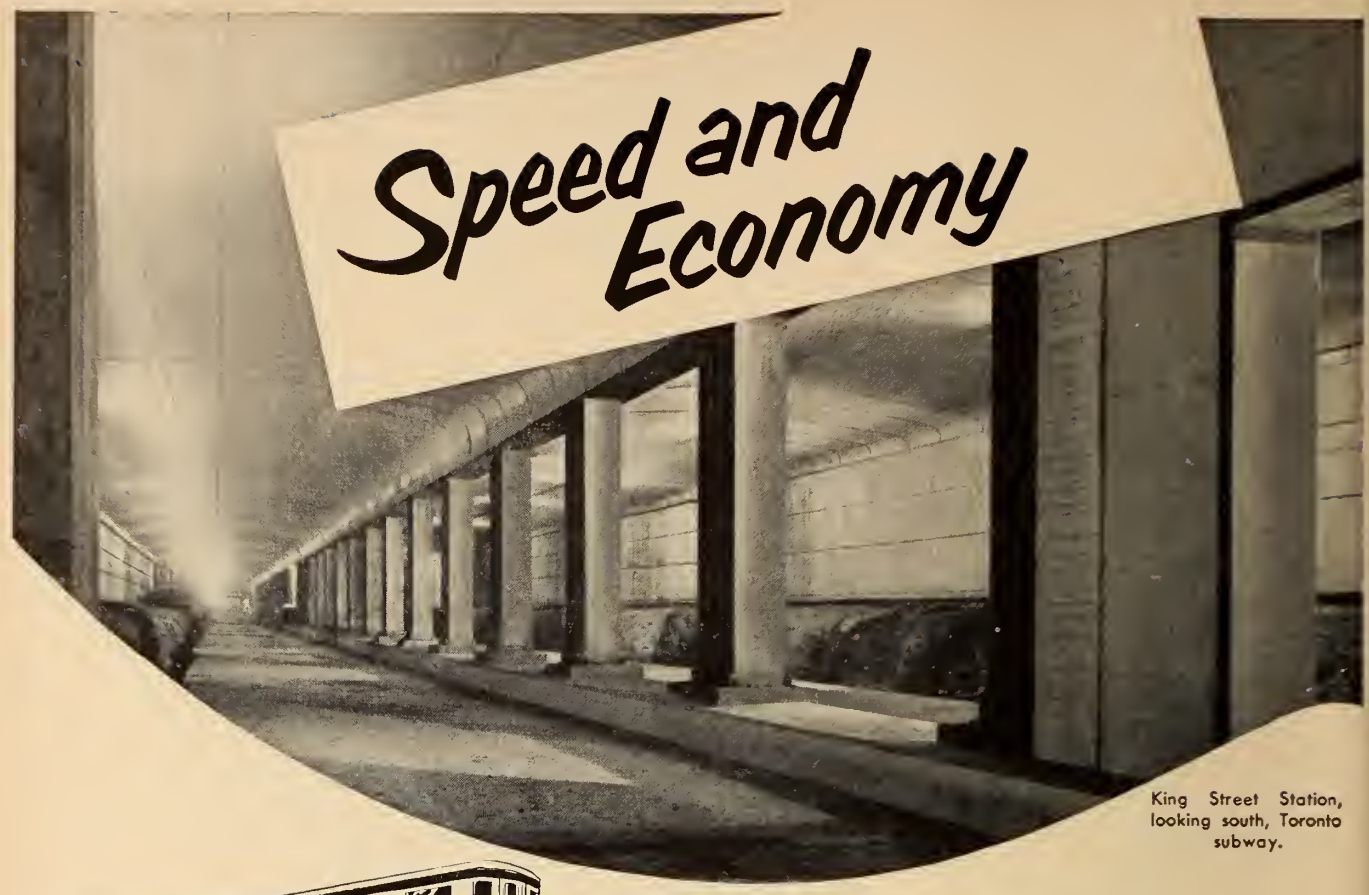

Grinding Mills

Gyratory Crushers

Kilns, Coolers, Dryers

Texrope Drives

Speed and Economy



King Street Station, looking south, Toronto subway.

An open cut section of the subway looking north through the Aylmer Bridge. Owners: Taranta Transportation Commission.

feature application of

CONCRETE

in Canada's FIRST SUBWAY

CONCRETE figured largely in the construction of the Toronto subway. By the time the entire route was completed, 1,140,000 bags of cement had gone into this huge transportation development. The flooring, roofing, station steps and platforms, tunnel walls and other parts of the project saw extensive use of this durable, fire-resistant construction material. Concrete speeds completion of the construction job in which it is used. It means faster schedules, real economy, moderate first cost and lower upkeep. No other building material of comparable cost offers *all* the money saving advantages of concrete. Write us for information on concrete for every construction use.

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Canada Cement Company Limited

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SALES OFFICES: MONCTON, QUEBEC, MONTREAL, OTTAWA, TORONTO, WINNIPEG, CALGARY

MAKING THE THINGS THAT MAKE THE THINGS YOU NEED

The coffee you had at breakfast

gives you a real interest in CANADIAN VICKERS

Coffee from Brazil, tea from Ceylon, Perfumes from Paris, Broadloom from Scotland . . . you constantly use products that were carried to Canada, and to you, in ships. And that gives you a real interest in Canadian Vickers . . ; because, Canadian Vickers builds ships.

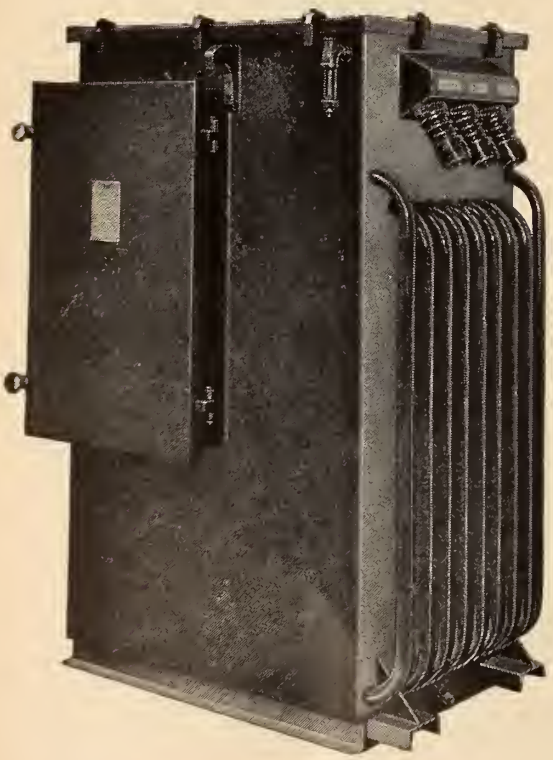
Ships that carry Canadian produce to distant markets and so enrich Canada; ships that bring good things from far away places so you can live a better life. Ships of every type, every size and every speed to fill every shipping need. And, in times of peril, Canadian Vickers builds tough, fast, fighting ships to defend our shores, our homes and our lives.

And so you and every Canadian has a real interest in Canadian Vickers . . . the ships they build, the industrial Boilers, the Paper machines, the Chemical and Mining equipment they make for the things you need.

CANADIAN VICKERS LIMITED MONTREAL

IF INDUSTRY NEEDS IT...CANADIAN VICKERS BUILDS IT...*BETTER*

Trouble on rural lines?



Voltage regulation has became a very real problem in serving rural areas. In most cases the complaint is about low voltage. This has became increasingly serious as existing lines have been extended far beyond the original areas considered, and electric ranges and other loads have been added. Designing engineers have found that money can be saved and the cost of service thereby reduced by stringing line conductors adequate for average or medium loads and using a step voltage regulator to raise the voltage during the short heavy load periods. The Ferranti 6-step regulator with a total range of 15% (the 100 amp. unit illustrated on the left is typical) has been service-proved in hundreds of rural areas throughout Canada and many repeat orders evidence satisfaction.

SPECIFY

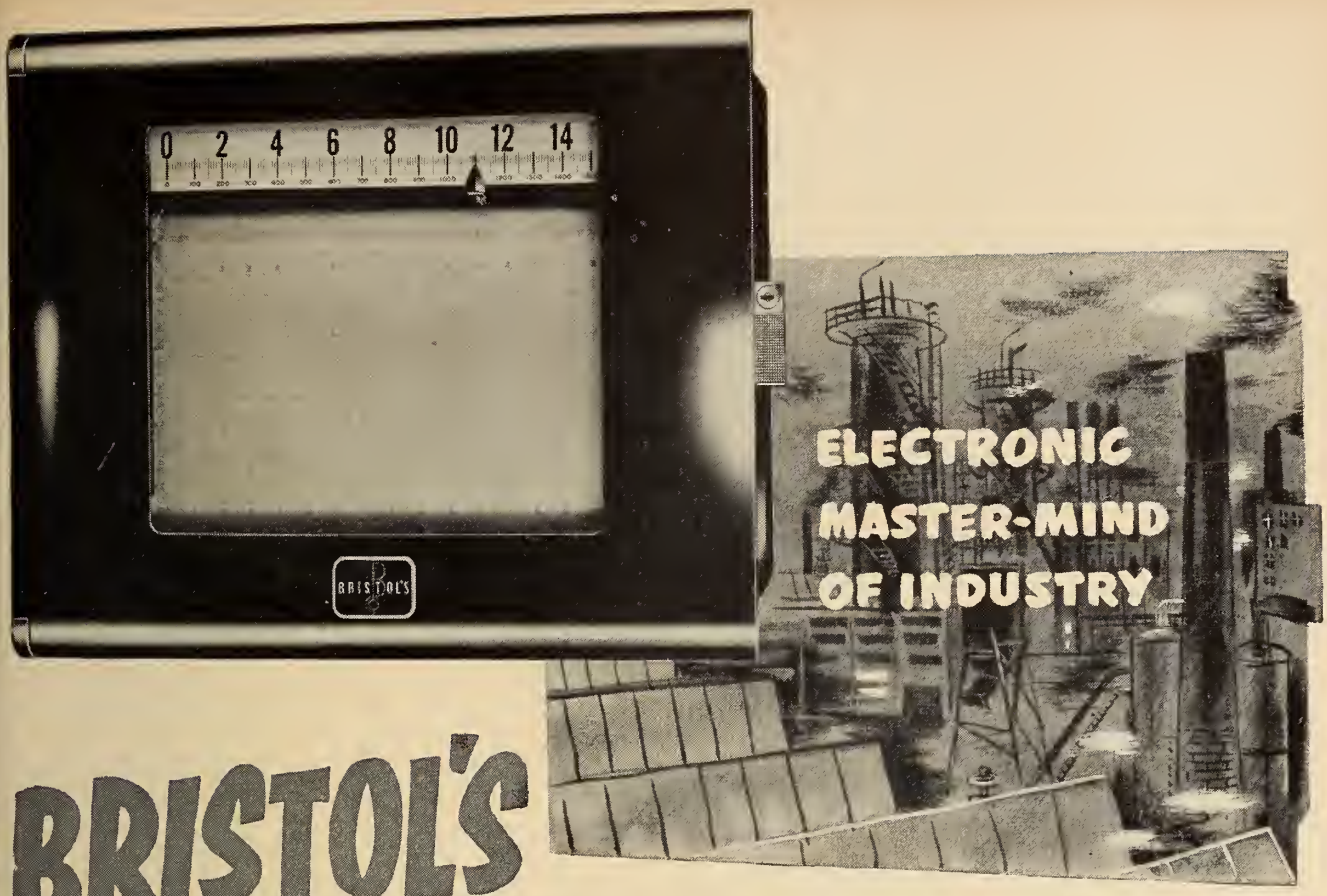
FERRANTI

AUTOMATIC STEP-VOLTAGE REGULATORS

Northern Electric

COMPANY LIMITED

41 BRANCHES THROUGHOUT CANADA



BRISTOL'S DYNAMASTER

Solves your measuring, recording and controlling problems . . . better than ever before

- Continuous-balancing electronic circuit responds instantly to minute changes.
- All types of electric and air-operated controllers offered.
- Available as a self-balancing bridge or potentiometer.
- Electronic component uses vacuum tubes available at any radio supply house.
- Full scale pen travel in 7, 3 or ⅔ seconds.
- Chart speeds from ¾ in. per hour to 7,200 in. per hour.
- Multiple recorders up to 16 points.
- Components interchangeable and easily replaced on all Dynamaster models.
- Immune to most vibration or shock.
- Unaffected by stray currents (1,000 to 1 discrimination).

For detailed proof of the sensitivity, versatility and reliability of the electronic Dynamaster, write for Catalogue P1245.

The BRISTOL Company of Canada Limited

BRISTOL'S

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A. R. WILLIAMS MACHINERY CO. LTD.

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EDMONTON-CALGARY
GORMAN'S LTD.

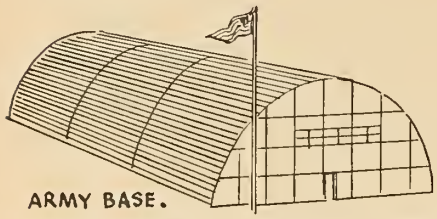
MEASUREMENT OF INDUSTRIAL PROGRESS

NOTES FROM AN ARCHITECT'S SKETCH PAD

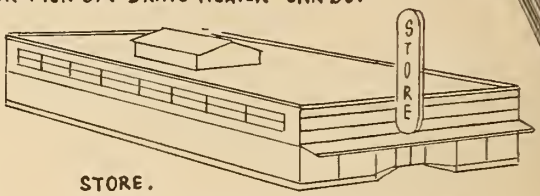
LOOKS LIKE THAT VERSATILE DRAVO "COUNTERFLO" HEATER CAN BE USED ON PRACTICALLY ALL OUR JOBS.

SCHOOL. DISTRICT BUDGET LIMITED. CAN SAVE WITH DRAVO HEATERS.

CHURCH. INTERMITTENT HEATING. NEEDS QUICK PICK-UP. DRAVO HEATER CAN DO.

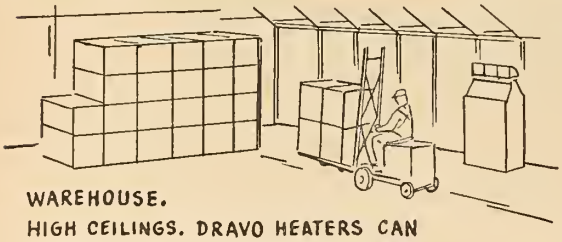


ARMY BASE.
WINTER CONSTRUCTION ON THESE BARRACKS. CAN INSTALL DRAVO HEATERS EARLY FOR HEAT DURING CONSTRUCTION AND AFTER COMPLETION.

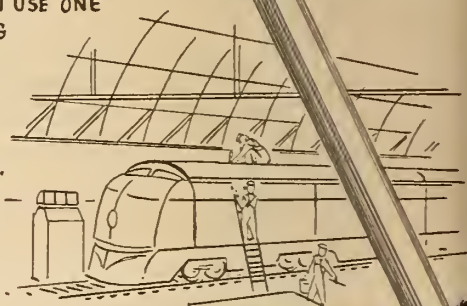


STORE.
WITH DRAVO HEATERS, CAN USE ONE SET OF DUCTS FOR HEATING AND AIR-CONDITIONING.

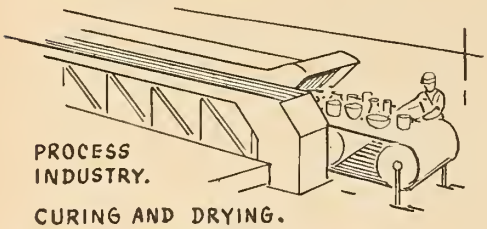
INDUSTRIAL PLANT.
DRAVO HEATERS HAVE 150' AIR THROW. NO DUCTS NEEDED.



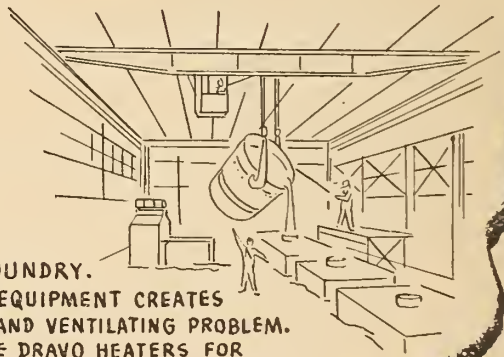
WAREHOUSE.
HIGH CEILINGS. DRAVO HEATERS CAN REDUCE ROOF HEAT LOSS, KEEP HEAT WHERE IT'S NEEDED.



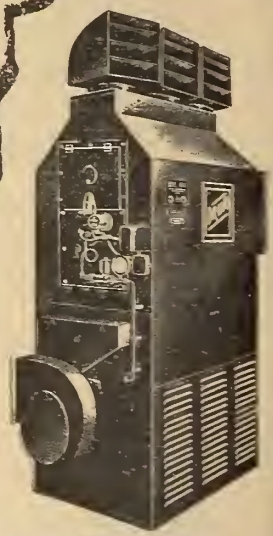
DIESEL RAILROAD SHOP.
NEEDS HEAT AT WORKING LEVEL.
DRAVO HEATERS IDEAL.



PROCESS INDUSTRY.
CURING AND DRYING.
SPECIFY DRAVO HERE.



FOUNDRY.
EXHAUST EQUIPMENT CREATES HEATING AND VENTILATING PROBLEM.
USE DRAVO HEATERS FOR TEMPERED "MAKE-UP" AIR.



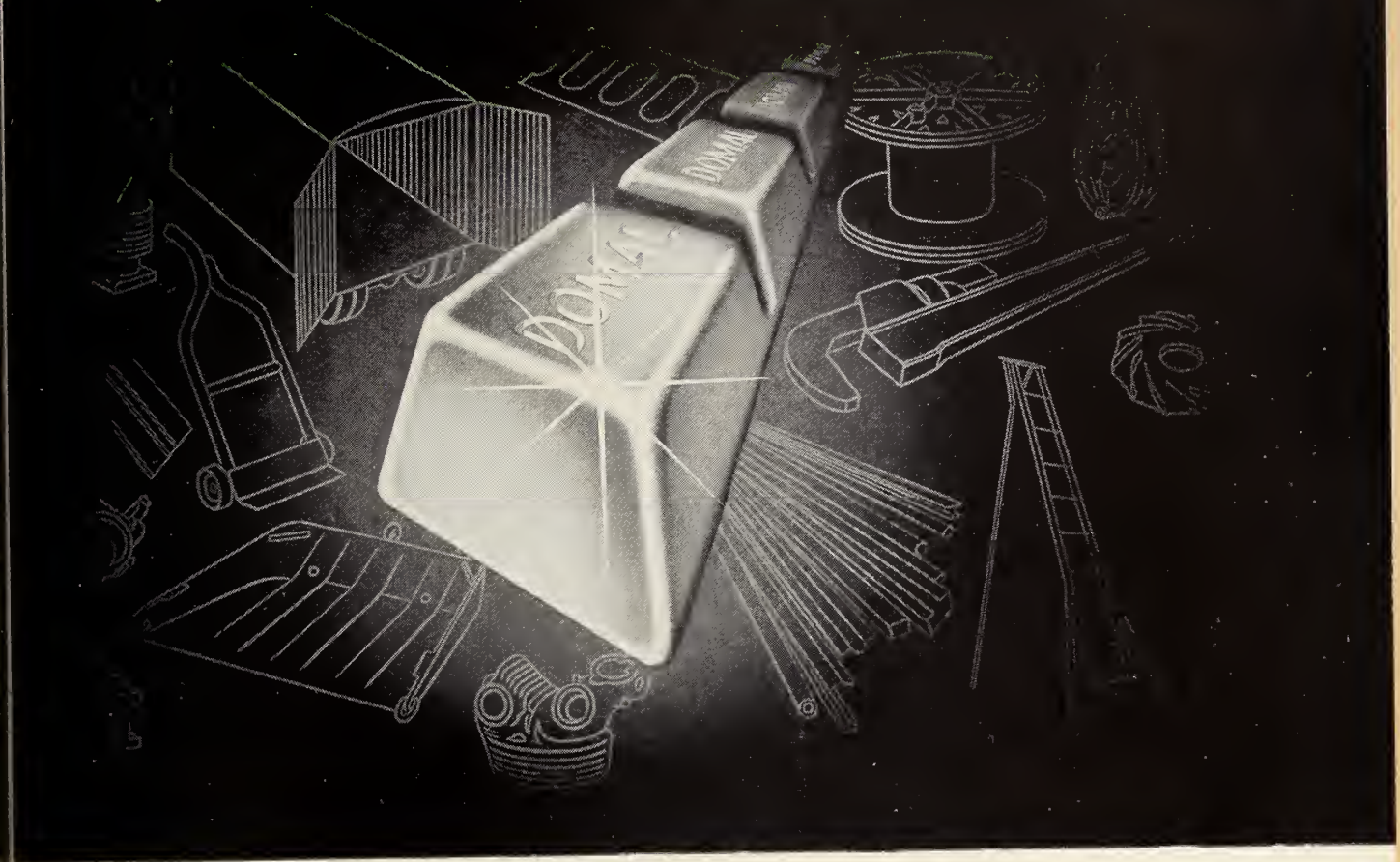
DRAVO

MARINE INDUSTRIES LIMITED

HEATING DIVISION

Head Office and Plant, Sorel, Que. • Ontario Division, Bloor Bldg., (Bloor & Bay Sts.) Toronto, Ontario

FABRICATING



...simple with MAGNESIUM

Whatever shop procedures suit your product best, fabrication is simple with light, strong, durable magnesium. It can be spot welded or riveted, and inert arc welding is simple and economical. This versatile metal can be die cast, extruded, spun, deep-drawn, rolled, forged, or cast in sand or permanent moulds. Moreover, magnesium can be machined at higher speeds than any other metal—a significant factor in keeping production costs low. Designers know magnesium as a metal of almost unlimited product application. Consider magnesium for *your* products. Our sales office will gladly supply further information.

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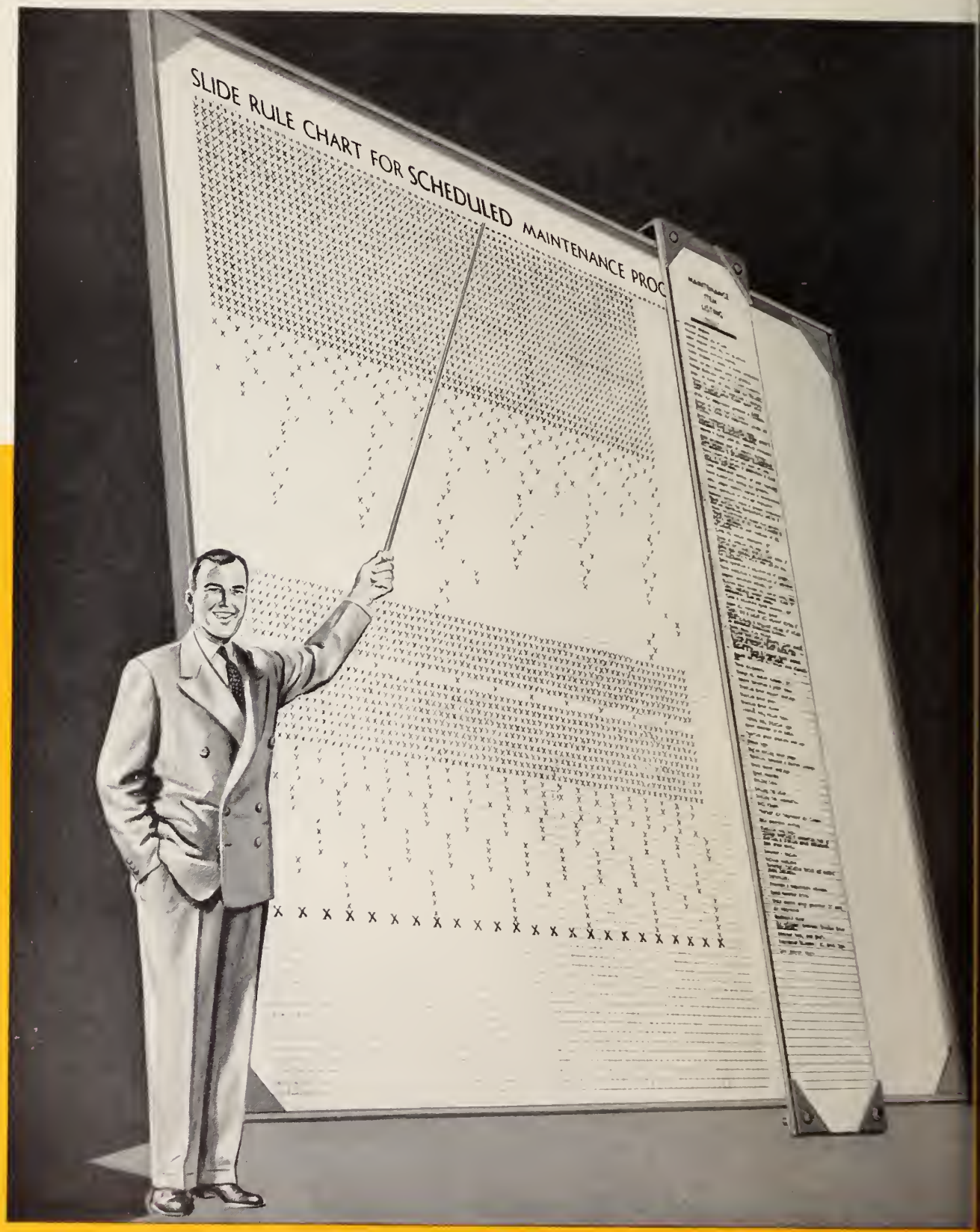
WHAT'S WRONG WIT



GENERAL MOTORS DIESEL LIMITED

HIS PICTURE?

NOTHING!

The co-ordination of G.M. Parts service with your Scheduled Maintenance Program

sures THE RIGHT PART AT THE RIGHT PLACE—*ON TIME*

Lower maintenance costs . . . higher availability . . . JS LOWER PARTS INVENTORY. These are the proven benefits of General Motors Co-ordination of Parts Supply with Scheduled Maintenance Programs. With locomotives programmed for definite maintenance dates—parts can be ordered months ahead and *shipped one month prior to use*. Locomotives stay young . . . and parts inventories stay low. Maintenance expenses are down . . . and locomotives enjoy a minimum of "down time" with a maximum of time on the line.

Here are further examples of money-and-time savings with General Motors Diesel Parts:—

ONE SOURCE — ONE RESPONSIBILITY — means maximum returns on your General Motors Diesel locomotive investment.

GUARANTEED 12 MONTHS OR 100,000 MILES—General Motors rigid system of testing controls and research enables G.M. to offer this Parts Guarantee.

UNIT EXCHANGE—Immediate delivery of traction motors, generators, injectors, governors, engines and sub-assemblies, from our pool of FACTORY REBUILDS. You pay only the cost of bringing your assembly to the same top-standard condition as the one you receive.

PLUS—Continuous product improvement passed along to you *automatically*. Engineered *packaging* to protect parts and cut shipping costs. Parts personnel training programs. Stock-Record System to help control inventory.

GENERAL MOTORS
LOCOMOTIVES

NERAL OFFICES AND PLANT: LONDON, ONTARIO
es Headquarters: INTERNATIONAL AVIATION BUILDING, MONTREAL, QUEBEC

This advertisement is No. 4 in a series.

Galvanized wire makes it rugged . . . . *and Stelco knows all the twists.*

For exacting applications like this, Steleo produces an exclusive specialty wire known as "Zinc Tight" Electro Galvanized Wire. It will not crack, flake, or chip, even under severe bending, twisting, and crimping, and is available with a wide range of coating weights.

To illustrate the variety of galvanized wires produced by Steleo, here are some further examples: Hot Dipped Galvanized Wire, Galvanized Telephone Wire, Galvanized Rope Wire, Galvanized Wire for Stranding, and Drawn after Galvanized (D.A.G.) Wire. In addition, Stelco is regularly producing standard and custom specifications of all types of High and Low Carbon Wire for a vast number of end uses.

Stelco's immense experience with wire . . . far exceeding that of any other Canadian wire manufacturer . . . is at your disposal; and so, too, are the facilities of the three wire mills which together make Steleo the biggest wire producer in the country.

No matter how specialized your wire problem may be, it is more than likely that Stelco's Metallurgical and Engineering Service has met and solved a similar problem before. When next you need wire, call any Steleo Sales Office. You'll get complete co-operation in every way.

Stelco can solve your wire problems . . . over 5,000 case histories on record!

THE Steel Company of Canada, LIMITED

EXECUTIVE OFFICES STELCO HAMILTON - MONTREAL

53331.B.

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver, J. C. Pratt & Co. Limited, St. John's, Newfoundland

Look What A West Coast Shipyard Is Doing With...

SYLVAPLY WATERPROOF -GLUE PLYWOOD

Floating Drydock in operation at Vancouver's Burrard Shipyard and Engineering Works Ltd.

performance under pressure!

Old dockyard hands gasped at the idea of *plywood* ballast tanks . . . but Vancouver's pace-setting Burrard Shipyards had already investigated other salt and fresh water installations where Sylvaply had demonstrated superiority over traditional construction materials.

The giant buoyancy tanks which make up both sidewalls of the drydock in the photo are built with ¾-inch Sylvaply. The crossply construction of Douglas Fir waterproof-glue plywood provides the necessary strength to withstand tremendous pressures.

Wood planking previously used for these tanks required many hours of costly labor to caulk the joins between each board. Sylvaply's big, rugged 4 x 10 foot panels reduced joins to a minimum. Ideally dimensioned for pressure treating with creosote, complete penetration is possible with plywood. Cuttings taken after treating demonstrated that the Sylvaply panels could be cut, sawn and bored without exposing any area not completely creosote protected.

Today, after a rigorous testing period which included repeated submersion and exposure to sun, Burrard reports "complete success, with no sign of water seepage anywhere." The Shipyard is also happy about the considerably lower construction cost with Sylvaply.

Dollar-wise men of Canadian industry have solved construction and fabrication problems with Sylvaply. For information which may help you solve your particular problem correspond with Technical Section, MacMillan & Bloedel Ltd., P.O. Box 355, Vancouver 1, B. C.

Specify **SYLVAPLY** *Canada's Busiest Building Material.*

MacMILLAN & BLOEDEL LTD., SERVING THE WORLD WITH FOREST PRODUCTS SINCE 1911

WAHLEACH, BRITISH COLUMBIA

Another Penstock job made easier with

DRESSER COUPLINGS

Lighter, high-yield steel pipe cuts tonnage, shipping, installation costs . . . speeds completion of 1760-foot Wahleach penstock.

Six weeks after construction began, this 70″ penstock—the fourth Dresser-Coupled installation made by the B. C. Electric Company—was ready to deliver water to a 75,000-kva power plant near Vancouver, British Columbia.

Eliminating extensive excavation, resilient gaskets in Dresser Couplings allowed the penstock to be deflected to the natural contour of the right of way. The lighter weight and longer lengths of high-yield steel pipe meant easier handling, fewer joints and anchors. A field crew of 20 men—with a minimum of skill, supervision and heavy equipment —*Dresser-Coupled 1,000 tons of steel penstock in 21 working days.* Under test, the line proved absolutely bottle-tight.

Dresser Couplings permitted faster completion of the line and assured permanently tight, maintenance-free joints. This resulted in *earlier revenue* from plant operation . . . *uninterrupted service* to power consumers.

Above—Overbends mode by 1° deflections ot each field joint eliminated shop-mode bends ond speciol onchors.

Left—Four men overaged less thon four hours making bottle-tight joint . . . 975 psi working pressure, 1500 psi shop test on couplings.

Project designed by B.C. Internotionol Engineering Co., Ltd.
Penstock installotion by Arrow Tronsfer Co., Voncouver

BE SURE you get a *better, faster* penstock installation. Put high-yield steel pipe and Dresser Couplings in *your* specifications.

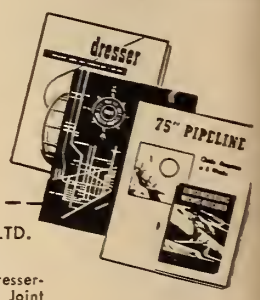
DRESSER®

COUPLINGS

Dresser Manufacturing Company, Ltd.
(One of the Dresser Industries)
Toronto, Ontario, Canada

FREE ENGINEERING DATA

Moil this coupon for interesting ond informotive engineering data on diversified Dresser instollotions. It's file moteriol thot will be o big help next time you're designing a pipeline.



DRESSER MANUFACTURING COMPANY, LTD.
Toronto, Ontario, Conodo

Pleose send me your lotest "Report of Dresser-Coupled Lines", ond copies of your Exponsion Joint ond Style 38 Cotologs.

Nome_____
Title_____
Compony_____
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QUALITY PRODUCTS

BY SKILLED CRAFTSMEN

STEEL STRUCTURES OF ALL TYPES
BUILDINGS BRIDGES

TANK AND PLATEWORK

MECHANICAL EQUIPMENT

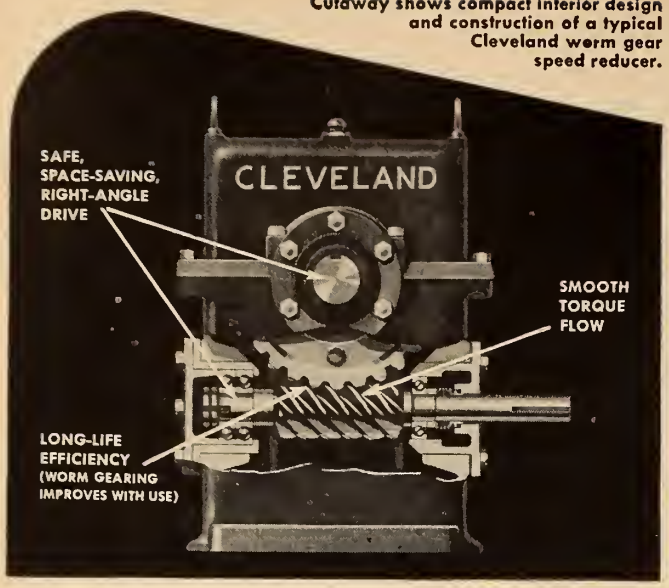
WELDED ASSEMBLIES

The high standard of fabrication is evidenced in all our diversified production. This is assured by the skill and experience of our craftsmen, our efficient, modern fabricating facilities and the long experience and training of our specialized engineering departments.

Let us assist you in your requirements.

CISC — Canadian Institute of Steel Construction — Canadian Construction Association

HAMILTON BRIDGE COMPANY LIMITED
HAMILTON ONTARIO



Cutaway shows compact interior design and construction of a typical Cleveland worm gear speed reducer.

Why WORM gear? Why CLEVELAND?

HERE are some of the inside reasons why Cleveland worm gear speed reducers are specified by many of the leading builders and users of industrial machinery.

Safe, Space-Saving, Right-Angle Drive—Clevelands are compact, provide a wide range of reduction speeds. Worm and gear enclosed in sealed housing replace dangerous open gearing, belts and pulleys. Safety always for machine operators and lube men! Gearing runs in oil bath, insures positive lubrication, eliminates oil cans and grease paddles.

Smooth Torque Flow—By virtue of the sliding action of worm on gear, a Cleveland transmits power uniformly and smoothly. Constant angular velocity assures positive control of work on driven machine.

Long-Life Efficiency—Experience demonstrates that Cleveland case-hardened worms and nickel-bronze gears actually improve with use. Even operating under continued, severe overloads, danger of sudden failure is remote. Thousands of Clevelands operate for the life of driven machines.

Get the complete Cleveland story by writing for new Catalog 400 today. Peacock Brothers Limited, 224 St. Patrick Street, Montreal 32, Que. Also Calgary, Noranda, Sudbury, Sydney, Toronto, Vancouver and Winnipeg.

Representatives in Canada of The Cleveland Worm & Gear Co. and The Farval Corporation.

CLEVELAND
Worm Gear
Speed Reducers

PACIFIC COAST PIPE

is famous for

WOOD PIPE INSTALLATIONS IN POWER DEVELOPMENTS PULP AND PAPER AND MINING INDUSTRIES

Our B.C. Fir continuous Wood Stave Pipe has been constructed by us in all parts of Canada and other Countries since 1904. It is made with our Pacific Metal Butt Joint (Patented) for connecting stave ends and has Pressure Creosote treatment applied to Staves and Cradles.

Pacific Coast Pipe Co. Ltd.
1551 GRANVILLE ST. ESTABLISHED 1904 VANCOUVER, CANADA

Throughout Ontario Eastern builds for Industry

In Orillia, Toronto, London, Chatham, and Windsor, EASTERN has new projects underway for clients such as Hiram Walker, York Trading, Borden's, Bryant Pattern, Daymond Company, Seven-up and others.

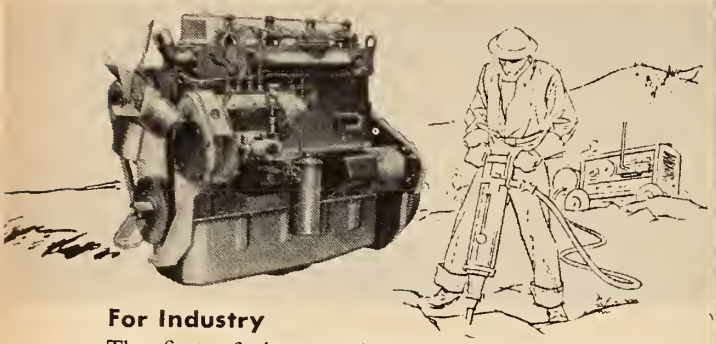
We specialize in industrial construction and have a staff of professional engineers to manage each project.

EASTERN CONSTRUCTION CO. LTD.
ENGINEERS AND CONTRACTORS

WALKERVILLE
ONTARIO

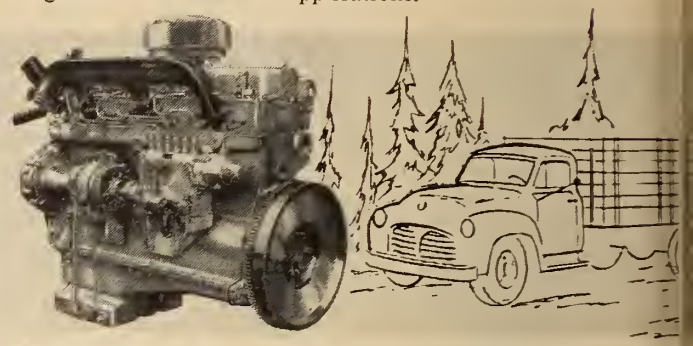
New Diesel engines meet growing demands of Canadian Industry

The rapid progress of Canadian Industry has created a demand for lightweight, high-speed diesel engines. In all branches of industry more and more diesels are being used . . . for their low operating costs and reliability. As the world's largest producers of diesel engines, the F. Perkins Co. entered the Canadian market with the idea of producing diesels to meet the particular demands of Canadian Industry. The result is a group of compact, economical diesel engines for all industrial applications.



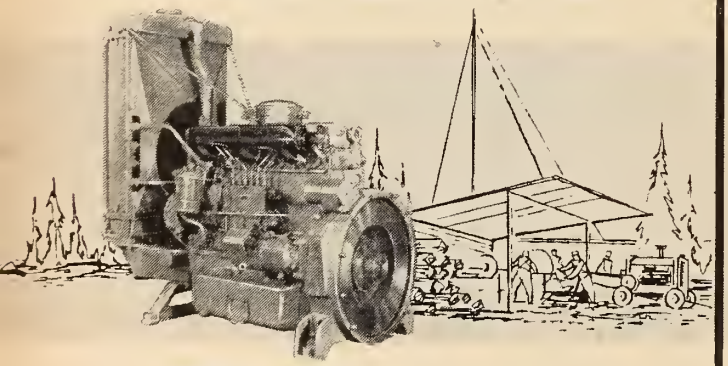
For Industry

The first of these engines, the Perkins L-4 was designed specifically for industrial use. It is a 4 cylinder, lightweight, high-speed engine that develops 60 H.P. at 2,000 R.P.M. It can be used for most industrial purposes, since it is cleanly and simply constructed for accessibility and easy maintenance. And, because of its exclusive "Aeroflow" system of combustion you get lower fuel consumption and quick starts—even in cold weather! Best of all, because of Perkins vast production, the L-4 is the lowest priced diesel of this size on the market.



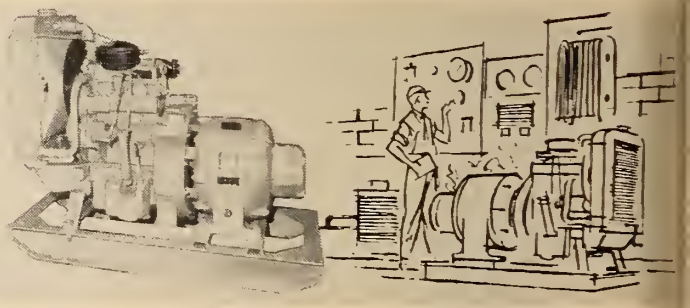
For Trucks

Until now, diesel engines in Canada have been used only for long hauls and heavy work, But there has been a need for a lighter diesel engine that would be economical and practical on short hauls. And Perkins have developed just such an engine. Now, every truck operator can have the economy, low maintenance, long wear, and smooth running ability of a diesel engine. The Perkins R-6 is a practical diesel for light and medium weight trucks on short hauls. Gas powered trucks can be converted quickly . . . without loss of a single working day.



For Lumber Industry

A versatile engine for the booming Canadian Lumber Industry. The P-6 can be used for operating logging winches, logging yarders and portable saw mills. It has a rating of 32/85 H.P. at 1,000/2,400 R.P.M. Already the P-6 has proven its worth in the vast and busy camps of B.C.



An All-Purpose Engine

Proven in installations throughout the world, the P-3 is a diesel engine developing 18/32 H.P. at 1,000/2,000 R.P.M. It will give you thousands of hours of trouble-free running.

From coast to coast these diesels are finding their place in Canadian Industry. In lumber camps, mines, factories and on trucks, owners are benefiting from the reliability and economy of Perkins Diesels.

Write us today for detailed information on any of these engines.

SALES AND SERVICE FACILITIES ACROSS CANADA
USE ONLY GENUINE PERKINS SPARE PARTS

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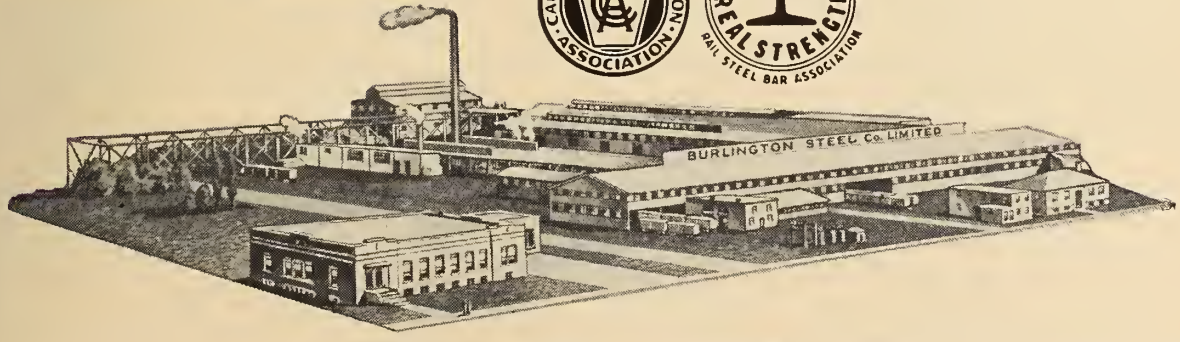


BURLINGTON STEEL COMPANY LIMITED *HAMILTON, CANADA*

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

Appointments and Transfers

Henry J. Kaiser Co. — Sydney W. Taylor has been named a vice-president of the Henry J. Kaiser Co. (Canada) Ltd., Dominion Square Bldg., Montreal. In his new position Mr. Taylor will administer the affairs of the firm in conjunction with R. H. Stokes-Rees, vice-president in charge of development.

●

Jas. Morrison Distributor.—The John McCrae Machine & Foundry Co. Limited of Lindsay has been appointed distributor for The James Morrison Brass Manufacturing Co. Ltd. in the Kawartha lakes district, extending north to Callander. The announcement was made by George R. Gardner, president of the Morrison Company.

●

R. A. McCallum

R. A. McCallum.—Ross A. McCallum has been appointed general purchasing agent of Plate and Structural Steel Sales Limited.

●

Another Morrison Brass Distributor.—General Welding Supplies Limited, 447 Birchmount Road, Toronto, has been appointed as distributor for the James Morrison Brass Manufacturing Co. Ltd. Territory is from eastern city limits of Toronto to the western city limits of Port Hope.

●

D. D. McLean

Westinghouse Transfers. — Canadian Westinghouse Company Limited has announced the following transfers. Donald D. McLean has been appointed manager of the defence contracts department, and John H. Fletcher is manager of the commercial contracts department.

●

Webster & Sons.—Webster & Sons Ltd., Montreal, Ottawa, Quebec, Toronto and Truro, have been appointed as distributors of Corland emery aggregate used in the making of "Emeri-Crete" flooring.

●

Shell Oil Changes.—Shell Oil Company of Canada Limited has announced the appointment of Dr. D. M. Morrison, M.B.E., as vice-president—manufacturing, and R. P. Ritchie as vice-president —transportation and supplies. Both Dr Morrison and Mr. Ritchie will continue to make their headquarters at the Company's head office in Toronto.

●

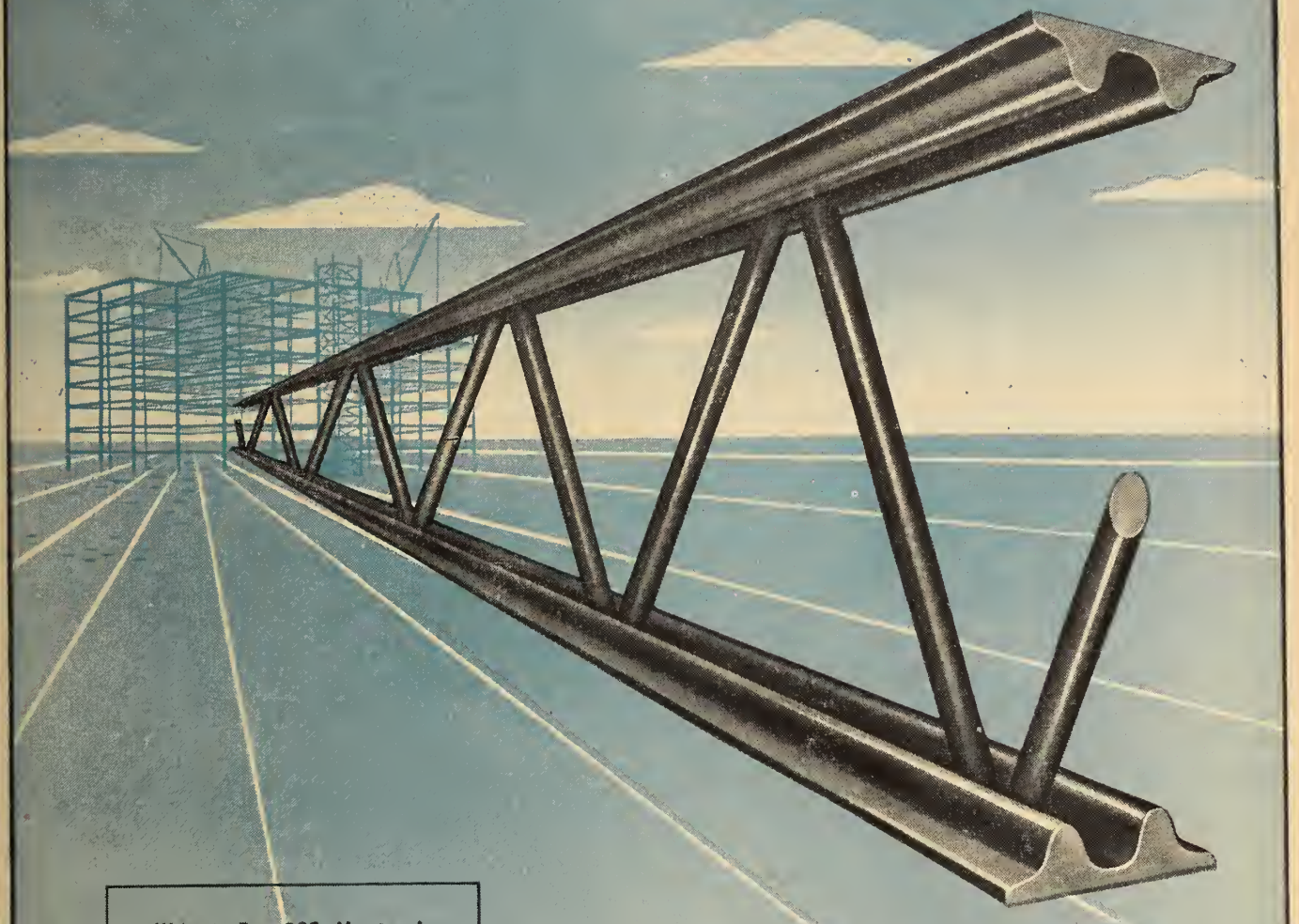
J. H. Fletcher

C. E. Macdonald. — Culminating five years as a director, C. E. Macdonald, of The International Nickel Company of Canada, has been named chairman of the board of the Canadian Welding Bureau. The appointment was made by the Canadian Standards Association.

Mr. Macdonald succeeds D. S. Lloyd, vice-president and general manager of Dominion Oxygen Co. Ltd. and Col. A. H. Cowie, founder-chairman of the Bureau and general manager of Dominion Bridge Company. Mr. Macdonald is Inco's manager of Canadian sales and development.

●

DB SHORT SPAN JOISTS



Write to Box 280, Montreal, for D.B. Short Span Joist Catalogue No. SF-108. For larger spans, write for Catalogue No. SF-100 J.

STRUCTURAL DIVISION
DOMINION BRIDGE
COMPANY LIMITED
Established 1882

Originally developed and extensively used as the "BLUENOSE" joist, this product has received wide acceptance by leading architects and contractors under its present name.

The D.B. Short Span Joist is available in depths of 8 inches to 16 inches and for spans up to 32 feet at Dominion Bridge plants.

Other Divisions:
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Plants at:
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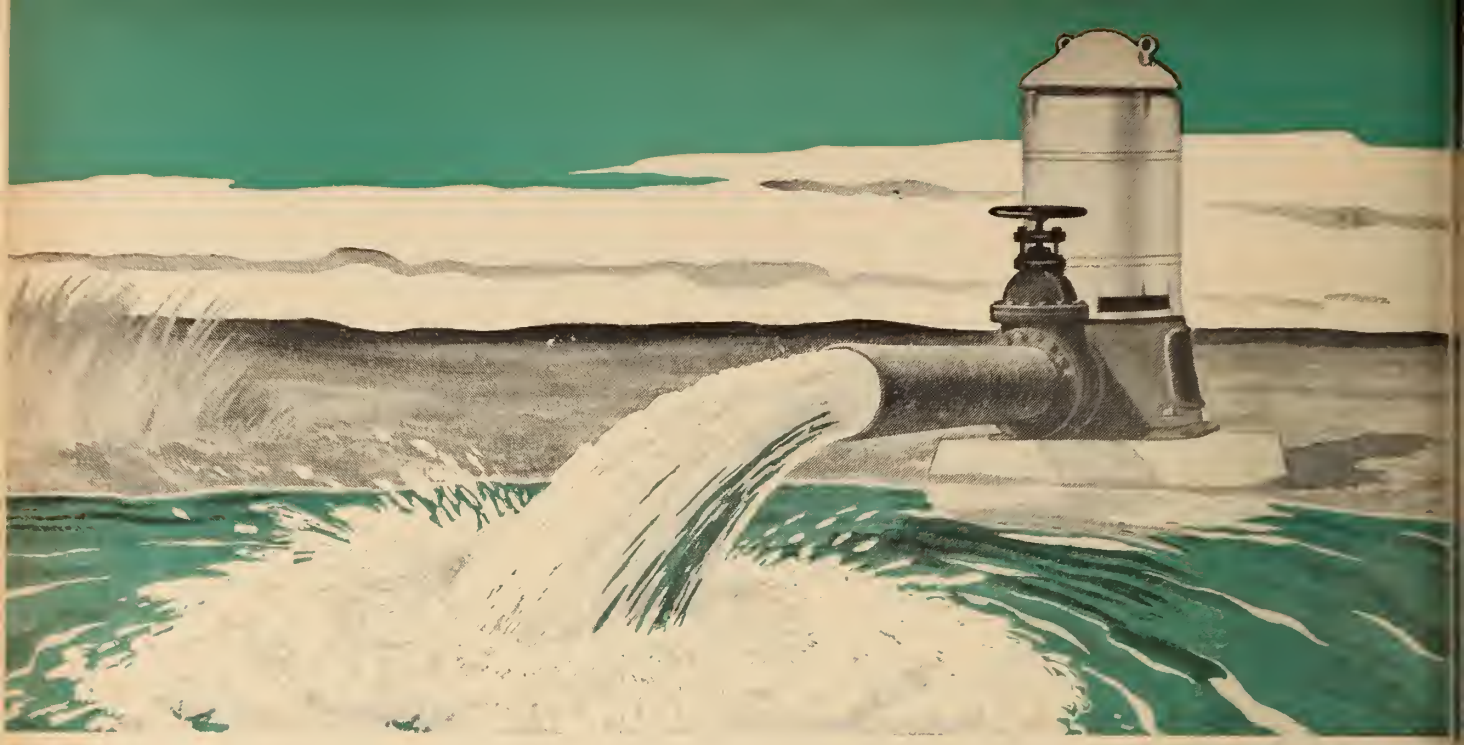
Assoc. Companies at:
AMHERST • QUEBEC • SAULT STE. MARIE • EDMONTON

In the Maritimes: Manufactured by ROBB ENGINEERING WORKS LIMITED and known as the "BLUENOSE" joist.



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Plan ahead for water needs

How Layne Can Help You—Water needs require long-range plans—for safety, dependability, economy, maintenance of adequate supply. In all such plans, Layne's engineering skill and unique research facilities are at your service.

Exploration — Layne's unmatched experience and technical ability assure an accurate "pin-pointing" of water-bearing formations before actual drilling begins.

Test Wells—Expert crews drill test holes on the site and remove samples to be sent to Layne's central laboratories for study.

Analyses—Exhaustive studies are made to determine rate of flow . . . chemical content of water . . . nature of earth formations. Guesswork is removed from your planning.

Recommendations—From all data, Layne recommends an overall plan for the best development or expansion of a water system geared to your situation and needs.

Undivided Responsibility

Specify a 100% Layne Well Water System

In a Layne water system, the name of the world's most experienced water developer stands behind everything—engineering, labor, wells, casings, screens, pumps. One contract assures you the finest in men and materials—and an undivided responsibility that assures your water supply.

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Layne

For catalogs on water well systems or pumps, or information on water supply, contact:

INTERNATIONAL WATER SUPPLY, LTD.
London, Ontario

Water Wells • Vertical Turbine Pumps • Water Treatment

Brake Shoe Executives.—The board of directors of Dominion Brake Shoe Company, a subsidiary of American Brake Shoe Company, have elected Thomas E. Akers as chairman, Kenneth T. Fawcett as president and Maynard B. Terry as vice-president.

Dominion Brake Shoe Company operates four plants in Canada. The Brakeblok Division manufactures automotive, aircraft and industrial brake materials in a new plant built in 1947, in Lindsay, Ontario. The Joliette Steel Division at Joliette, Quebec, is the largest exclusive producer of manganese steel in Canada. Air compressors and paint spray equipment are manufactured at the Niagara Falls, Ontario plant.

●

J. D. Grant.—J. D. Grant, for the past eight years advertising and sales promotion manager for all divisions of Minneapolis-Honeywell Regulator Co. Ltd., has been appointed sales manager of the company's heating controls division.

●

H. L. Wright.—Howard Leroy Wright has been elected president of Curtis Lighting of Canada Limited. Mr. Wright joined the Company in 1922. In 1932 he was transferred to Toronto as chief engineer of the newly formed Canadian Company. In 1949 he was appointed vice-president and general manager.

●

Shawinigan Chemicals Expansion. — Expanding business has necessitated separation of the research and development departments of Shawinigan Chemicals Limited and the appointment of an additional vice-president.

P. W. Blaylock, who heretofore has been assistant to Dr. R. S. Jane, vice-president in charge of both those departments, is now appointed vice-president in charge of development.

Dr. Jane, will continue as vice-president in charge of research but has assumed additional executive responsibilities.

●

Defence Production.—The Department of Defence Production announced on September 3rd that it has closed its petroleum division. G. S. Hanna, director, has returned to the British American Oil Company and M. C. Burns, assistant director, has returned to the Imperial Oil Company.

●

1954 Annual Meeting

●

Quebec City

May 12-13-14

PERFORMANCE-PROVED *IN THOUSANDS OF INSTALLATIONS*

"Canadian Buffalo"

MECHANICAL DRAFT FANS

INDUCED DRAFT FANS

Economy of operation, durability and ease of servicing are the features power plant engineers like about "Canadian Buffalo" Induced Draft Fans. The rising pressure characteristic coupled with the flat horsepower performance assures minimum power consumption. Medium-speed design counteracts the abrasive action of fly-ash. Note the wearing strips and welded ridges on the blades. Bolted sectional housing design permits quick inspection of all parts. Write for bulletin No. 3750.

FORCED DRAFT FANS

These husky, high efficiency fans are built to deliver right up to rated capacity even when the fuel bed is extra heavy. Their non-overloading characteristic allows arranging several fans to discharge into one duct without fear of burning out motors.

"Canadian Buffalo"

CANADIAN BLOWER & FORGE

COMPANY LIMITED

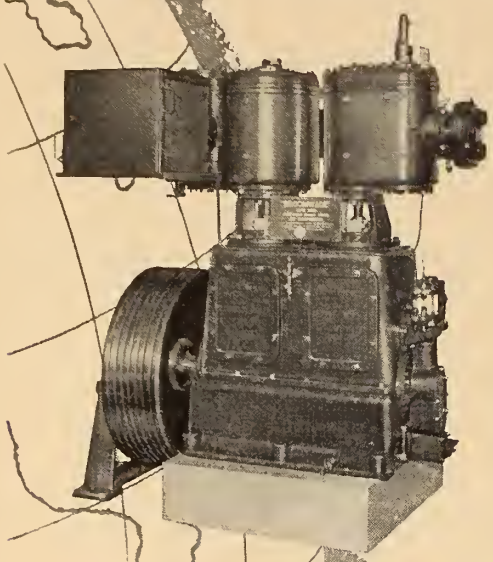
HEAD OFFICE: KITCHENER, ONTARIO

PUMPING PROBLEMS?

Our associate organization, Canada Pumps Limited, maintains a staff of specially trained representatives to help you solve your pumping problems. Branch offices in principal cities of Canada.

ENGINEERING SALES OFFICES: Montreal • Toronto • Hamilton
Saint John • Winnipeg • Regina • Calgary • Edmonton • Vancouver

"BROOMWADE"
AIR COMPRESSORS
ESTABLISHED 1898



CANADIAN BROOMWADE LTD. BROOM & WADE (S.A.) PTY. LTD. BROOM & WADE (AUSTRALIA) PTY. LTD. subsidiaries of BROOM & WADE LTD. High Wycombe, England

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Norway Nyassaland
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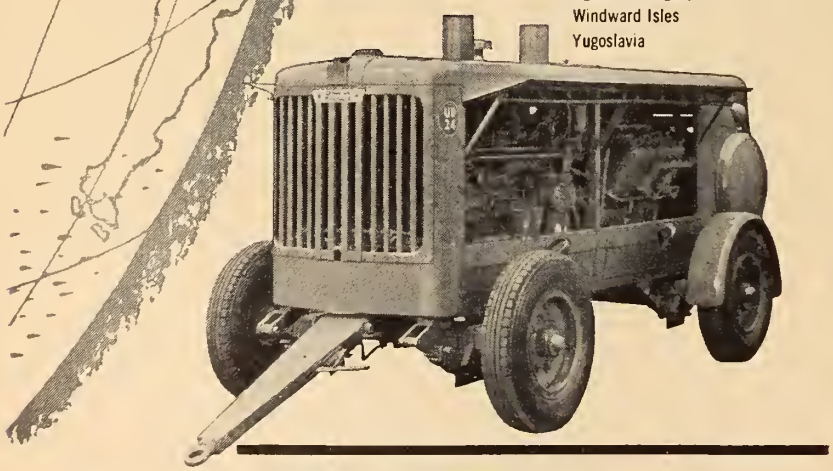
Known world-wide for reliability and value



Canadian BROOMWADE Limited
144 PARK LAWN ROAD, TORONTO, ONTARIO

Sales and Service:

MARITIMES: Atlantic Bridge Co. Ltd., Lunenburg, N.S.
QUEBEC: Laurie & Lamb, Railway Exchange Building, Montreal
ONTARIO: Laurie & Lamb, (Stationary), 284 King St. West, Toronto
Sheridan Equip't Co. Ltd. (Portable), 33 Laird Drive, Toronto
MANITOBA & SASKATCHEWAN: Medland Machinery, 576 Wall Street, Winnipeg
BRITISH COLUMBIA: B. C. Equipment Co., Ltd., 551 Howe Street, Vancouver

5305

New Equipment and Developments

C.I.L. Plant.—An increase of 20 per cent in production capacity is expected to be the result of a $300,000 expansion which will soon get under way at the York paint and varnish works of Canadian Industries Limited. The expansion will include the installation of another resin manufacturing unit and additional enamel-mixing equipment. The resins building will be extended to make room for the new unit. The plant is located in York Township just north of Toronto.

●

Westinghouse in Winnipeg.—Canadian Westinghouse added another link to a multi-million dollar postwar expansion program on September 17 with the official opening of a $500,000 Winnipeg headquarters. Provincial, civic and industrial leaders were present, with more than two thousand guests, for the opening ceremonies. The new building will serve both the Canadian Westinghouse Company and the Canadian Westinghouse Supply Company.

Equipment in the service department shops include a ten-ton crane for the handling of heavier apparatus than previously possible. Westinghouse claims to be the only Canadian electrical manufacturer maintaining a chain of electrical service shops across the country and the new facilities will provide yet speedier service to apparatus customers in all parts of the Prairie Provinces. The new shops will handle electrical equipment of all manufacturers.

●

Lighting in Mecca. — This year the Saudi-Arabian Government decided to modernize the pre-war lighting system in the Grand Mosque at Mecca. The design was entrusted to the General Electric Co. Ltd. of England. L. E. A. Phillips, the chief lighting designer for the Company ,was sent by air to the Red Sea port of Jedda to undertake the design of suitable fluorescent and tungsten lighting. The job presented many difficulties since Mr. Phillips was unable to visit Mecca himself. The city is the cradle of Islam and it is forbidden to all but those who belong to the Moslem faith.

Mr. Phillips had to gain the data he required from photographs and basic dimensions taken for him by agents.

The old lighting installation consisted mainly of bare lamps hanging from lengths of flexible cables. The new installation includes 1000 tungsten projector lamps, narrow angle floodlights and scores of coloured fluorescent floodlights. The total lighting load for the new system will be approximately 200 kw.

●

Air-Borne Concrete.—A "push button" system of blowing concrete by com-

THEN . . . Men dared the mountains to build the first railway through the Canadian Rockies. The last spike was driven on November 7, 1885.

Now . . . Men have dared the mountains a second time, to build the fabulous Edmonton-to-Vancouver oil pipeline . . . completed in September, 1953.

History Repeats

The story of men against mountains is as old as time, as thrilling as creation.

A New Zealand beekeeper and a Sherpa mountaineer have just conquered the biggest mountain of them all.

And while they were battling their way up Everest to stand on the roof of the world, other men, ordinary men—drillers, swampers and drivers—were pitting their strength, courage and skill against other mountains—the Canadian Rockies.

They were daring the mountains to build the Trans-Mountain Oil Pipe Line from Edmonton to Vancouver as their ancestors had in building the Canadian Pacific Railway.

Comstock Midwestern Crews laid 412 miles of the 718-mile line, through forest, muskeg, crag and river. They are proud of their part in this incredible feat, proud to carry on the tradition set by the men who built Canada's first trans-continental railway 68 years ago, proud to have helped forge another link in the chain of Canadian industry.

COMSTOCK COMPANY

COMSTOCK SPANS CANADA

THIS IS OUR BUSINESS

Electrical	Process piping and fabrication	Pipelines and stations
Plumbing	Refrigeration	Design, engineering and manufacturing
Heating	Warm air heating	Mining plants
Ventilating	Frequency conversion	Millwrighting
Air-conditioning		Shipbuilding

COMSTOCK MIDWESTERN LIMITED

An Associated Company of

CANADIAN COMSTOCK *Company Limited* ENGINEERING CONSTRUCTION

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Farmers know that rugged performance in the field depends on engineering skill and quality components in the implement. Just as the foremost manufacturers of all types of industrial machinery and production equipment specify Canforge light or heavy forgings, Harry Ferguson, Inc., matches the quality of its line of tractors with proven Canforge quality. To maintain its pre-eminent position in Canadian industry, Canada Foundries & Forgings Limited has kept constant pace with the rapidly expanding Canadian scene — supplying light or heavy forgings for a myriad of Canadian products.

Canforge

Light and Heavy Forgings for Aircraft, Automotive, Farm Implement, Hydro-Electric, Marine, Mining, Pulp and Paper and Transportation Industries. Your enquiry is invited.

CANADA
FOUNDRIES & FORGINGS
LIMITED · WELLAND, ONT.
MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

pressed air through pipe from underground mixing stations into construction forms has been installed by the International Nickel Company of Canada, Limited at its Creighton mine. This system of utilizing "air-borne" concrete is greatly expediting the Company's program of mining by induced caving.

To stabilize areas of the mine worked and abandoned 40 or more years ago, and utilize old openings in which the timber supports have rotted and collapsed, extensive concreting is necessary. Very slowly, and often only with the greatest difficulty could concrete be delivered to these locations until the "push button" system of blowing it there by compressed air was installed.

Several thousand bags of cement a month are now being used underground at Creighton to build slusher stations and drifts, boxhole brows, switchrooms and other installations required to meet the caving project's quote of 12,000 tons of ore per day.

Concrete mixing stations are located on the 6th and 20th levels. Gravel for the concrete is received at the mixing stations by gravity from surface through a raise formerly used for bringing rock fill to the various levels of the mine. Control chutes have been installed in the raise for handling the gravel at each station. Cement is brought from surface by the mine's regular transportation system.

The mixers which can produce a 16-cubic foot batch of concrete every three minutes are located in large rooms which provide ample space for cement storage. Concrete is poured into the placer, a cylinder 2½ feet in diameter by 10 feet long, into which compressed air is then introduced from the mine's main air line.

Best "up" delivery so far was a total of 1,315 feet from the 20 level placer, consisting of 875 feet on 20 level, up 210 feet on a 47-degree incline, 100 feet on the level, up 50 feet at 90 degrees, and finally 80 feet on the level. The 6 level station takes credit for the longest "down" delivery to date, a total of 1,670 feet from the placer into the forms for a new slusher station on 14 level.

●

New Cement Plant.—It is claimed that two million bags of cement will be available yearly to Canadian constructors within the next two years. This cement will come from the plant of the St. Lawrence Cement Co. which is building a kiln and plant at Villeneuve, a suburb of Quebec City.

Dr. Bernard Ulrich, general manager, has stated that when production is started his Company will be in a position to supply cement to all contractors in eastern Canada. He also stated that the Company owns enough cement land to produce at full capacity for at least one hundred years.

Operating now with a technical staff only the Company will eventually employ some 250 persons.

The St. Lawrence Cement Co., although a Canadian organization, was created through the financial investment of a Swiss financial organization, the Holderbank group, which already had interests in nineteen cement companies throughout the world.

It is estimated that annual output will be approximately one million, five hundred thousand Canadian barrels.

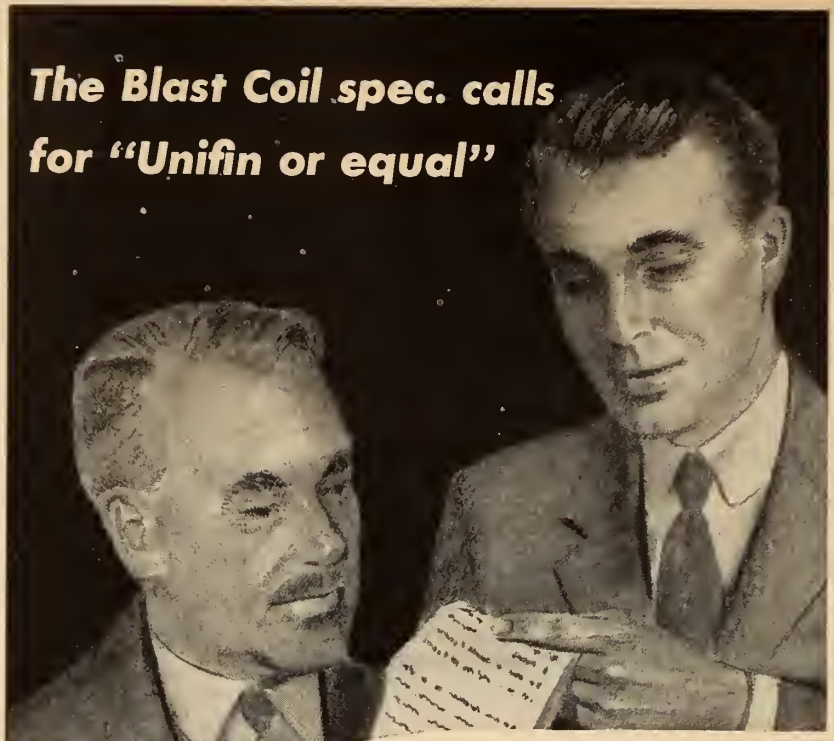
●

Wallace Barnes Springs

The Wallace Barnes Company, Limited **Hamilton, Ont.**

Western Agent: E. A. Tipping, 957 Notre Dame Ave., Winnipeg, Man.

The Blast Coil spec. calls for "Unifin or equal"



. . . but with respect, sir Unifin has no equal!

Take for instance the tubing itself ...Unifin's integral construction of tube and fins means superior heat transfer, reduced air pressure drop, and quieter operation.

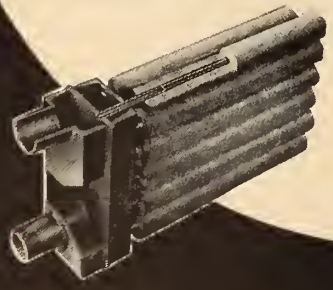
Unifin's "Copperline" coils — aluminum with a copper liner — are lighter in weight and less costly than all copper, and they're just as efficient.

If it's a job involving considerable expansion and contraction stresses, Unifin's Type H hairpin coils remove all possibility of fracture at the tube and header joints.

For Frost-Proof Blast Coils, Unifin offers a design with larger and thicker tubes than other makes — thereby providing better drainage and greater resistance to corrosion.

And finally — in spite of Unifin's superior features — the price is competitive. Why not just specify "Unifin Blast Coils" and leave it at that?

Unifin*



Engineering data available on request.

Unifin Tube Company LONDON, CANADA

*THE ONLY INTEGRAL FINNED TUBE. Patented in Canada and patents pending.

Aluminum Extrusions.—R. S. Inboden, vice-president of Chromedge (Canada) Limited has stated that their newly built Toronto plant is scheduled to begin large scale extrusion of aluminum mouldings this month. A. M. Beemer has been appointed as divisional sales manager, in charge of marketing operations.

It has been reported that complete facilities are available at the new plant for production of custom made aluminum extrusions for architectural and industrial needs, aluminum prime and storm windows and doors, and similar requirements.

Buffing, polishing, drilling and fabricating operations will also be handled. When in full production, more than 150 employees will be needed in all operations.

●

Carbon Dioxide in Water. — The problem of corrosion of steam condensate systems is due to a large extent to the reduction of the pH of the condensate by carbon dioxide evolved in the boiler, according to a paper presented at the recent meeting (September 8 1953) of the American Chemical Society, Chicago, Illinois.

The paper, "Determination of Low Amounts of Carbon Dioxide in Water" by J. B. Smith, E. K. Gilbert and M. Howie of The Permutit Company, New York 36, N.Y., declares that analysis of condensate and boiler feed water for total carbon dioxide of less than approximately 0.5 ppm. has, in the past, been accomplished by direct means. The authors point out that a newer method has been perfected to allow the determination of total carbon dioxide at levels of approximately 0.1 ppm. The system, designed to minimize the introduction of fresh air, and hence CO_2, when introducing the sample, is described and its operation discussed.

This method is an evolution process employing recirculated air in a closed system to strip the carbon dioxide from a boiling acidified sample. The CO_2 is absorbed in a barium hydroxide solution, which is back-titrated with standard acid. The values obtained are compared with a blank, previously boiled acidified distilled water.

Results obtained in the laboratory on standard solutions are presented. Data obtained in the field on the determination of carbon dioxide in the effluent from a corrosion-resistant deaerating heater treating an acid water show a value of less than 0.1 ppm. Field tests on a demineralizing plant, employing a highly basic anion exchanger, also show a value of less than 0.1 ppm. carbon dioxide in the effluent.

●

Electric Induction Furnace. — A new electric induction furnace for melting zinc sheets is now in operation at the Trail plants of The Consolidated Mining and Smelting Company of Canada Limited. It is the largest of its kind in the world and the first to be used in the western hemisphere.

It was designed and constructed by Societa Italiana Costruzioni Elettrotermiche of Milan, Italy. The furnace is rated at about 300 tons of zinc a day.

Most of the zinc is obtained from ores mined and milled in British Columbia. The zinc concentrate is shipped to Trail, roasted and the zinc dissolved in sulphuric acid. The resulting zinc sulphate solution is purified before enter-

Here is the story of 24-hour concrete*

They said it couldn't be done.

Before James Watt invented steam, travellers were used to taking months to cross the Atlantic. Before the Wright Brothers invented the airplane, people took it for granted that it would always take most of a week to cross the Atlantic. But the wheels of progress turned . . . some of the people who didn't believe the ocean could be spanned in a few hours are today the airlines' greatest customers.

And a short time ago, no one would have believed that the same kind of miracle was being performed for concrete. Industrial men the world over believed that concrete took days and even weeks to reach the peak of its hardness. Plants were closed down because concrete under heavy machines often needed days to fully harden before it could be used. Costs of industrial products soared, and schedules of production fell behind. Canada's expanding industrial might demanded a concrete that kept this new and growing giant producing night and day.

So now there is a concrete that actually does achieve rock-hardness *within twenty-four hours.* Plants with faulty concrete under heavy machines can lift the machines today, repair their concrete foundations and be producing on those same machines tomorrow — because a cement makes a concrete that in 24 hours is stronger than ordinary concrete after twenty-eight days.

This industrial miracle is called Ciment Fondu.* That's French.

It means concrete . . . hard as rock . . . in twenty-four hours — and in any language. To progressive men in industry — the men who buy machines to make them money . . . and who keep those machines producing night and day — Ciment Fondu is worthy of a place at the top of their list of maintenance materials.

You'll want to know how much Ciment Fondu costs and how to use it. Ciment Fondu costs more than ordinary cement — any miracle product does. It costs more because it can do jobs that ordinary cement cannot do. This means it is cheaper for you to pay a little more for CIMENT FONDU — It makes concrete ready for full load overnight — and lets your machines get back to producing the products that make you money. For patching, for all your concrete work that has to be done fast — for profit — Ciment Fondu is actually more economical than any concrete you can lay in your plants. And it lays easier than ordinary concrete.

Ciment Fondu can do the work of ordinary concrete of course. But it is not intended for that. Ciment Fondu has been created to reduce your loss of production time — to fight the ravages of a wide variety of chemical reagents — to withstand temperatures as high as 2400 degrees Fahrenheit — and to pour and harden in zero weather.

IN BRIEF THIS IS THE STORY OF CIMENT FONDU — THE 24-HOUR CONCRETE.

These amazing properties of Ciment Fondu are completely nullified if you have to wait for delivery into your plant. Because Ciment Fondu is principally an emergency-repair material, immediate availability is the essence of its use. It is, therefore, inperative to have a few bags or drums in your storeroom. Try it. It will become a vital part of your industrial life.

Write to Ciment Fondu Lafarge (Canada) Limited, 1405 Peel Street, Montreal, Que. We'll be pleased to supply you with technical literature and the name of your local dealer.

CONSULTING ENGINEERS, CONTRACTORS, ARCHITECTS, ETC.

The great 24 hour strength of Ciment Fondu concrete makes it an ideal material for concrete foundation work in all conditions. Furthermore Ciment Fondu's complete immunity to the corrosive action of ground waters and contaminated sub-soils adds a further insurance to long life.

Concrete piles or pile extensions can be made on site and driven the next day.

CIMENT FONDU
ALUMINOUS CEMENT

Ciment Fondu is a high Alumina Cement made from Bauxite (aluminum Ore) and Limestone. These materials are melted together in a reverbatory furnace. Hence the name CIMENT FONDU.

HOW MANY OF THESE 4 UNIQUE FEATURES WILL SAVE *YOU* MONEY?

USES

ULTRA-RAPID HARDENING. Ciment Fondu concrete is rockhard and ready for full load within 24 hours of placing. Machinery foundations, floors, roadways, etc., can be laid one day and used the next, avoiding costly shutdowns.

***USED** where time is urgent — general manufacturing • mines • bakeries • contractors • city streets • dairies • factories • breweries • chemical plants • refineries • pulp & paper mills • railways • docks • shipping • concrete piling • etc.*

CORROSION RESISTANCE. Ciment Fondu concrete is resistant to practically every known substance which attacks ordinary concrete. It can be used with confidence wherever weak acids, beer, tan liquors, fish juices, animal fats, tar, sulphur compounds, or sea water are present.

***USED** where chemicals attack: bottling works • breweries • chemical plants • dairies • distillers • fish plants • linseed oil plants • mines • oil refineries • pulp & paper mills • harbour installations • sugar refineries • tanneries • tar oil processors • chocolate manufacturers • etc.*

REFRACTORY CONCRETE made with Ciment Fondu carries the advantages of concrete construction into the refractory field. Mixed with crushed firebrick, it forms a refractory concrete that is stable under load up to 2400°F. It can be *cold cast* to any shape. It is ready for service in 24 hours and requires no pre-firing. Owing to it's small expansion and high resistance to thermal shock, it is excellent for monolithic furnace linings. It is also widely used for flues and stacks as it resists the corrosive action of combustion gases. In many cases small jobs can be handled more conveniently by proprietary castable refractories incorporating Ciment Fondu.

***USED** where heat attacks: nonferrous foundries • brick plants • coke ovens • distilleries • refineries • railways • boiler manufacturers • cement plants • furnace manufacturers • iron and steel manufacturers • etc.*

COLD WEATHER. Concrete made with Ciment Fondu will harden unprotected at atmospheric temperatures many degrees below freezing. This makes Ciment Fondu invaluable for emergency concreting work during the winter.

***USED** in zero temperatures: harbour installations • cold-storage plants • roads • meat packing plants • northern mines, mills and outdoor installations.*

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(CANADA) LIMITED
1405 PEEL STREET • MONTREAL, P.Q.

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ALUMINOUS CEMENT

...IT BEGINS A *new life*

... as one of the many products made of wood. Under our climatic conditions unprotected wood is soon attacked by moisture, rot, insects and termites.

All this can be avoided by using tested and proven "Osmose" wood preservatives. Simply applied by mopping or dipping, "Osmose" utilizes the moisture in the wood to penetrate and protect ... increasing the life of wood from 3 to 5 times.

This economical protection is widely used by Federal and Provincial governments, pulp and paper companies, leading mines and power companies, contractors and others. Its effectiveness is well substantiated by service records available on request. Write for descriptive literature — consult our free service department.

RAILWAY TIES. Osmose-treated Birch ties, 12 years in track and still sound. Untreated life in the same location, 3 to 4 years.

BRIDGE in P.Q. No rot 12 years after treatment. Untreated bridges, same road, needed extensive maintenance after 7 years.

QUANTITIES of "Osmose" used since 1936 in Canadian mines. Under severe conditions, treated wood lasted up to 12 times longer.

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MANUFACTURERS OF INDUSTRIAL AND DOMESTIC WOOD, PRESERVATIVES, PRIMERS AND SEALERS

ing an electrolytic refining process in which pure zinc sheets are plated out of the solution. Until recently all the zinc sheets were melted in oil-fired reverberatory furnaces. A fairly large volume of flue gas carrying zinc oxide from these furnaces has to be treated to recover metal values. Very little gas is generated in the new furnace.

●

Huge Wire Rope Plant. — Canada's largest wire rope manufacturing plant, the new million-dollar Grandview Highway development of British Rope Canadian Factory Ltd., was officially opened on September 23 by the Hon. Ralph Chetwynd, B.C. Minister of Trade and Industry.

The 60,000-square-foot manufacturing division, 30,000-sq. ft. warehouse unit, shipping facilities and adjoining head office and administration centre, are the first stage of an eventual 15-acre development.

The plant has a capacity of more than 1,000 tons of wire rope per month. This is the equivalent to more than half of all the steel wire rope manufactured in Canada today.

●

Electrical Manufacturing. — According to information released by the Canadian Electrical Manufacturers Association domestic production by firms in the Canadian electrical manufacturing industry is estimated at $715,873,342 for 1952, an increase of 5.9 per cent over 1951.

This figure does not include products such as washing machines, electric driers, porcelain insulators, etc., which are manufactured by the industry but classified by the Dominion Bureau of Statistics under other industries. These products totalled an additional $119,-125,000 in 1952.

The imports of electrical products into Canada in 1952 were in the vicinity of $200,000,000, representing an equivalent of around 28 per cent of the industry's total domestic production. Comparative figures for 1951 showed an increase in domestic production of 16.4 per cent over 1950 and a ratio of imports to domestic production of 22.5 per cent.

Commenting on the situation, Brigadier F. C. Wallace, president of the Canadian Electrical Manufacturers Association said "While the gross national product of Canada's electrical manufacturing industry has been increasing, statistics show that the annual percentage of increase has been steadily declining over the past three years. On the other hand, the percentage of imports to domestic production has been steadily increasing. This is borne out by Dominion Bureau of Statistics records and if this trend continues it can have serious repercussions not only in the manufacturing capacity of Canadian plants, but in the ability of our electrical manufacturers to purchase Canadian raw materials and maintain high levels of employment in the industry."

During 1952, some 401 electrical manufacturing plants located across Canada gave employment to a total of 69,200 workers. Combined salaries and wages amounted approximately to $217,564,963. The consumption of Canadian-produced raw materials by the industry in 1952, was down from 1951.

●

Canada's Trade Fair.—The 1954 Canadian International Trade Fair will feature, for the first time, a separate aircraft industry section. Arrangements have been made with the National Air Show Committee to hold the 1954 aviation event in conjunction with the Trade Fair, which will be open from May 31 to June 11.

The Trade Fair Administration hope that practically everything that Canada produces in aeroplanes, engines, instruments and other aircraft parts will be exhibited. This section will be open throughout the period of the Fair and also on Saturday, the day following the Fair's closing. An aerial show on that day will climax the exhibit.

●

Pure Oxygen Plant.—A huge Oxyton (oxygen plant) to produce 100 tons of pure oxygen daily is to be designed and built by Canadian Liquid Air Company for Dominion Foundries and Steel Company, Hamilton, Ont., it is announced by Liquid Air officials.

Costing well over a million dollars the Oxyton will supply oxygen for a new and reportedly highly efficient oxygen steel making process which Dofasco will pioneer in North America. It will be the first steel plant on the continent to use the process and only the third in the world (the others are in Europe).

Engineers of the Engineering and Construction Division of Liquid Air, Montreal, will be responsible for the designing and building of the Oxyton which is expected to be in operation for Dofasco by the middle of 1954.

This 100 ton Oxyton will be the sec-

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for Indicator
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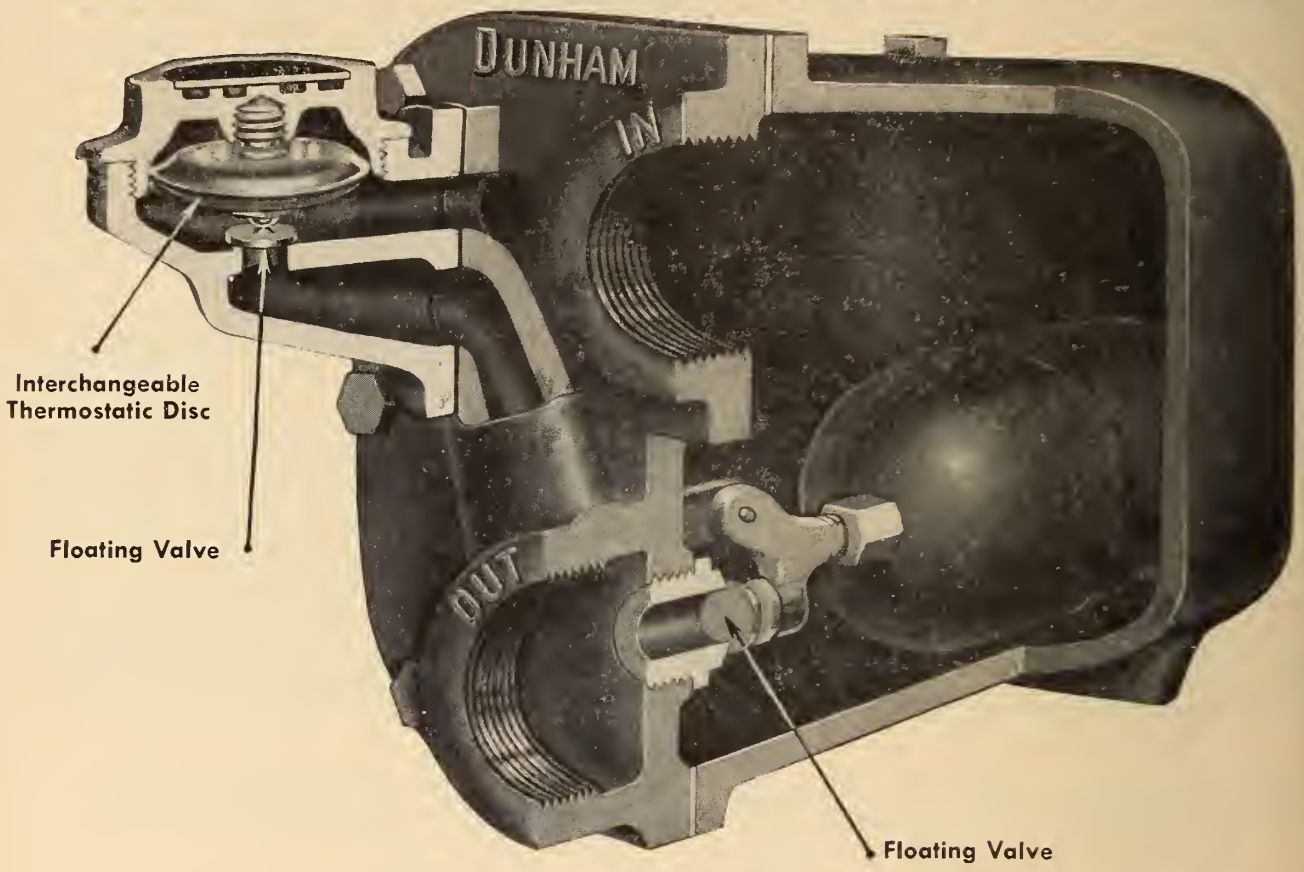

This trap is designed for use on low pressure steam heating systems. It is applied at drip points in piping, and to unit heaters, ventilators and other heating units which discharge a large quantity of condensate during the heating-up period.

The assembly is designed so that the thermostatic trap can discharge air while the float valve discharges condensate. The thermostatic trap can also handle condensate when the rate of condensate returning exceeds the capacity of the float valve. Body and cover are constructed of cast iron. The float valve assembly and thermostatic element are easily accessible.

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ond largest in Canada. The other, also designed and built by Canadian Liquid Air for the International Nickel Company, Copper Cliff, Ont., has a daily capacity of 300 tons of oxygen.

●

The Cooksville Co.—Dominion Tar & Chemical Co. Ltd. has acquired the control of The Cooksville Co. Ltd.

The Cooksville Co. Ltd. and its subsidiaries, The Laprairie Co. Inc., Interprovincial Brick Co., Ltd., and Aerocrete Construction Co. Ltd., operate plants in Cooksville, Scarborough, Milton and Cheltenham in Ontario, and Delson, Laprairie, and Montreal East in Quebec. They manufacture various types of brick and tile, concrete blocks and a lightweight aggregate known as "Haydite" or "Aerocrete".

These products, and the recently acquired license to manufacture a lightweight concrete building material, known as "Zeprex", will enable Dominion Tar to widen its interest in the construction field.

●

Plating Solutions. — According to Patwin Instruments Co. and the Canadian General Electric Company's Apparatus Division, chemical analysis of plating solutions now can be made with a great degree of accuracy and speed by means of an electro polarizer and a portable galvanometer.

The new Patwin electro polarizer utilizes the polarographic method of analysis, which chemists estimate saves half the time formerly consumed by the chemical method. Most plating solutions, including copper cyanide, zinc cyanide, cadmium, brass, and nickel can be analyzed with the equipment.

Patwin records show that routine analysis of copper cyanide solutions which formerly took an hour now can be done in fifteen to twenty minutes and with a high degree of accuracy.

Complete information on the galvanometer can be obtained from Canadian General Electric Co. Ltd., 212 King St. West, Toronto.

●

Steel Processes and Bridging.—Three steelmaking processes — forging, rolling and welding — played a part in the manufacture by Bethlehem Steel Company of four giant sheaves for the new $6,000,000 vertical-lift bridge to Welfare Island, New York.

The three-lane bridge, which connects Welfare Island and Queens, will span the east channel of the East River. It will afford speedier access to the 7,000-bed hospital on the island.

Automobiles now reach Welfare Island by elevators from the Queensboro Bridge. The elevators frequently caused traffic jams on the bridge when lines of automobiles form near the easterly end while waiting to be lowered to the island. Congestion has been increased by the heavier vehicular flow over the Queensboro Bridge between Queens and Manhattan.

Over the sheaves, after they are placed in the towers of the new bridge, will pass cables carrying the 515-ton counterweights. The total weight of the two counterweights will approximate the weight of the lift span.

Each sheave weighs 37 tons and is about fifteen feet in diameter. Their hubs were forged on a 2500-ton forging press and center-bored to an inside diameter of 22 inches.

For the web section, two rolled plates 1¾ in. thick and 7 ft. 3 in. wide were welded together and the cut-outs were made. Stiffener ribs of plate of the same thickeness were welded inside the web to give it added strength. The rims are rolled plate 6 in. thick and about 3 ft. wide. Following shipment to the Bethlehem, Pa., plant, the rims were cold formed into semicircular shape and butt welded together to form a complete circle. About 275 pounds of weld metal was used to fill the gap between the web and the rim.

●

An Unusual Portable Compressor.—A simplified 236 cfm portable air compressor, with most moving parts eliminated, has been introduced by Canadian Copco Limited.

There is no battery or electrical system. The unit is started by a power cartridge, found especially superior at extreme low temperatures. The compressor is mounted on the same crankcase as the diesel. There is no clutch, only one crankshaft, one lubricating system, and one cooling system.

Manufactured by Atlas Diesel Ltd., Sweden, the compressor utilizes the well-known A.D. Polar engine. It is designated HR4V. The free air delivery is rated 236 cfm. The new compressor is lighter and smaller than most 210 cfm machines and is ruggedly built for low maintenance costs.

Power is supplied by a simplified two-stroke cycle diesel engine that has no valves or valve gear, no camshafts, no ignition system and no auxiliary drives. The injection pump is directly coupled on the end of the crankshaft.

Copco branches in Truro, Montreal, Toronto, Kirkland Lake, Port Arthur, or Vancouver will supply details on request.

●

Recording Turbidimeter. — Canadian General Electric have introduced a new recording turbidimeter. It continuously and automatically measures and permanently records the number of particles suspended in liquids. It had been developed for use in any process where turbidity is a significant factor. It can be used with an audible or visible alarm. It provides readily available turbidity measurements for monitoring and controlling. Adjustable over a wide turbidity range, the instrument has a splash-proof construction and semi-null-balance system.

Specific applications include chemical and paper plants with private water supplies where turbidity has a direct effect on processes; monitoring of wastes dumped into streams and lakes to guard against pollution; water treatment plants where turbidity of incoming water determines the amount of flocculation chemicals to be added; detection of oil contamination in boiler feed water; soil erosion studies; and in any process where filter effectiveness must be constantly monitored.

The theory of operation is that if a liquid has no suspended particles, all light is transmitted while none is scattered, so that the ratio of scattered to transmitted light is zero. As turbidity increases, more light is scattered, less transmitted, and the ratio increases. The turbidimeter's detecting element is a single photovoltaic cell with current output proportional to the amount of light falling upon it. The light ratio is determined by computing the voltage output of the photo cell when scattered light and then transmitted light are successively incident upon it.

For complete details communicate with the Company at 212 King St. W., Toronto 1.

●

Wire Rope Fittings.—A new European method for attaching fittings to wire rope is now available for the first time in Canada. This new development eliminates the difficult and often painful practice of splicing wire rope. The method may entirely replace splicing. It is known as the "Talurit" Wire Rope Clamping system.

The formation of an eye in a wire rope or the position of a joint formerly meant that wire ropes had to be opened up and the strands forced and pulled through, the splicer usually finishing the job with numerous hand lacerations.

The "Talurit" system depends on special hydraulic presses which exert tremendous pressure on the metal ferrule; both the presses and the ferrule have been developed specifically for wire rope applications. The ferrules are applied to the rope under such pressure that the metal of the ferrule flows into the interstices between the individual strands and wires, forming an almost indestructible bond. This method of attaching fittings to wire rope has been approved by Lloyds' Register of Shipping and other authoritative bodies. The fittings can be attached to ropes from 1/16 in. diameter up to the largest diameters of ropes now in use. Donald Ropes & Wire Cloth Limited, Hamilton, Ontario, have the sole Canadian rights for applying "Talurit" fittings.

●

C.M. & S. Fertilizer.—The new roaster and acid plant units at The Consolidated Mining and Smelting Company's new Kimberley fertilizer department went into operation in September. The first unit, the phosphate rock crushing plant commenced operation in July and the new project produced its first fertilizer in September. Stone and Webster (Canada) Limited, contractors for the entire project, have now completed their work and have taken all crews off the job.

●

Trane Condensation Pump. — The Trane Company of Canada Limited, Toronto, announce the introduction of a new condensation pump—the design principle of which is distinctively different, reducing wear to a minimum. Jig-machined construction, plus high grade materials and workmanship gives dependable, economical operation.

Of turbine design, with no metal to metal contact, the Trane Condensation Pump requires no internal lubrication. Double suction design provides hydraulic balance for the impeller and minimizes thrust on bearings. Radical load is taken by two ball bearing assemblies. Reversible bronze levers completely encased with a separate housing form the liquid channel of the Pump. In turn the impeller is housed within the levers, thus protecting the pump from abrasives and erosions.

The receiver is rectangular in shape; removable with exceptionally large area brass strainer. Only standard motors of

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Tips by Johns-Manville Engineers to help you keep production rolling

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A handy 6-page guide, "Johns-Manville Packings for the Power Plant" simplifies the selection and application of power plant packings. Covering 32 of our most popular styles, it tells at a glance what J-M packings to use... why they are recommended... and how to install them.

Its schematic diagram is spot-keyed to help you locate packing styles for various equipment units. Its brief group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes... to seal against steam, water, oil, brine, etc.... to withstand various temperatures and pressures. Its condensed packing descriptions give you essential buying information.

And a page is devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

Your local Johns-Manville Packing Distributor will be glad to give you a copy of this handy packing selector, free of charge. Or write to Johns-Manville, Dept. 3366, 199 Bay Street, Toronto 1, Ontario, asking for Brochure PK-61A.

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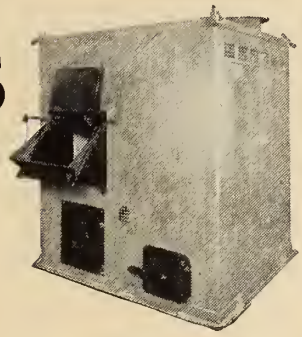

- **AIR COOLED WALLS:** Keeps walls cool. Preheats combustion air. Increases efficiency.
- **SECONDARY AIR INTAKES:** Insures complete combustion. Keeps flue gases below 700°.
- **BRICKWORK:** The brickwork in the trash burner is entirely suspended. This frees walls from mechanical strain—has double the usual life expectancy.
- **CHARGING DOOR:** Makes feeding easy. Operator does not need asbestos apron. No burning embers or hot ashes can fall out of door.
- **BRULÉ STEP AND FLAT GRATES:** Assures peak fire chamber temperatures. Eliminates stoking.
- **THREE CHAMBERS:** The firing chamber into which the wastes are charged. Combustion chamber in which complete combustion occurs and in which fly ash separates out. The upper chamber which assures ultimate completion of combustion.
- **SIZE AND WEIGHT:** Requires a minimum of space. Weight is one-half that of a comparable masonry unit.

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This packaged, portable unit operating on as law as an 18 ft. refractary-lined stack, shipped in twa sectians far erectian. Incineratar and stack readily positioned far same day aperation. Simple cancrete pad eliminates true faundation. This unit perfarms withaut emitting fly ash, saat, sparks, odors. Na praperty cantaminatian. Burns 500 lbs. af usual plant wastes per hour with same reduced to but one pound af ash.

USE THE COUPON ta find out haw this unit can work for you ta cut your costs, save flaor space now used far stacking trash, and increase operating efficiency.

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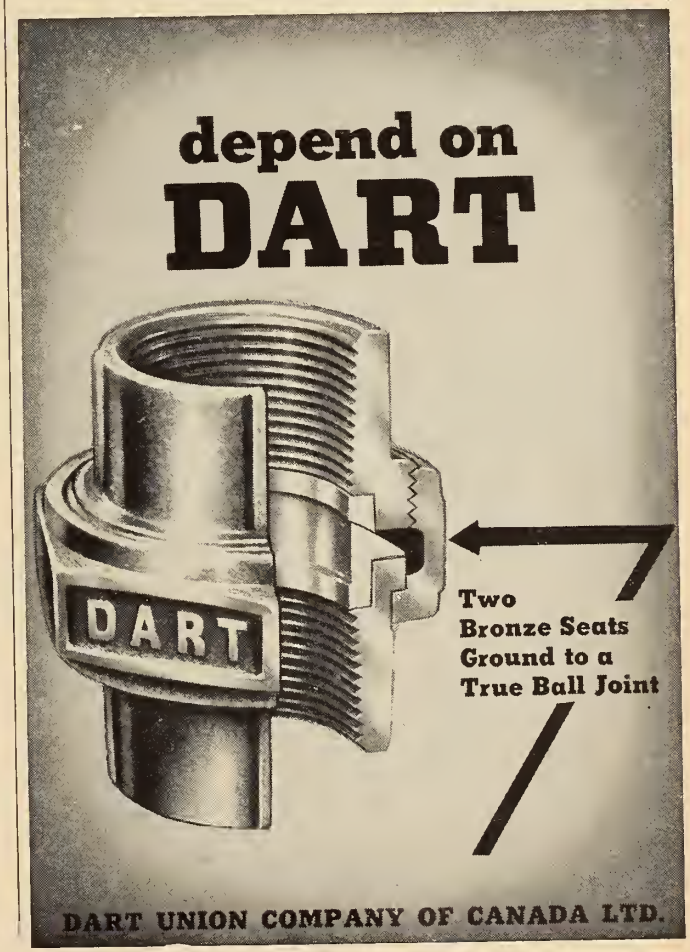


approved make are used in Trane pumps. Square "D" float switch actuated by float located inside receiver automatically starts and stops pump. Adjustment is provided for reaching start and stop positions. Each pump is thoroughly tested under simulated operating conditions with water at 190 F. Duplex units consisting of two pumps, two motors, two float switches and floats with common receiver and base are also available.

●

Gradall Attachments. — Two boom-extension attachments designed to further broaden the application scope and operational versatility of the Gradall are announced by Warner & Swasey Co., Cleveland, Ohio.

The first attachment is 12 ft. extension which, affixed to the regular telescoping, 24 ft. boom of the unit, extends its working reach to 36 ft. Used only with an 8 ft. blade, this extension is particularly suitable for grading and sloping operation.

The second boom extension is a 4 ft. unit, which is intended for use with digging buckets up to 24 in. With it the digging depth of a Gradall is increased from 10 ft. to approximately 14 ft., normal dumping height of 14 ft., 9 in. is increased to over 17 ft., and the reach of the unit lengthened from 24 ft. to 28 ft.

●

New Biocide.—A new biocide, a material which is effective in killing slime causing bacteria, is now giving excellent slime control in paper mills. This new biocide, called Crag Fungicide 974, has been used for over two years in several mills. Crag 974 is marketed as a free-flowing dispersible powder that is readily dissolved in water. This product is available in carload and less than carload quantities from Carbide and Carbon Chemicals Limited, 40 St. Clair Avenue East, Toronto 5.

Paper mill experience has shown that continuous addition of Crag Fungicide 974 at the head chest or beater is the most effective method of application. A large initial dose is employed, and the concentration decreased gradually until the best control level is reached. In this way, the bacteria count drops quickly and stays down to a minimum.

Crag Fungicide 974 is also being used in tanneries to prevent bacterial damage to hides, and by glue manufacturers as a preservative for glue solutions. It has proved effective in keeping wallpaper from mildewing when incorporated into sizing and pastes. It is being tested on cotton fabrics other than clothing, on heavy-duty canvas goods, in plastic-base coatings, lacquers, oil and casein paints and varnishes, and in rubber manufacture.

●

English Electric Expansion.—One of the first steps in a $1,500,000 five-year expansion programme planned by the English Electric Company of Canada Limited has recently been completed with the beginning of production in the Company's new transformer bay at the St. Catharines plant.

The new building, 333' long by 60' wide, is equipped with two 20-ton cranes, giving a tandem lift of 40 tons, and has an annex 20' wide for housing various services. Initially, this will permit an expansion in production of approximately 40 per cent.

The new bay is designed to handle units up to 10,000 Kva., 3 phase, 60 cycles. The most modern electrical test equipment has been installed, as well as improved vacuum processing equipment and a fine paint spray shop. In addition, the Company has installed this year, in its main Transformer Test Department, a Haefely Impulse Generator and recording equipment. The generator is capable of delivering 1.5 million volts.

One interesting piece of equipment designed specially for and fitted to this bay is a core stacking fixture which permits the stacking of cores up to 15 tons in a horizontal position, and then raising the core on the stacking table into a vertical position without the use of cranes or auxiliary equipment, and without distortion stresses on the core structure.

The Company, now enjoying these new facilities, will be in a particularly good position to improve its competitive standing, especially in respect to delivery times.

●

Imperial Oil Plant.—Contract for the major portion of a $10 million expansion and modernization program at Imperial Oil's Montreal East refinery has been let to Canadian Bechtel Ltd., of

(Continued on page 1422)

ASHCROFT *Gauges*

AMERICAN
BI-METAL
Thermometers

CONSOLIDATED
Relief Valves

HANCOCK STEEL-GATE
Weldvalves

PRECISION CONTROLS FOR OIL PRODUCTION & REFINING

Barber
ENGINEERING
& SUPPLY CO. LTD.
CALGARY
EDMONTON

Our customer's answer was:

"SPUN ROCK WOOL* INSULATION NEVER SETTLES IN THE STEEL CASE!"

"You see," he explained to his foreman, "Spun Rock Wool* consists of extra long fibres. Because they have a natural resiliency, no binders are needed in the industrial blankets. That's how Spun Rock Wool* avoids the fault of some other insulators whose binders often break down at high temperatures, causing the insulation to settle in the steel case.

"There are other advantages, too. For instance, Spun Rock Wool* is non-corrosive. It is also lightweight and fireproof."

So remember — when you want to save money through more efficient insulation in boilers, refrigerators, drying ovens, oil refineries or other industrial installations, it will pay you to investigate Spun Rock Wool*.

For samples and technical data write:

SPUN ROCK WOOLS LTD.
THOROLD ONTARIO

Represented by
Asbestos Limited,
Atlas Asbestos Co. Ltd.
Toronto and Montreal

*Reg'd.

SPUN ROCK WOOL HEAT COLD SOUND INSULATION

Half mile of HELIARC TRADE MARK welds OK'D by rigid X-ray tests

One manufacturer was faced with the problem of getting X-ray quality welds in aluminum vessels. These welds were subject to pressure and had to be entirely free from porosity and oxide inclusions. After thoroughly investigating customer specifications, our service engineers recommended HELIARC inert gas shielded welding for the job.

Since then, about a half mile of these HELIARC welds have been OK'd by 100% X-ray inspections. According to company officials, HELIARC welding was "perfect for the job" and meant real savings by getting X-ray quality welds the first time without expensive rejections or repairs.

Whether you weld aluminum or other hard-to-weld metals, you, too, will find that fast, clean, HELIARC welding will save you time and production costs. HELIARC welding takes place under a shield of inert argon gas which eliminates the need for flux. As a result, HELIARC welds are free from porosity and oxide inclusions. This means fewer rejects and lower finishing costs. In fact, spatter-free HELIARC welds in many cases can be left "as welded."

You owe it to yourself and to your Company to find out more about the cost saving benefits of HELIARC welding. Call your local DOMINION OXYGEN representative today. He will be glad to furnish you with detailed information on HELIARC welding.

LEFT Welding heavy aluminum sections with HELIARC *HW-10 torch. These welds were strong, dense, and required little finishing. BELOW The 300 amp.* HELIARC *torch has all-internal water-cooling of both torch head and power cable for cool, long-lasting operation. The HW-10 also features quick electrode adjustment.*

DOMINION OXYGEN COMPANY LIMITED

DOC

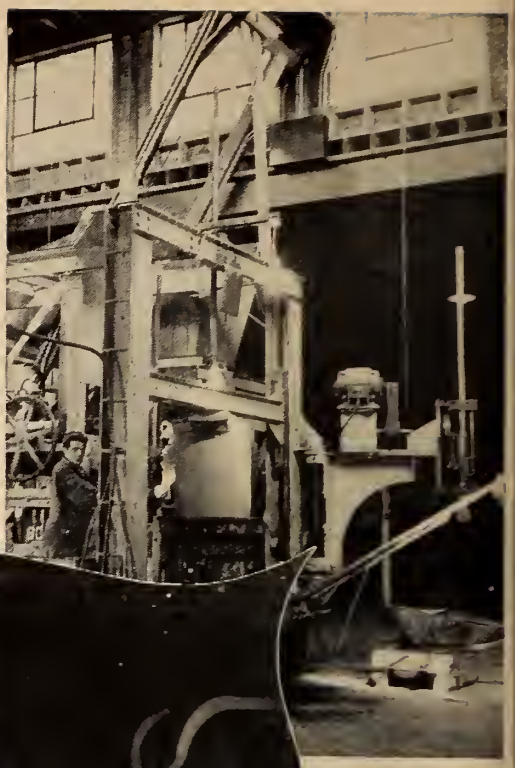
Montreal Toronto Winnipeg Vancouver

Plants, Warehouses and Distributors Throughout Canada

Dominion Oxygen

Equipped

to supply all your CONCRETE PIPE needs ...when you want them!



Latest design Concrete Pipe Machine. Capacity 6" to 54" diameter in 4 foot lengths.

Fabricating the steel reinforcements of a concrete pipe.

We have the facilities to meet your needs for pipe. In our modern plants we have the most up-to-date equipment available to the concrete pipe industry, and a staff of engineers well qualified through years of experience in manufacturing concrete pipe.

These men and machines working together have developed for us a well-earned reputation for producing dependable, long-lasting concrete pipe . . . of all types!

Our whole organization is geared to meet just one goal—to produce the best concrete pipe for your requirements. So if you need *any* concrete pipe for municipal, highway, railway construction projects or any other jobs—Concrete Pipe Limited can supply it to you . . . when you need it!

Partial view of Toronto yard showing a range of sizes available

CPL 5302

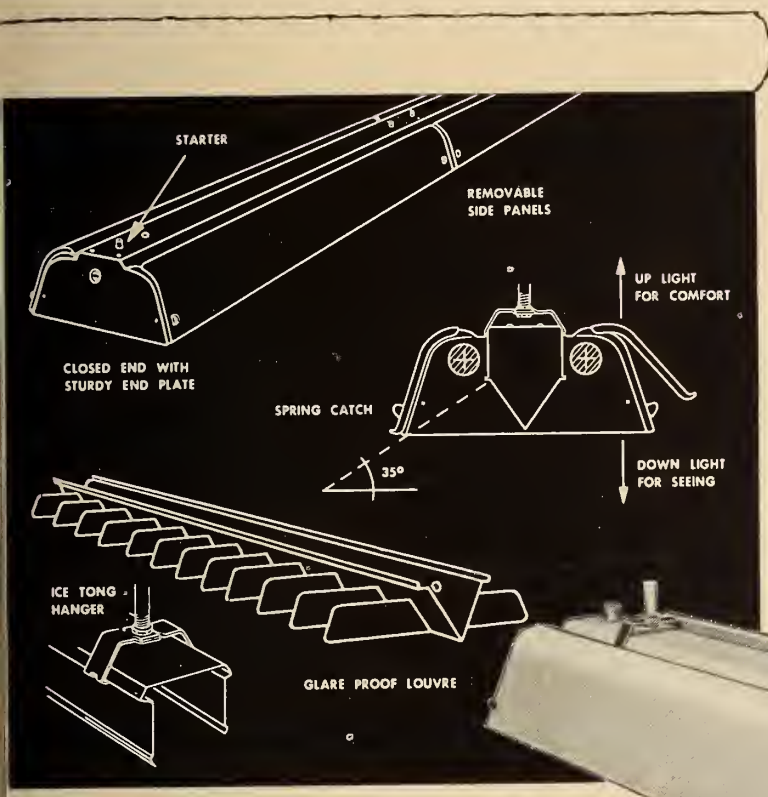
CONCRETE PIPE LIMITED

HEAD OFFICE: 940 CALEDONIA ROAD, BOX 7, FAIRBANK P.O., TORONTO 10, ONTARIO

SALES OFFICE: 402 HARBOUR BUILDING, TORONTO

MANUFACTURERS OF: PIPE FOR STORM AND SANITARY SEWERS • HIGHWAY CULVERTS AND SUBWAYS • RAILWAY CULVERTS AND UNDERPASSES
INDUSTRIAL PLANT STORM DRAINAGE • TOWNSHIP DRAINAGE SYSTEMS

light the way to **better production** in your plant...

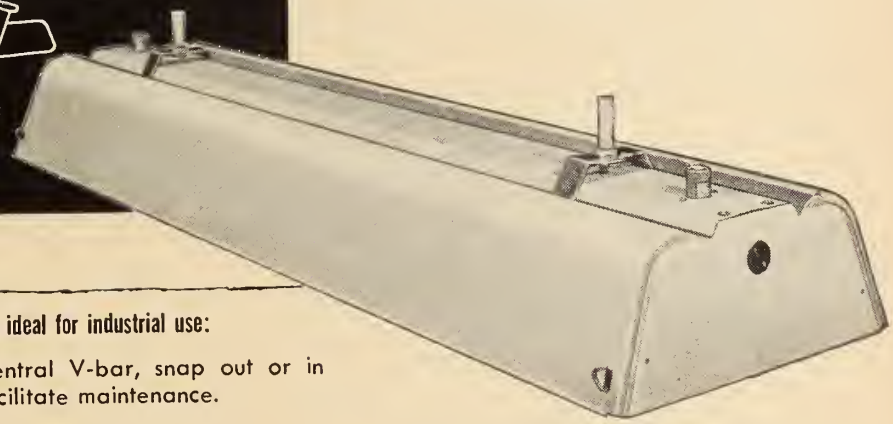


with these **NEW**

CURTIS

eye comfort
industrial lighting units

Their new, low-cost design
reduces brightness,
lights working areas correctly,
cuts installation and
maintenance time.



Check the features that make these units ideal for industrial use:

- Side reflector panels and central V-bar, snap out or in without removing lamps, to facilitate maintenance.
- Newly developed Snap-on Tong hangers for easy installation.
- No horizontal diffusing or reflecting surfaces to collect dust and lower efficiency.

It will pay you to investigate these and other features that make this revolutionary new design so efficient for industrial lighting. Write today or phone for further information on Curtis "Sixty-One Hundred Series" Industrial Lighting.

Curtis
LIGHTING
of Canada Limited

195 WICKSTEED AVENUE, LEASIDE . . . TORONTO 17, CANADA

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1418*)

Vancouver. Work will commence immediately.

Expansion of the Montreal East refinery will result in a 25 per cent increase in capacity, raising it by 12,000 barrels to 58,000 barrels a day and will further improve product quality. The refinery will continue to be Canada's second largest, surpassed only by the Imperial plant at Sarnia.

The equipment includes an atmospheric and vacuum distillation unit and vacuum pipe still. In these, the first steps are taken in the distillation of crude oil. The refinery's "cat cracker" and several other units are being enlarged.

●

New Electronic Relay.—A new electronic relay which is highly sensitive to resistance changes and can be varied by a stepless dial has been announced by Canadian General Electric Company's Apparatus Division.

The new relay may be used to start or stop a fractional horsepower motor directly when a contact making ammeter, voltmeter, or wattmeter reaches a required meter reading. Other uses include liquid-level control, sorting of small parts, and operating of lights, solenoids, and contactors wherever there is sufficient change in the resistance of a circuit.

Power requirements are 115/230 volts a-c, 50/60 cycles, and should not exceed 10 volt amperes. The contact rating is: inrush 30 amps, carry 10 amps, break 10 amps on normally closed contacts and 5 amps on normally open contacts. The break inductive load for 125 volts d-c is 0.2 amps normally open and 0.1 normally closed; for 250 volts d-c, it is 0.1 normally open and 0.05 normally closed. The time delay, depending somewhat on the dial setting and the external resistance value, is rated at 5 milliseconds minimum.

Further information may be obtained by writing to the Canadian General Electric Company, 212 King St. W., Toronto.

●

"Packaging" Process Controls.—Introduction of a series of individually engineered control systems as "packaged" units to provide automatic control of various industrial process operations was reported recently by the Minneapolis-Honeywell Regulator Company.

Designed by the firm's industrial division in Philadelphia, the "packaged" units will be developed to take advantage of the uniformity among many process operations. Each unit, to be specially engineered for the specific process operation, will include recording and controlling instruments, measuring and control elements and related accessories. Complete instructions will be provided to facilitate their installation without benefit of specialized skills.

Company engineers explain that many processes in either one or many industries have similar operations. For example, they cite batch cooking operations which are basically the same in the textile, chemical, pharmaceutical and food industries.

The "packaged" systems will enable a processor to select an instrumentation system on the basis of over-all function. By conventional methods, lengthy consideration must be given to the characteristics of the individual control elements and their effect on the over-all operation.

The "packaged" units will only be developed for those industrial process operations where there is little or no need for variation in the control system elements. Ultimately the matched control units will cover all industries, ranging from ceramics and chemicals to textiles and utilities.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Brush Circuit Breaker.—Brush Export Limited, Loughborough, England, have issued a 16-page publication "Outdoor Oil Circuit Breaker Type-Or". This publication deals with circuit breakers built by the British company for use in the United States and Canada.

To obtain copies communicate with the Company and ask for publication No. 41166-A.

●

New Sirocco Bulletin. — Canadian Sirocco Company, Limited, Windsor, Ontario, announce the release of a new 2-colour, 24-page bulletin covering Type VS, Class 4, Gyrol Fluid Drive.

The publication has been designed and produced to permit quick, easy, reading. It covers such subjects as applications, advantages, features, selection and dimensions. The bulletin will be of value to engineers interested in obtaining adjustable speed operations in a range from 100 to 2500 h.p.

To obtain copies write to the Company, Canadian Sirocco Co. Ltd., 310 Ellis St., Windsor, Ont., and ask for bulletin No. 9319.

●

Fire-Fighting Equipment. — A new 8-page bulletin describes all types of portable fire extinguishers for Class A, B, and C fires. The brochure also outlines smoke and temperature-rate-of-rise fire detection systems as well as automatic carbon dioxide extinguishing systems for machinery and entire rooms. Ask for bulletin No. P8R5, and address requests to Walter Kidde & Company of Canada, Ltd., 6975 Jeanne Mance St., Montreal.

●

Ferranti Stock Lists.—To obtain copies of Ferranti Electric Limited stock list, write to the Company at Mount Dennis, Toronto 15, Ontario. Simply state "Please place me on the mailing list for regular receipt of your stock list".

●

Hamilton Gear Data Sheets.—Hamilton Gear and Machine Co. Ltd., 950 Dupont St., Toronto, have released a new data sheet "Data required to supply or quote on single helical, double helical and spiral gears". To obtain this and other technical bulletins issued by the Company, write to the address given above.

●

New Welding Price List. — Canadian Liquid Air Company, Ltd., 1111 Beaver Hall Hill, Montreal, have issued a new price list covering electrodes, weldments and accessories. The publication consists of twenty pages of arc welding price data. It should be of great value to engineers who are interested in the practices and specifications of welding equipment and supplies. Communicate with the Company for copies.

●

L. & N. Catalogue.—Leeds & Northrup Company, 4907 Stenton Ave., Philadelphia 44, Pa., have issued a new catalogue covering manually operated indicators for temperature, electrolytic conductivity and pH Measurements. The catalogue is designated as ND42. Write to the company for copies.

●

Ventilating Equipment. — Air Conditioning Engineering Co. (Canada) Ltd., 636 St. Paul St. West, Montreal 3, Quebec, have issued a new bulletin entitled "Ventilating sets". To obtain copies write to the Company at the address given above and ask for Bulletin No. 8.

●

Plastic Greenhouse. — Engineers who are interested in horticulture, either professionally or as amateurs will be pleased with a detailed plan for building a 16 x 24 ft. reinforced plastic greenhouse, which is offered by Monsanto Chemical Company.

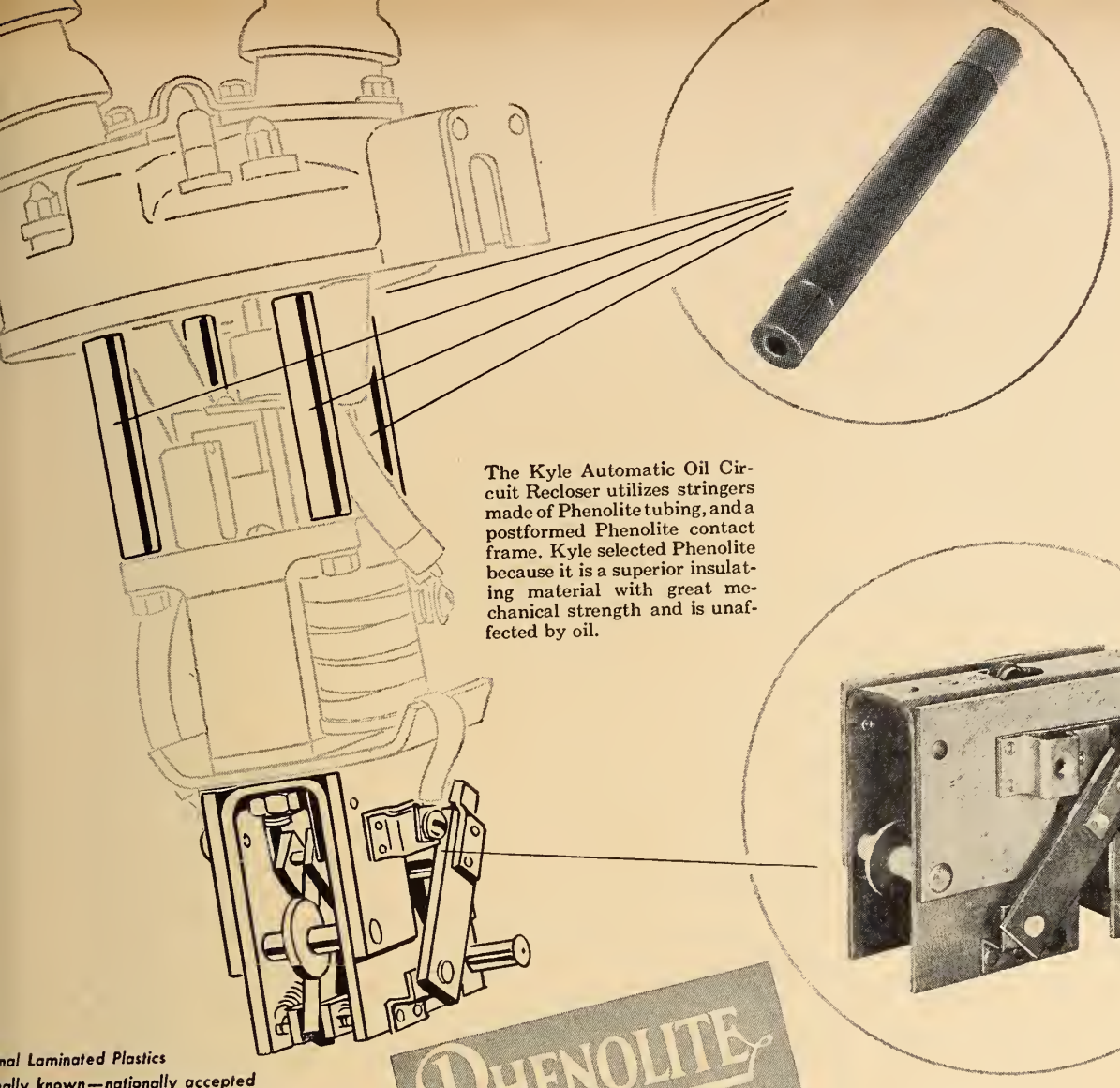
The plan incorporates several structural innovations made possible by the use of the new material. It has been reported that plants touching the sides of reinforced plastic greenhouses, even in freezing weather, are unharmed. There is a nominal charge of 25 cents to cover the cost of handling and mailing. Write to Monsanto Chemical Company, Texas City, Tex., and ask for "Reinforced Plastic Greenhouse" booklet.

●

New Bristol Controllers.—A new line of Free-Vane Electronic Controllers has just been announced by The Bristol Company of Canada Limited. The new instruments are part of the Series 500 line, and are available as indicating or recording controllers for temperature, pressure, flow, liquid level, humidity and time program control. They use the standard Bristol measuring elements.

Based on a unique frequency modulation principle, the Free-Vane Controllers are offered for low-open, high-open, low-high, low-open-high or low-normal-high control, as well as proportional input control.

Various combinations of one or two recording pens or indicators with one or



The Kyle Automatic Oil Circuit Recloser utilizes stringers made of Phenolite tubing, and a postformed Phenolite contact frame. Kyle selected Phenolite because it is a superior insulating material with great mechanical strength and is unaffected by oil.

nal Laminated Plastics
ally known—nationally accepted

PHENOLITE
Laminated PLASTIC

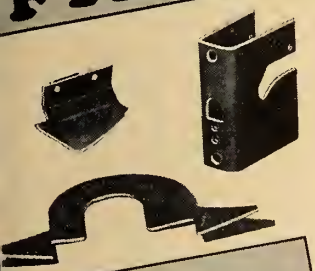
contributes to an improved product— in the Kyle Automatic Oil Circuit Recloser

This practical use of Phenolite by the Kyle Products Plant of the Line Material Company is typical of its countless applications in the electrical field. Phenolite, about one-half the weight of aluminum, is the perfect insulating material for high and low voltage applications. It possesses an unusual combination of properties. Phenolite has great mechanical strength and high resistance to moisture; ready machinability; is unaffected by solvents and oils.

It can be easily punched, sawed and sheared. The toughness and high impact strength of cloth base Phenolite sheet make it suitable for gears; it is one of the strongest materials per unit weight known.

Available in various grades and colors; and in sheets, rods, tubes and special shapes. Write for detailed literature and engineering information—

NATIONAL VULCANIZED FIBRE



PHENOLITE
Laminated PLASTIC

NATIONAL FIBRE COMPANY OF CANADA, LTD.

107 Atlantic Avenue
Toronto

1411 Crescent Avenue
Montreal

two control units in one case make the new controllers adaptable to a wide range of control problems.

More descriptive information, as well as complete specification data, is given in Bulletin B 226, now available from The Bristol Company of Canada Limited, 71-79 Duchess Street, Toronto, Ontario.

●

The Dependable Diesel. — Russel-Hipwell Engines Limited, Owen Sound, Ontario, offer Journal readers copy of an excellent magazine "The Dependable Diesel".

This multicolour publication will be of great interest to engineers who buy, specify or use Diesel engines. To obtain copies, regularly, just forward your name and address to the Company at the address given above.

●

Conveyors.—In a new book Link-Belt Limited offers information on conveyors for the steel industry.

Several types of coil conveyors are shown, adaptable to large and small coils, designed to carry them on end or on their sides, longitudinally or transversely, and integrated with various types of auxiliary equipment that lead and unload the coils, turn, tilt, transfer, and weigh them.

To obtain copies of this bulletin write to Link-Belt Limited, P.O. Box 173, Station "H", Toronto 13, and ask for book number 2464.

A second publication offered by this Company is book No. 2466 which covers performance records of the Link-Belt Multi-Louvre dryer in heat drying coal.

Nine case histories from mines in various parts of the United States are given.

To obtain copies write to the Company.

●

New Film. — The Northern Electric Company Limited, 1600 Notre Dame St. W., Montreal, have just released a film describing submarine telephone cable. In describing the film, the company states "The Northern Electric Company have produced a new film. This film records the problems encountered in the manufacturing and installation of a giant 'Submarine Telephone Cable' running between Quebec City and Levis, Quebec. It is a 16 mm colour-sound film, with a running time of 32 minutes. It is available for private showings." To arrange for showings, communicate with the company at the address given or with your nearest Northern Electric Office.

●

Protein Adhesives.—Protein adhesives for the woodworking, plastic laminating and prefabricated home industries is the subject of a new 24-page booklet prepared by Monsanto Chemical Company's Plastics Division.

The new, illustrated bulletin discusses thoroughly Monsanto's Lauxein protein adhesives which include casein, soybean and casein-soybean blends. Complete directions for using eight different protein formulations are given.

Details of Monsanto's No-Clamp gluing process are described in a separate section of the booklet. Patented in 1939, the No-Clamp method eliminates the use of cumbersome "I" beams and clamps formerly associated with cold press plywood production.

Also included is a special section on materials, equipment and production tips.

The bulletin will be furnished on request. Write to: Monsanto Canada Ltd., 420 St. Patrick St., Montreal, Que.

●

Concrete Mixing. — To explain the "why" of making concrete as well as "how", the Division of Building Research has just published a "Better Building Bulletin" on Concrete. If the suggestions in the booklet are followed, concrete made for small jobs should last for years and will, in the long run, cost much less than a concrete job which will have to be repaired every few years. A nominal charge of 10 cents is made for the booklet. Write to the Division of Building Research, National Research Council, Ottawa. The appropriate remittance should accompany such requests, stamps are not acceptable.

●

Four Language Publication. — Atlas Steels Ltd., Welland, Ont., publish a magazine "Atlas Steel Topics" in four languages. It is very unique both as to content and "make-up". To obtain copies communicate with the editor, Atlas Steels Limited, Welland, Ont.

●

Public-Industrial Relations.—Engineers interested in public and industrial relations will obtain useful information from a publication recently released by the Bureau of Business Practice, New London, Conn. It is entitled "It Serves You Well".

In a release which accompanied a specimen copy it is stated "every employee, no matter where he works—in shipping, in an office, in delivery, in a retail store or at a bench or machine—is a good will ambassador for his firm." To obtain a sample copy of this bulletin write to the Bureau of Business Practice, 100 Garfield Ave., New London, Conn.

●

Septic Tank Beds.—Dominion Tar & Chemical Co., Ltd., Sun Life Bldg., Montreal, have just prepared an interesting booklet called "How to Install a Septic Tank Disposal Bed". To obtain copies communicate with P. A. Webb, Dominion Tar & Chemical Co., Ltd., Sun Life Bldg., Montreal.

●

Valve Bulletin. — Simplex Valve & Meter Company, 68th and Upland Streets, Philadelphia 42, Pa., offer a new 4-page bulletin No. 1203, in which is described the functions of their new type AV combination air release and air inlet valve.

The valve was designed for the specific purpose of providing a small unit having the functions of releasing automatically air accumulations from systems, admitting air to systems for the purpose of breaking vacuums within them, and venting large quantities of air when filling systems with water. Write to the Company at the address given above for copies.

●

Wales-Strippit Catalogue. — Wales-Strippit of Canada Limited, 344 Sherman Ave. N., Hamilton, Ont., have just released their catalogue "H", which illustrates and describes the new, independent, self-contained Wales Type "H" Horizontal Hole Punching Units. Write to the Company at the address given above for copies.

●

Jeffrey Manufacturing Catalogue. — The Jeffrey Manufacturing Company, Limited, Ville La Salle, Montreal, have available copies of a new 16-page catalogue "Jeffrey Rigid Hammer Shredders-Grinders Hashers". This publication is well produced and highly informative. To obtain copies write to the Company and ask for catalogue No. 847.

●

A.S.M.E. Code.—A new 24 page booklet, "Selection and Sizing Pressure Relief Valves to Comply With ASME Boiler Code Requirements" has been published as a contribution to the heating industry by McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago, Ill.

A copy will be sent to readers, without charge, on request. Write to the Company at the address given above.

●

Morrison Brass Catalogues. — The James Morrison Brass Manufacturing Co., Ltd., 276 King St. W., Toronto, have just issued two new catalogues covering Pressure Reducing Valves and Boiler Mountings. To obtain copies write to the Company at the address given above.

●

Armco Folder. — In a new bulletin Armco Drainage & Metal Products, Inc., states "Bury your Bridges to Make Them Better". They have produced the well illustrated folder which explains how corrugated metal structures forestall obsolescence, cut maintenance cost, provide ample strength and are quickly installed. To obtain copies write to Armco Drainage & Metal Products, Guelph, Ont. Ask for bulletin "Bury Your Bridges".

●

A.S.T.M. Research. — The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., has just arranged for the reprinting of copies of the "Review of ASTM Research". It was originally published in December, 1952, and January and February, 1953, in the form of ASTM Bulletins.

This material, prepared by the ASTM Administrative Committee on Research, summarizes the work of the various technical commmittees of the Society as of May, 1953.

Copies of this 22-page pamphlet are available without charge. Write to the Society at the address given above.

●

Roll Crushers.—Lippman Engineering Works, 4603 W. Mitchell St., Milwaukee 14, Wis., offers a new bulletin on roll crushers. Write to the Company and ask for Bulletin No. 1120.

●

Miniature Bearings.—A new 20-page bearing catalogue published by Miniature Precision Bearings, Inc., of Keene, N.H., offers information on the design and application on miniature ball bearings. This three-colour 8½" x 11" book-

(Continued on page 1428)

We have found Aerial Mapping to be the quickest — most accurate — cheapest way of securing basic planning information

says David Jamieson,
City Planning Commissioner
of Hamilton, Ontario

Hamilton's extensive mapping programme, conducted by CANADIAN AERO SERVICE, LTD. during the past few months, is giving city planners up-to-date map facts at a great saving in time and taxpayers dollars.

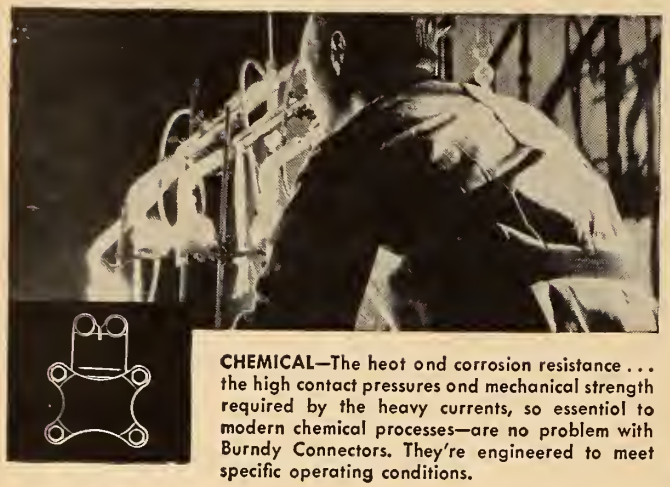
This survey included topography of the 458 sq. mi. Wentworth County Area at a scale of 1″=1,000 ft.; controlled mosaics or photo-maps of 101 sq. mi.; and topographic mapping of 3 separated areas at a scale of 1″=200 ft., at a 5 ft. contour interval. Hamilton is using these maps for zoning studies, land use plans, and for the calculation of populations and acreages, as well as for planning streets, schools, parks, and other civic projects.

Experience of the Hamilton Planning Department shows CANADIAN AERO maps to be extremely accurate, in addition to their low cost, multiple uses. If your city has growing pains, regardless of its present size, speedy aerial mapping can put your planning months and years ahead, at a fraction of slow ground survey costs. Free your own engineers for detailed mapping and engineering problems.

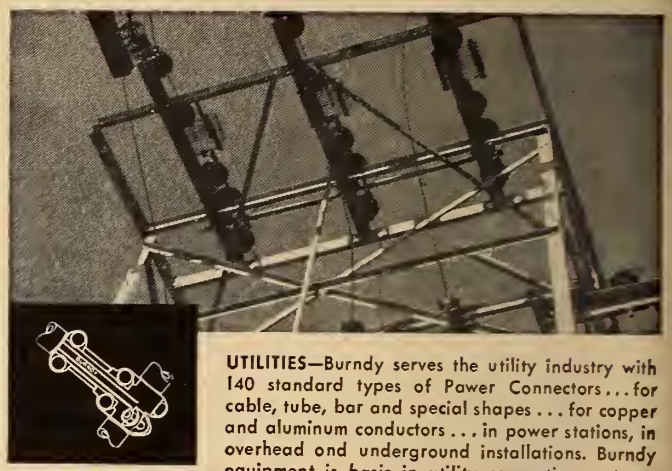
CANADIAN
AERO
SERVICE, LTD.
348 QUEEN STREET, OTTAWA, ONTARIO

OUR AFFILIATE IS SPARTAN AIR SERVICES, LIMITED

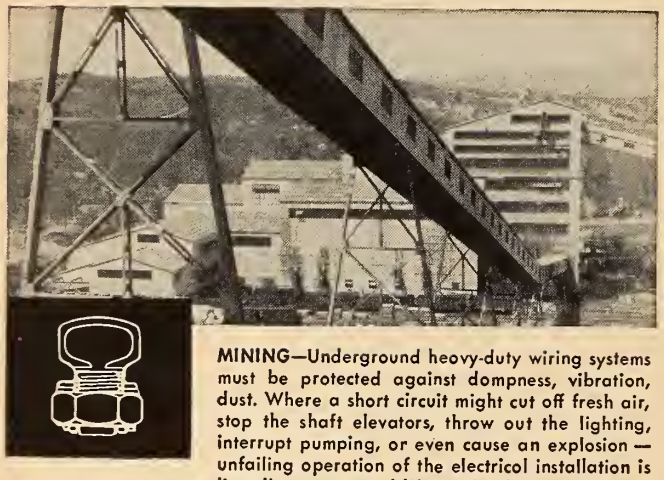
Wherever there's electricity... you'll find Burndy connectors on the job!



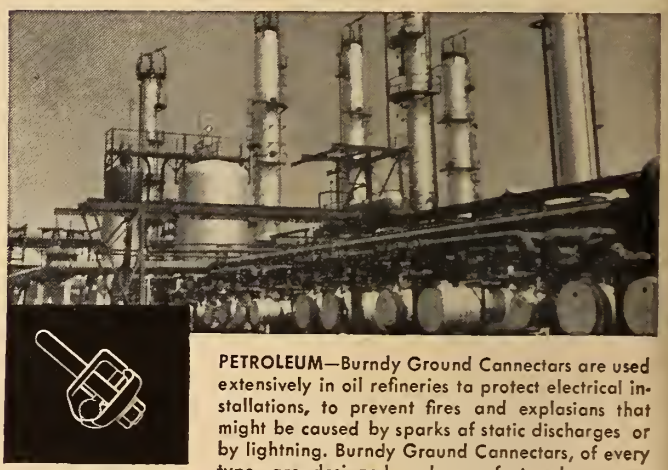
CHEMICAL—The heat and corrosion resistance . . . the high contact pressures and mechanical strength required by the heavy currents, so essential to modern chemical processes—are no problem with Burndy Connectors. They're engineered to meet specific operating conditions.



UTILITIES—Burndy serves the utility industry with 140 standard types of Power Connectors . . . for cable, tube, bar and special shapes . . . for copper and aluminum conductors . . . in power stations, in overhead and underground installations. Burndy equipment is basic in utility connecting systems.



MINING—Underground heavy-duty wiring systems must be protected against dampness, vibration, dust. Where a short circuit might cut off fresh air, stop the shaft elevators, throw out the lighting, interrupt pumping, or even cause an explosion — unfailing operation of the electrical installation is literally a matter of life or death. Leading engineers specify Burndy Connectors.



PETROLEUM—Burndy Ground Connectors are used extensively in oil refineries to protect electrical installations, to prevent fires and explosions that might be caused by sparks of static discharges or by lightning. Burndy Ground Connectors, of every type, are designed and manufactured as accurately as those which are called on to carry current continuously.

Burndy Connectors are specified because of their superior performance in joining, terminating, clamping, and grounding every size and functional variety of electrical conductor—from the smallest home wiring circuit to the largest industrial installations. Burndy engineering is continuously developing more and more efficient connecting methods. *Engineering graduates and students are welcome visitors at Burndy Connector Headquarters.*

BURNDY CANADA LTD

381 GREENWOOD AVE., TORONTO 8, ONT.

QUEBEC and MARITIMES: 1434 ST. CATHERINE ST. W., MONTREAL 8, QUE.

VANCOUVER: BUNSTON, Ltd.
2532 Yew Street
Tel.: CHerry 1932

CALGARY: BUNSTON, Ltd.
2611 - 24th St.
Tel.: 4602

WINNIPEG: BUNSTON, Ltd.
682 Osborne St.
Tel.: 49394

SOME THINGS *Can't* BE MEASURED

A man can measure the accuracy of a Trident meter. He can check for himself its workmanship, have its materials tested, test the ease of assembly and disassembly.

But some things can't be measured. For instance, the kind of friendly informative service that a Neptune salesman gives his customers . . . service that has brought many of them official awards from the water works field.

Or Neptune's 50-year record of continuous interchangeability, proof for the future that your Tridents won't become obsolete, can always be made modern.

Or just the fact that Tridents have *always* been the standard by which meter performance has been measured.

When you buy Tridents, you buy over 50 years of sustained accuracy, continuous improvement, and quality performance.

NEPTUNE METERS LIMITED
Toronto 14, Ontario

Branch Offices:
Vancouver • Calgary • Winnipeg
Montreal • Halifax • St. John, N.B.

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1424*)

let presents useful information on ball bearings in sizes ranging from 0.100 inches OD to .375 in. OD. All technical data, printed in large type for easy reading, is supported liberally by drawings, graphs, tables and photographs.

The catalogue contains data on all MPB products, including radial, angular contact, pivot and thrust bearings. To obtain copies of the publication write to the company at the address given above.

●

Dial Thermometers.—A new 16-page bulletin, describing dial thermometers for long distance measurement, has just been issued by The Foxboro Company of Foxboro, Mass., manufacturer of industrial instruments for the measurement and control of process variables. Emphasizing the variety of ranges, and the bulbs, tubing and accessories available, the bulletin provides complete data on temperature indicators of the vapor pressure and gas pressure types.

A separate section gives details of construction, helpful in understanding the precision performance of the instrument. Discussed in detail is the exclusive ball and trough movement which, by eliminating all connecting links, avoids loss of motion either up or down the temperature scale.

Both Centigrade and Fahrenheit ranges are listed for Class II and III systems (vapor pressure and gas pressure)—a total of 94 ranges. Fahrenheit ranges cover all frequently-used scales from —300° to plus 600° in Class II and from —250° to plus 1000° in Class III. The method of determining which class of system to use for a given application is clearly explained.

Six pages are devoted to bulbs, tubing and accessories. Dimensions and bulb lengths are given for plain and union type bulbs, with bendable and rigid necks. Five types of connecting tubing are illustrated; bushings, sockets and flanges are described. Diagrams show suggested installation methods, covering cookers, retorts, kettles and pipelines.

Copies of the new bulletin, 467, will be sent on request from Peacock Brothers, sole sales agents in Canada, Ville LaSalle, P.Q.

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Wrought Iron Nipples.—"Wrought Iron Nipples," is the title of a folder-type bulletin recently prepared by A. M. Byers Company to help technicians complete wrought iron piping specifications.

The new bulletin explains how to identify wrought iron nipples and contains a full page of size and dimentional data. Separate tables list stock sizes and lengths in inches of standard weight and extra strong nipples.

Listings include nominal size, close nipples, special short, short, long and extra long lengths of both black and galvanized nipples.

Copies of the "Wrought Iron Nipples" bulletin can be obtained by writing A. M. Byers Company, Clark Building, Pittsburgh, Pa.

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THE YOUNG MAN IN BUSINESS

(*Continued from page 1331*)

No fancy titles will make up for lack of competence. An "expediter" may have an office and a staff, but his efficiency is not judged by his high rank. He stands or falls by his ability to get goods out the door, goods so well made and so well packed that there are no returns.

In other words (to quote the philosopher Socrates): Kings are not those who hold sceptres merely, but those who know how to rule. To gain promotion, a young man needs to show that he has qualities of some sort or other which others have not. The manner in which he meets certain situations will show his capacity and decide his advancement.

Continuing Education

Taking a position in business does not mean that your education must stop. When Henry Adams wrote the story of his life he called it *The Education of Henry Adams.*

In addition to the habit of thoroughness and the zeal for your business, you need to augment your opportunities by intelligent study and the fostering of broad interests.

Men who limit themselves rigidly to their official duties become sluggish in their reactions and develop blind spots. It is a mistake never to think of a business concern in terms any bigger than one's own personal position in it.

There are many roads to learning, and few hindrances. Night schools, correspondence courses, university extension classes, study groups—these are all open to anyone. The building of a well-used personal library is a fine investment, and in these days of Penguins and Mentors it is available to everyone.

Merely having a bookcase full of beautifully bound volumes does not mean anything, but to read them and then link up your study with business experience will give a sense of pleasant accomplishment.

The great hindrance to study is the sense of "I have no time". Everyone has all the time there is, and the excuse means simply that study for advancement is not considered so important as some other time-user.

Another way to increase the length of your strides toward success and perhaps to speed them up is simple, too. It is doing the little bit extra.

Life is activity. It means doing things, planning, aspiring, dreaming, and then making the dreams come true. Where else than through extra work can a man show his initiative and enterprise?

About Success

Achievement in business life, just as in the arts, is dependent upon imagination combined with industry. It is necessary for the young man just entering business to do his first job, small though it may be, to the very best of his ability, and at the same time to carry his head high, the better to see far horizons.

To achieve that, he needs to lay aside non-essentials, and to be sincere with himself as well as others in the service he gives. Sincerity, in this regard, means much: honesty of thought as well as of action; self-respect; fidelity to one's own objectives and to those of the employer.

There are few fairy tales in business life. Usually there will be found behind the success of a man, beneath the expansion of a company, a lifetime of experience put to creative use by the touchstone of an imaginative idea.

Into that experience went work, and the little bit extra: mistakes; rubbing shoulders with many people; study; observation; meditation, and controlled ambition.

Success is not a destination to be travelled to; it is the journey itself, and happiness is found along the way. Those who feel handicapped by their dearth of formal schooling or by any other lack should recall Conwell's wonderful lecture *Acres of Diamonds* in which he said: "Greatness really consists in doing great deeds with little means."

Never before have capacity and talent been less impeded by lack of formal training. But never before has it been more true that he who longs to achieve does not ask whether the seat is soft or the hours short or the weather pleasant.

The real joy of life is not in doing things easily, but in doing them better than others, and the harder a thing is to do the greater the opportunity that is offered to the young man of ambition.

Straight thinking, willingness to work and alertness to problems: these should be the watchwords of this year's graduates. The world of business has a place for them.

The Cracking Problem in Reinforced Concrete Buildings

by

E. M. Rensaa, M.E.I.C.

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Engineers & Architects,
Edmonton.

To the best of our knowledge, not much information, either theoretical or practical, is available on the prevention of shrinkage and temperature cracks in structures; probably every designer has his own methods for dealing with the matter. Mr. Rensaa first considers cracks and fissures from the standpoint of theory and then proceeds to lay down some practical rules for crack control, drawn from his own experience and used successfully in a number of cases.

The structural design of a building must necessarily be based on certain assumptions. If these assumptions are incorrect, the most exact mathematical analysis cannot rectify errors by them. This paper aims to contribute to the understanding of the actions of shrinkage and temperature forces. Unless the designer has a fairly clear conception of the action and magnitude of these forces he cannot expect to design a crack-free structure.

The term "crack" will mean a separation of such magnitude that it is easily seen, while "fissure" is a separation so small that it is not noticed by ordinary inspection. Except where prestressing is used, it is generally not feasible nor economical to design a fissure-free reinforced concrete structure. Ordinary reinforced concrete beams have fissures on the tension side, but if the beams are properly proportioned and reinforced, the fissures are hardly noticeable and in most cases are not objectionable.

In a correctly designed building, cracks caused by gravity loading should not occur, as stresses caused by such loading are comparatively easy to calculate and to provide for by proper reinforcing. It is more difficult to calculate shrinkage and temperature stresses, even if the exact fundamental shrinkage and temperature coefficients are known. The reason for this uncertainty is the variable and complex conditions of restraint acting against changes of length of the structure. In a long building, the frictional force between wall foundations and ground is generally greater some distance from the end of wall than the tensile strength of the wall concrete. When there is a temperature fall with corresponding contraction, the tensile concrete strength will be insufficient to overcome the frictional force and a crack or fissure will develop. If the wall is high and not restrained by warm inside floor slabs, it may contract with less hindrance. The conditions of restraint may therefore differ considerably from top to bottom of wall.

Perhaps the most unpredictable stresses occur where the outside reinforced concrete walls are built integrally with reinforced concrete floors. It is customary in North America to place insulation on the inside wall surface and so the wall will have a greater range of temperature change than the concrete floors. Some heat will be led from the floors into the wall at their junctions and the actual wall temperature will, therefore, not be as low, for low outside temperature conditions, as would ordinarily be the case. A concrete floor at its junction will, on the other hand, have a lower temperature than farther away from the outside wall. The elastic deformations of wall and floor will have some modifying effect on the stresses.

The stress distribution in both wall and floor will, for the above reasons, be uneven to start with and, when the influence of mutual restraint is added, the resulting problem will be hard to analyze. Taken as a whole, it is clear that making correct assumptions for the exact calculation of stresses becomes impossible and it is necessary to rely mostly on judgment and experience. While it is not possible to make exact calculations of stresses, it is still necessary to have a clear conception about the action of forces and the best method to take care of them in such a way that unsightly cracks do not occur.

It is sometimes stated in descriptions of buildings that cracks came in unexpected locations and did not occur at the control joints where they were supposed to. However, cracks do not come accidentally, but only where they should be according to the laws of nature. The more correctly these laws are understood and observed, the less likely is punishment in the form of cracks. There has been a tendency in the past to use joints and hinges in places where they were not necessary. They were put in merely to make stress calculations easier or to overcome lack of ability to make proper calculations. Joints and hinges which ordinarily increase maintenance cost and weaken a structure, could, in many cases, more properly be called "ignorance joints".

The following example from the author's practice will show how variable shrinkage, variable temperature deformation and variable restraint may act in combination. A large bridge pier which had been constructed during the summer was

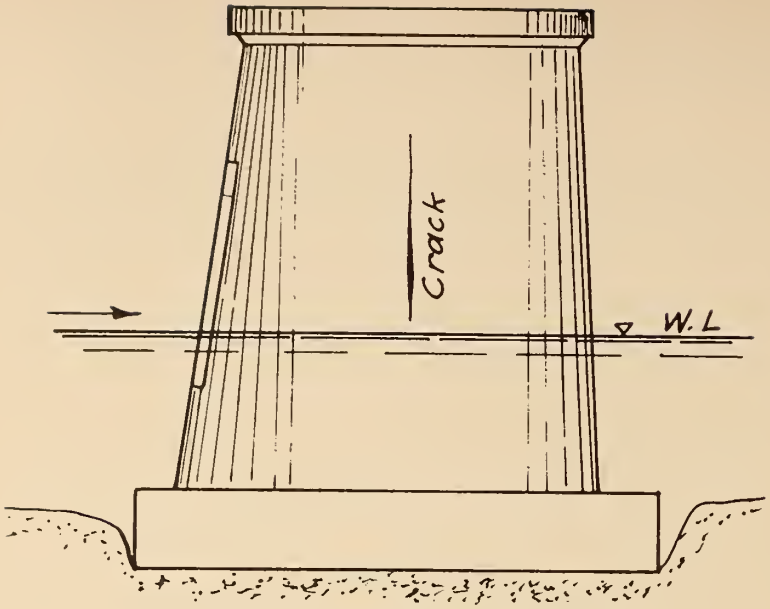

Fig. 1

found to have developed a crack during the next winter. The crack started about 6 in. above the water line, increased in width upwards for about a third of its length and then disappeared about 10 ft. above the water level. The shape of the crack was about as shown in Figure 1, but its width is exaggerated in the figure. The actual width of the crack was small and, so far as the author knows, it has not caused any difficulty, but cracks do not improve the appearance of a structure. This crack had undoubtedly been caused by the combined effect of shrinkage of the concrete above the water line and the greater cooling of the pier top compared to the portion under water. There would be no shrinkage of the concrete below the water level and less than full shrinkage from this line and for some distance upward, because of capillary water rise in the concrete. In addition, some heat would flow from the warmer part under water up into the pier and then gradually be dissipated into the colder air. On the other hand, the resistance to deformation would be greatest below the water line and gradually decrease towards the pier top. It was therefore natural that the crack should not extend below the water line, where there was no shrinkage; in fact, the concrete there would be in compression, due to the greater contraction of the part above the water. Because of gradual drying out and cooling of the concrete from the water line upward, the shrinkage and temperature deformations would naturally increase and the crack widen. Restraint would decrease with height, and the top would therefore contract more freely so that the tensile strength of concrete at a certain height above the water line would be sufficient to prevent the crack from reaching the top of the pier.

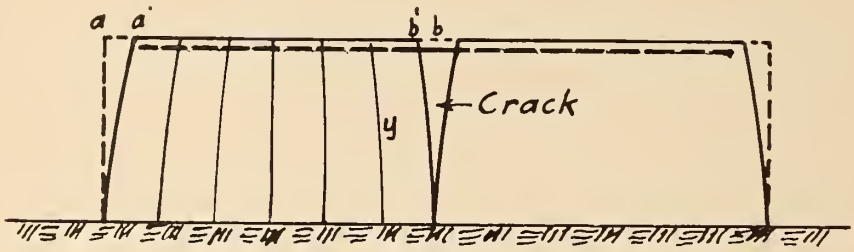

Fig. 2

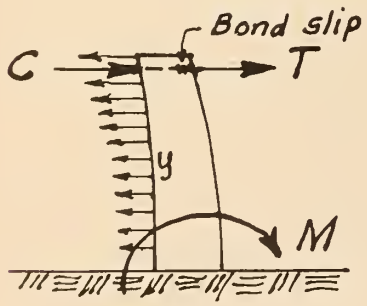

Fig. 3

The relatively simple case described above is in most respects analogous to what is encountered in a building. The soil is generally moist and the foundation walls and footings therefore do not dry out completely. Temperatures below ground do not reach the same low level as above ground. Restraints to deformations decrease upwards.

Shrinkage will not induce any differential stress between wall and floor, unless there is a difference in moisture content. There may, however, be great differential stresses at the junction between floor and wall if one part is warmer than the other. The wall is ordinarily in the worse position because the tensile stresses, which are the most dangerous, will be combined with shrinkage stresses during cold weather.

In what follows, some of the conditions which influence the design of crack-free buildings will be discussed. The discussion will refer only to shrinkage and temperature forces.

Shrinkage Stresses

All concrete shrinks when it dries out after hardening. Concrete which is kept constantly submerged in water after hardening does not shrink, except when its mass is such that there is a considerable temperature drop after complete hydration. This is an important property of concrete, because there may be little or no shrinkage in footings and foundation walls if they are kept relatively moist. The unit shrinkage depends largely on the total amount of water in the concrete per unit of volume and to a lesser extent on the cement content as was formerly believed. For minimum shrinkage, as low a concrete slump as feasible should be used and the concrete should be adequately cured. The first requirement is not so easy to meet especially for thin walls, if a smooth surface is wanted. To get a good "architectural concrete" surface with a dry mix is difficult, at least if the cost is to be kept reasonable.

Thus there is the choice either of using a dry mix, giving an imperfect surface and little shrinkage, or of using a wet mix, giving a good surface, but high shrinkage. The author prefers the first choice, combined with the application of some kind of surface finish. The use of architectural concrete surfaces has, in the author's opinion, been greatly overdone in North America. It will, in

most cases, be necessary to do some patching which will probably be noticeable even if the wall is painted. Perhaps workers can be found who will not make errors during compacting, but they are scarce. A concrete surface cannot be seen until forms are removed, so compaction is largely subject to the judgment of the worker.

To make placing easy requires a wet mix, a relatively thick wall and a minimum of reinforcing obstructing concrete placing. These conditions tend to promote the formation of shrinkage cracks. Reinforcing in itself will not prevent cracks in concrete due to shrinkage, but will rather promote the formation of them, since shrinkage will induce initial compressive stresses in the reinforcing. It would then seem that reinforcing is of no use to prevent shrinkage cracks. Actually, reinforcing will not prevent the formation of fissures, but if correctly applied it will prevent visible cracks. While the initial stress in the steel is compression, it will change to tension at and near a separation as soon as the concrete cracks. The stronger the reinforcing is at the break, the more power it has to keep the broken surfaces together in such a way that visible cracks are not formed.

The theoretical amount of reinforcing necessary to prevent wide shrinkage cracks is a steel area, which, within the elastic limit of the steel is sufficient to overcome the tensile strength of the concrete section. If the cracks are to be closely spaced, it is further necessary that the total bond resistance on a comparatively short length of reinforcing bar shall be greater than the tensile strength of the concrete section. If this amount of steel were used, there would be no limit to the length of structure that could be built, as the cracks could be kept down to the fissure size. The temperature stresses will, however, limit the practicable length of a continuous structure. In practice it has been found that good results may often be obtained when even less steel than that required by the above analysis is used.

The following will illustrate why this may happen. Assume a long wall restrained by friction or other means at its foundation. A reinforcing bar is embedded near the top of the wall. The wall has cracked at mid length due to shrinkage shortening. Since the length $a'-b'$ (Figure 2) is less than the original half length there must evidently be compression in the embedded reinforcing bar, except near the crack, where there may be some bond failure. Assume that a portion of the wall along a line y which originally was vertical is cut out with retention of the internal stresses in concrete and steel (Figure 3). When a crack forms in such a reinforced concrete wall, the stress in the steel changes from compression to tension. Even if the steel is stressed beyond its elastic limit, it is usually not broken and the force T may even be equal to the maximum possible steel strength. At the left of the section, where it is assumed that the bond is not broken, there is a compression C in the steel and both C and T are seen to act in the same direction. In addition to this, the moment M in the deformed wall cantilever element acts in the same direction as C and T. Acting in the other direction are the tensile concrete stresses. The sum of C, T and M increases from both ends of the uncracked half section towards its middle, where a new crack may be formed when the tensile concrete strength has been exceeded. The outline and location of cracks may be very irregular due to nonuniformity of the concrete strength.

This example shows a wall which is low compared to its length, contrary to the case with the bridge pier. It is thus seen that any amount of steel will help to form cracks, but that the steel will also help to keep the cracks small after they have formed and the steel stress has changed from compression to tension. In a building with reinforced concrete outside walls, this resisting cantilever action exists not only in an originally unbroken wall, but window piers and even columns will help to form new cracks because of their resistance to lateral bending. The greater T, C and M are, and the weaker the concrete section, the closer will be the spacing of the cracks and the smaller they will be. The designer's problem is to put in just enough steel to make the size of crack come into the fissure class. It is further of advantage that the steel have a high bonding value, so that the crack cannot be widened by too much sliding along the steel when a crack is formed. A steel of high elastic limit will also help if the cross sectional area of reinforcing area is kept the same.

This discussion refers to foundation restraint, but the general principle applies where the restraint is of a more complex nature, such as from an adjoining floor dryer or wetter than the wall.

Temperature Stresses

It is well known that temperature deformations are nearly the same for concrete and steel. For ordinary buildings, it may also be assumed that there will be little difference in temperature between steel and concrete. So far as temperature deformations are concerned, it may further be assumed that stresses in concrete and steel in an unbroken section, caused by resistance to deformation, will be of the same sign. The same complex restraint described for shrinkage stresses will apply also to temperature stresses. Since shrinkage and temperature deformations are difficult to separate, the resulting stresses become even more indeterminate. Temperature increases in a structure from the time of construction cause opposite deformations to those of shrinkage and the resulting stresses are generally small. It is therefore seldom necessary to consider stresses caused by temperature rises above normal. Temperature drops and shrinkage act together to shorten the structure and to induce tensile stresses in it. Unlike shrinkage deformation, temperature deformation will not allow a structure of any length to be made without the use of contraction joints. The discussion in connection with Figures 2 and 3 holds for temperatures below normal, except that there will be no differential stress between concrete and steel in an unbroken section, that is, C will be zero and only T and M will act to crack the wall.

Control Joints in Outside Walls

It seems to be generally assumed in North America that cracks cannot be avoided, except in very short walls. To make sure that cracks will form where they supposedly are least objectionable, both the concrete section and the steel reinforcing are weakened on vertical lines at comparatively short distances apart. These weakened sections are called "control joints". Cracks usually form at openings for doors and windows where the concrete sections are weakest. Control joints are consequently located there, where in reality they look most out of place, considering beam or lintel action. The result of the introduction of control joints is to lessen the structure's resistance to uneven foundation settlement. They also provide access for surface water, which may cause spalling by frost action. The latter weakness is especially important when some kind of surface coating such as stucco is used. North America has,

in other words, accepted defeat so far as cracking is concerned, and wants only to make sure that the victim (structure) is killed in a proper manner. The question may then be asked if cracks in reinforced concrete walls can be avoided without the use of control joints. The answer to this question is that such joints are not generally necessary if sufficient temperature and shrinkage reinforcing is used and the distance between contraction joints is not unduly great. Climatic conditions and architectural form of design will also have an important bearing on spacing and location of temperature and shrinkage reinforcing required.

If visible cracks can be avoided by adding a few hundred dollars' worth of extra steel, this certainly would seem worth while. Control joints apart from their detractive appearance are not entirely gratis either. That cracks can be avoided by the use of proper reinforcing has been proved beyond doubt, both by the author's designs and by ordinary practice in Scandinavian countries, where control joints are not used, so far as the author knows.

What Decides the Spacing and Location of Contraction Joints?

It has been stated that so far as shrinkage is concerned, the length of structure which can be built without cracks has no limit. One would only have to make sure that at all sections the amount of steel were sufficient to keep the cracks in the fissure class. Temperature stresses are not as easy to take care of. However, such stresses are not as important in floor systems in heated buildings as they are in outside walls. If floors have enough steel to take care of shrinkage stresses, it will seldom be necessary to add steel because of temperature changes. It is different with outside walls where temperature stresses may be much larger than those from shrinkage.

It is not generally practicable to separate walls from floors. A crack in a wall must therefore be assumed to induce tensile stresses in the adjoining floor, which may or may not crack at this point. Where the distance between wall joints is large, it may be necessary to carry the joint through the complete floor system. It is clear that the location and spacing of joints will depend mostly on the shape and length of outside walls.

Floor Reinforcing to Prevent Cracking

The minimum temperature and shrinkage reinforcing specified by building codes is seldom sufficient to prevent cracking, if the floor is long and restrained and the temperature and shrinkage steel is placed in the longitudinal direction. The cheapest way to avoid cracking in a floor is to place the main slab reinforcing parallel to the longest direction of the building. This is, of course, not always practicable, as for instance, in corridor slabs placed in the long direction. It may then be necessary to use much more longitudinal steel than required by the code in order to avoid cracks. This is seldom done, with the result that corridor slabs often show more cracks than any other part of the structure. The same consideration applies to all other slabs when the principal reinforcing runs transversely to the long direction of the building.

It is, on the other hand, unnecessary to use extra steel where the floor is not restrained to any considerable extent from contracting. This is the case for a slab acting as the compression flange for a beam. It is hardly conceivable that such a slab should crack transversely to the beam, so shrinkage steel in the slab parallel to the beam need be only a minimum. The author has only seen one instance where cracks formed transversely to a beam. The beams in this case were steel I sections encased in concrete. The steel section was designed to carry the complete load and the concrete used for the slab was extremely sloppy. Little shrinkage steel was used and considerable unsightly cracking occurred. The reason, of course, was that there was not sufficient deflection of the steel beams to compensate for the slab shrinkage, and too much friction between beam and slab to allow the slab to contract.

From the above it should be clear that it is not generally possible to design a crack-free slab by using the minimum steel specified by codes. It is impossible to write a code which will cover all cases met in practice. Neither would that be necessary if designers understood the fundamentals of the problem. Much would be gained if textbooks on reinforced concrete gave some hints about such practical considerations as those mentioned above. From what the author has seen of cracks in reinforced concrete floors and walls, he has the impression that the majority of designers work on the basis of using the minimum amount of shrinkage and temperature steel allowed by building codes, regardless of slab or wall lengths and of end restraint.

Design of Outside Walls

When designing outside walls, there is the choice between the use of control joints at short distances or building unbroken walls which may have a length up to 140 or 200 ft. between through contraction joints, depending on climatic conditions, and the form of building. The author prefers the latter alternative and will confine his discussion to it.

The variable items in the cost of a wall are the cost of the material used in it and the cost of the labour required to place this material. Cost of formwork, scaffolding, etc., will be about the same whether a wall is 6 in. or 12 in. thick. It has been claimed by cement manufacturers that the total cost of an 8 in. wall will be less than for one 6 in. thick because of extra labour needed for compaction in the latter. The claim is that some contractors have offered to build 8-in. walls without extra cost even though only 6 in. was specified. This claim may have some foundation if the surface is architectural concrete and if the amount of reinforcing steel is the same in both cases. It is not generally true that an 8 in. wall is the cheaper when a corresponding increase is made in the amount of reinforcing and when no unusual care is needed to get an absolutely smooth surface, an opinion which has been confirmed by alternate bids from contractors.

The ideal condition to avoid heavy temperature stresses is to place the insulation on the outside face of the wall. This is quite feasible in a fairly dry climate. In Sweden, where the inland climate is comparable to that of the Prairie Provinces, outside insulation has proved entirely successful. By placing the insulation on the outside it need not be broken at floors and the greater part of temperature stress is eliminated. However, this custom has not so far been adopted to any extent in North America. In deciding what amount of reinforcing is necessary to control cracking, it should again be pointed out that the minimum amount of steel required by building codes, plus the ordinary two 5 8 in. diameter bars around openings, is insufficient to prevent cracks in any but short and fairly unrestrained walls. Theoretically, it would appear that to keep the fissures small and at close intervals, the strength of steel at its elastic limit in a section should be greater than the tensile strength of the concrete section. This may and may not apply, depending on the

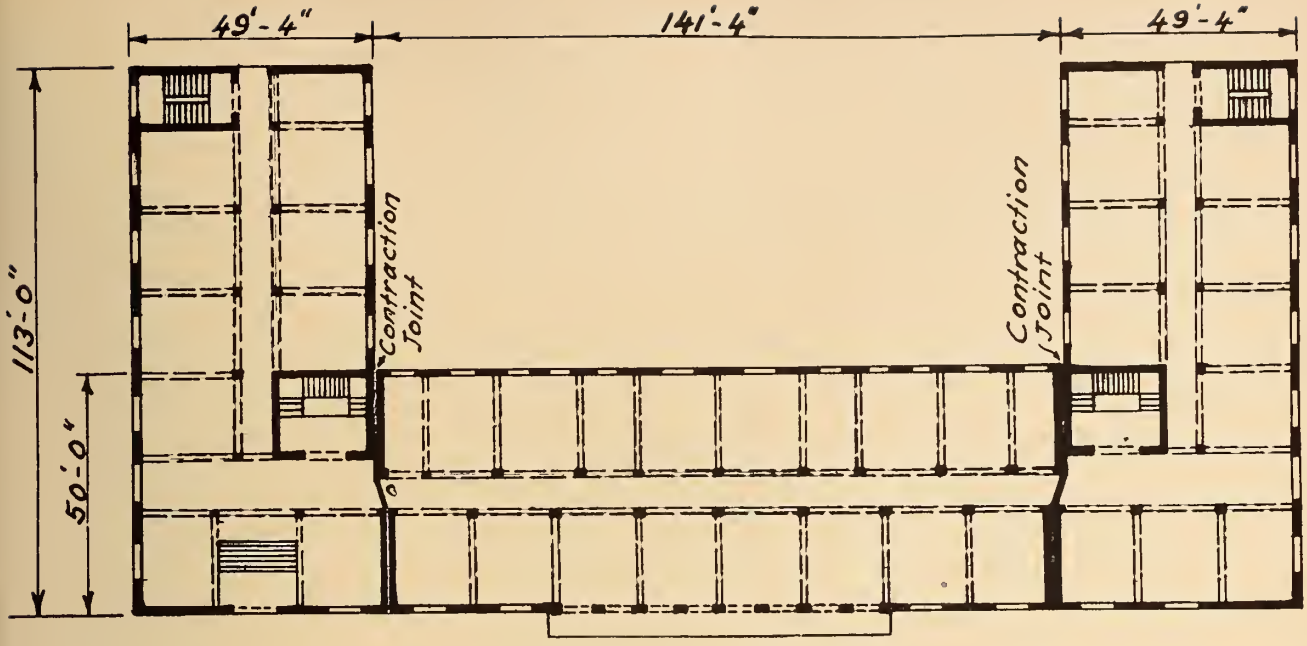

Fig. 4

length of wall and on restraint. It should also be noted that a reinforced concrete floor, while restraining the wall from contraction, will also act the same as reinforcing in distributing the fissures.

It is usual practice in North America to specify two 5/8 in. diameter bars around openings in a wall. This is in most cases sufficient in the vertical direction, but is generally too little for horizontal reinforcing. The author has tried bars from two 5/8 in. to two 1 1/8 in. on a considerable number of wall designs during the last 16 years and has found that, in order to be fairly sure of not getting visible cracks, it is necessary to use as much as two 1 in. diameter bars over and under openings. The bars should preferably be of high elastic limit steel and deformed. For walls thicker than 8 in. more steel might be necessary if the wall is long. These bars will ordinarily also take care of bending stresses for ordinary openings. Cracks usually start at corners or edges of openings and heavy reinforcing at these places both helps the whole section and prevents the starting of cracks.

Cornices and long canopies require more shrinkage and temperature reinforcing than outside walls. In order to prevent cracks in such members it is often necessary to use enough steel to exceed the tensile strength of the concrete. One or two heavy bars should be placed along the outside edge and smaller bars closely spaced in the rest of the member.

Fig. 5

Offsets and concave wall corners which necessitate bending of horizontal bars are very susceptible to cracking. If proper strengthening of such places is not feasible, it will then be better to introduce contraction joints. Sliding joints should, in general, not be used. It is better to make a complete cut between double beam and columns systems or double bearing walls. When designing a through contraction joint this may generally be begun at the top of wall or column footings, and carried upward, as there will be little shrinkage of concrete and relatively small temperature changes below that line.

Examples

Figures 4 and 5 show the plan and the elevation of a building at Calgary, Alberta. Outside walls are of 2,500-lb. concrete, 8 in. thick and are reinforced on each side with 1/2 in. bars, 16 in. c-c. vertically. In the horizontal direction the through wall strips are reinforced with 1/2 in. bars, 7 in. c-c. on the outside and 3/8 in. bars 7 in. c-c. on the inside. Two 5/8 in. bars were placed vertically on each side of openings. Over and under openings were two 1 in. bars in the long walls, and two 3/4 in. bars in the short walls. To match other buildings in the group a special stucco finish was

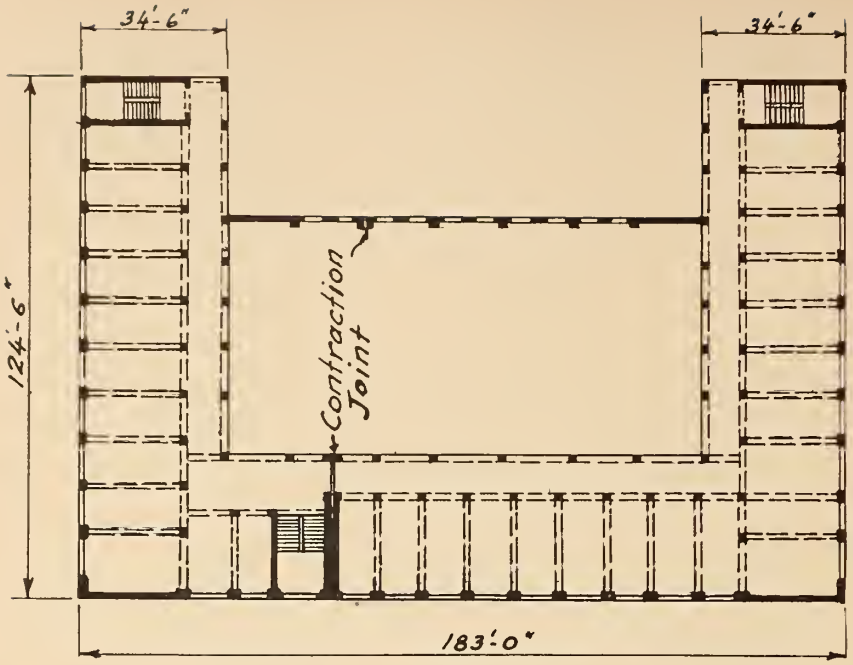

Fig. 6

with two 1 in. bars over and under wall openings. The vertical reinforcing is 1/2 in. bars 8 in. c-c. with two 5/8 in. bars on each side of wall openings. This building has also stood two winters, one with very low temperatures. No cracks have been found in the walls or in the reinforced concrete floors. There is only one contraction joint in this structure; it opened up considerably during the coldest part of the winter. Because of the extremely cold weather at this location, the placing of contraction joints was carefully studied. Looking at the elevation, it will be seen that both wall ends are rigid and act as anchors, while the central part, with fairly slender columns, is more flexible. A weak point in the wall is the main entrance, where reinforcing could not be carried through continuously. These structural conditions were the deciding factors in locating the joint.

Fig. 7

used. The officials acting for the owner, on recommendation from a cement manufacturer, wanted control joints 15 to 25 ft. intervals. and only two 5/8 in. dia. bars around openings. The Calgary climate is ordinarily dry, involving maximum shrinkage and temperature range between approximately +95° and −45°. The temperature is, very changeable during the winter, when there may only be few hours between hard frost and thawing. The foundation is not good; soil tests indicated that only 1.5 tons per sq. ft. foundation loading should be allowed. It is easily seen that the great number of control joints cutting through the stucco would have increased the cost of maintenance and would have weakened the wall's resistance to uneven settlement. After considerable discussion, the design without control joints was adopted. The building has been through two winters, one with very low temperatures, but no cracks have been found either in the floors or walls. The horizontal wall reinforcing was cut rather too fine, even if it was heavier than held to be necessary by the officials. The building has two main contraction joints between double walls so that inside joints can be seen only from the corridors. Footings are continuous.

Figures 6 and 7 show a building at Whitehorse, Yukon. The temperature there may be as low as −60°F. The outside walls are of 2,500 lb. concrete 7 in. thick and are reinforced horizontally in their centres with 1/2 in. bars 6 in. c-c.,

The above examples are of buildings designed by the author's firm at locations where cracking was difficult to avoid. The author has found that when shrinkage and temperature cracks occur, the reasons are either too little reinforcing, too great a distance between contraction joints or an architectural design such that cracks were unavoidable. As for the last, it is clear that to obtain a crack-free building, complete cooperation between the architect and the structural engineer should be carried out from the start of planning. Such cooperation, from which both parties would benefit has not always existed, but is fortunately now being more and more recognized as a necessity, if the best service is to be given to the client.

The Use of a Gelatin Model in the Photoelastic Analysis of a Gravity Dam

by

J. S. Ellis, Jr.E.I.C., and K. W. Gent, A.M.I.C.E.

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Design by model testing is becoming more and more common; it gives information which cannot be obtained by conventional analysis. This article deals with the practical problems encountered in making gelatin models and describes an optical system designed to accommodate a large photoelastic model.

Introduction

In photoelastic stress analysis a model made of a photoelastic material is illuminated by polarized light and is observed through a polaroid filter. If the model is under appreciable load, it will exhibit fringe patterns which are caused by the stresses. In practice, the fringe patterns are photographed and these photographs give, upon mathematical interpretation, the stresses in the structure.

Among the materials that are photoelastic is gelatin, which is 200 to 1,000 times more sensitive than other common photoelastic materials and with which very small stresses give fringe patterns. In fact, a small free standing prism of gelatin exhibits fringes because of its own dead weight; it is this property which makes it an attractive choice for the analysis of structures such as gravity dams[1], earth embankments[2], tunnel linings[3] and flexible bulkheads[4] in which gravity or dead weights must be considered. The two features of greatest interest in the work to be described are the use of a special type of gelatin and the optical arrangement which accommodated an unusually large model. This article describes the method used in making a gelatin model of a solid gravity dam and its foundation and the arrangement of the optical equipment, and discusses the general design and limitations of such models.

Method of Making the Model

The first step in making the model was to build moulds to contain the gelatin solution until it had set. The moulds were of ¼-in. plate glass and ⅛-in. lucite; the lucite was used for curved surfaces and was shaped by heating it until it became

Fig. 1. Close-up of gelatin model of a gravity dam.

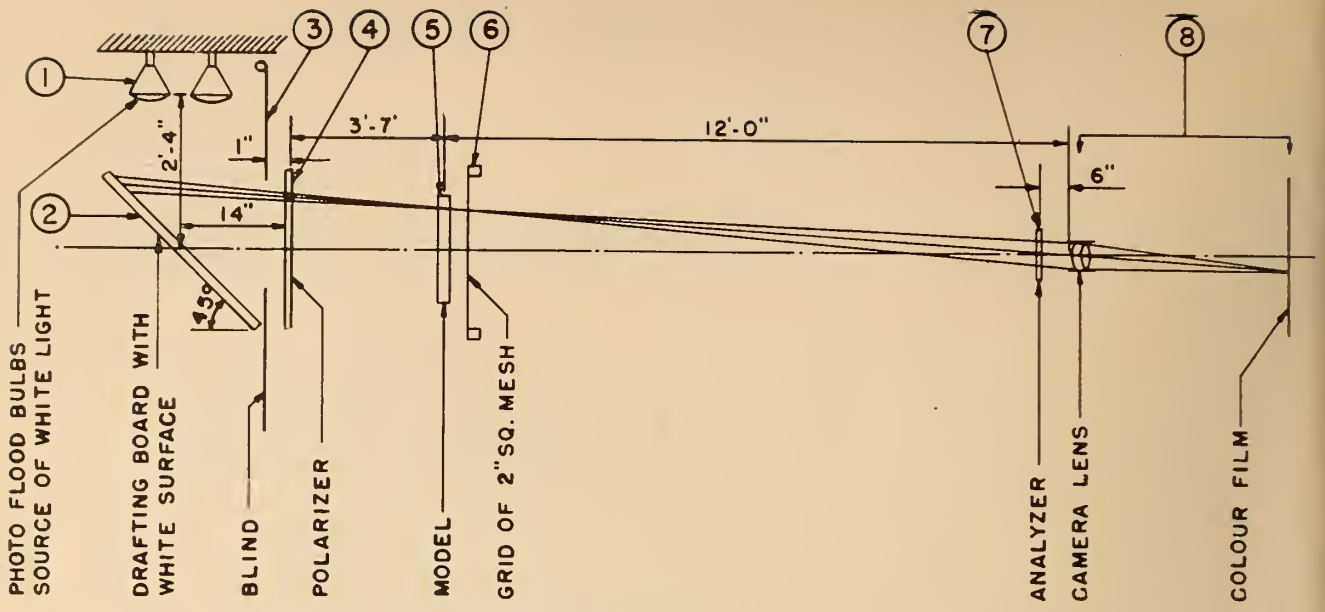

Fig. 2. Optical system.

pliable and bending it to shape using wooden forms. It was then clamped to the forms until it cooled to room temperature. To prevent the gelatin from sticking to the glass and the lucite, they were thoroughly cleaned, coated with wax, polished until only a thin film remained, and then dusted with finely powdered talc. The moulds were clamped together and household cement was applied to the outside of the joints. Some difficulty was experienced in obtaining tight moulds which emphasizes the need for careful glass cutting and adequate clamps.

The gelatin mixture was composed of photographic gelatin (Kodak No. 188-400F.), sodium benzoate as a preservative and distilled water. Preliminary models made from ordinary commercial gelatin required lubricated glass plates for lateral support and friction between the gelatin and the glass invalidated the results. Such lateral support was unnecessary for the final model. Distilled water was considered preferable to tap water because of the chemicals in the latter. Preliminary models were made in which formaldehyde was added to the gelatin mixture. This did increase the rigidity of the models, but it caused the solution to be excessively quick setting and weak in tension. The proportions of the ingredients of the mixture for the final experiment were:

Gelatin.....	20.0% by weight
Sodium benzoate	0.1% by weight
Distilled water..	79.9% by weight

The sodium benzoate was dissolved in the water, then the gelatin was added and the mixture allowed to stand for an hour. The mixture was then quickly heated in a double boiler to about 130°F., stirred until all the gelatin was dissolved, cooled to about 100°F. and syphoned into the moulds. The syphon system was employed to reduce the amount of air introduced into the solution. The moulds were stored for 24 hours at a temperature of about 60°F. to allow the solution to set.

The model shown in Fig. 1 was made according to the above procedure. Its surfaces were not damaged by the removal of the moulds, it was sufficiently rigid to take the applied load, and its settlement under its own dead weight was negligible. Its dimensions were 5 in. thick, 22 in. long, and 11½ in. high. Tests on this model were conducted at a room temperature of about 65°F. The needle-like rods which appear in the figure represent a special foundation condition which will not

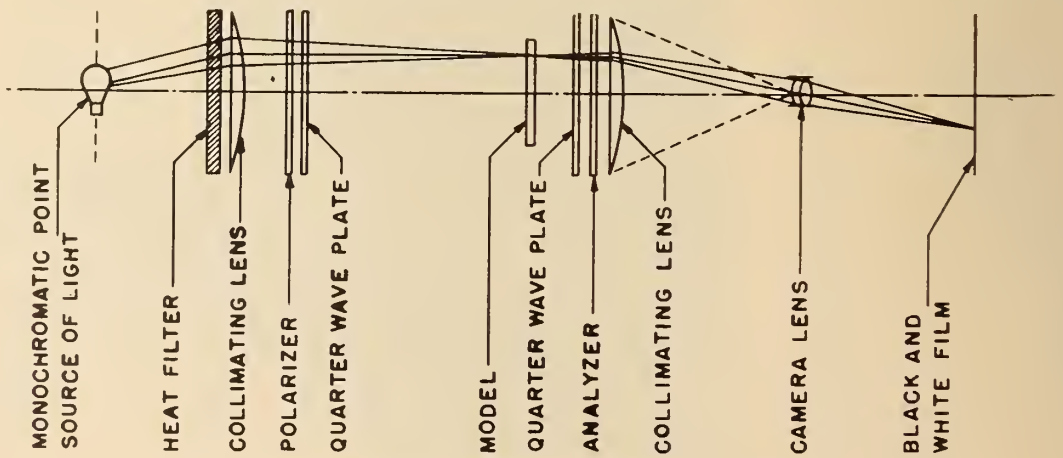

Fig. 3. Optical equipment normally employed in photoelasticity.

be discussed in this article. The loading device to represent the hydrostatic force is shown at the top of Fig. 1 and consisted of a system of pneumatic cushions.

Arrangement of Optical Equipment

The optical equipment was designed to accommodate an unusually large photoelastic model. Figure 2 illustrates the arrangement.

The light source, *1*, consisted of five 500-w. photoflood bulbs above an inclined drafting board, *2*, with a white surface. This served to diffuse the light and to minimize the heat which struck the polarizer, *4*. Between items, *2*, and, *4*, a blind, *3*, was located which had an opening equal in size to the polarizer. This blind prevented any unpolarized light from passing beyond the plane of the polarizer. The polarizer, *4*, consisted of a 20 x 40-in. sheet of polaroid. It was supported to permit its rotation through 90° in a plane at right angles to the optical axis.

The gelatin model and its loading device are shown at *5*. A wire grid, *6*, of 2-in. square mesh provided reference co-ordinates for the photographs. The analyser, *7*, was a polaroid filter mounted in a frame which was calibrated to permit a controlled counterclockwise rotation through 90°. The analyser's plane of polarization was set at 90° to the plane of polarization of the polarizer so that no light passed through the analyser unless the model was positioned between them. Item *8* was the camera.

The camera used was a 4 x 5-in. ground glass focusing type with an f4.5 Kodak Ektar lens of 152 mm. focal length. A roll film adapter taking 620-size film was fitted to the back of the camera and permitted 16 exposures to be taken in rapid sequence. Ektachrome film was chosen because it is possible to develop it in the darkroom within two or three hours, thereby eliminating the time required for the processing of some other types of colour transparencies. Early development of the film is advantageous for checking the exposure and for retaking photographs if necessary. The importance of this second advantage results from the fact that the useful physical life of a model is only about 12 hours, measured from the time of its removal from the moulds.

The optical equipment normally employed in photoelasticity is illustrated in Fig. 3; that used in the experiment differed from it in four ways:

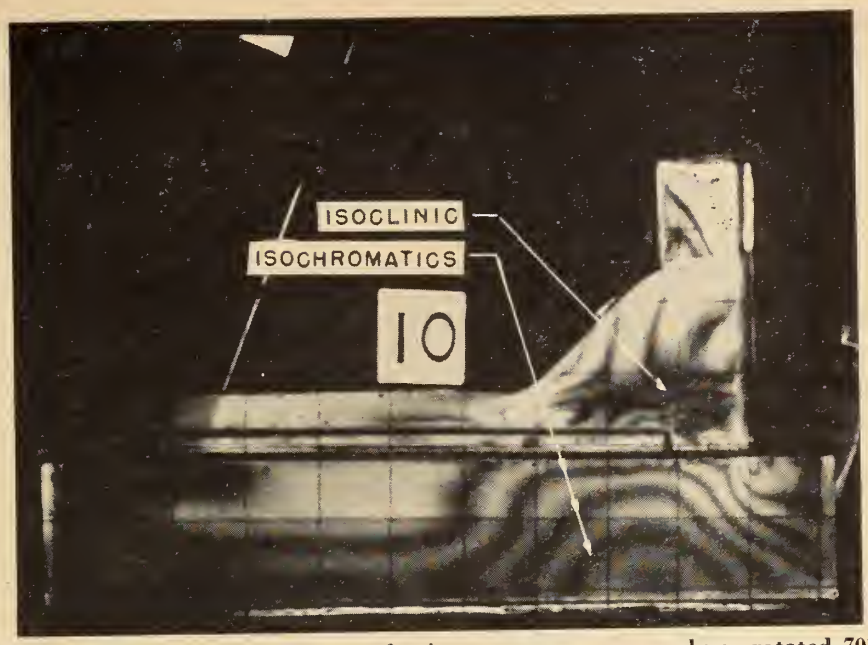

Fig. 4. Black and white print of colour transparency, analyser rotated 70° counterclockwise from the vertical.

1. White light was used instead of monochromatic light.
2. Colour film was used instead of black and white film.
3. Quarter wave plates were omitted
4. Collimating lenses were omitted.

In order to explain the above differences it is necessary to:

1. Refer briefly to the two types of fringe patterns which must be observed through the analyser and be photographed in order to calculate the principal stresses in a structure.
2. Describe the procedure which was followed in taking the photographs.
3. Describe the procedure which is followed in taking photographs when the normal photoelastic equipment is employed.

One type of fringe pattern, called an "isoclinic", is seen in Fig. 4 as a dark area in the lower central region of the concrete spillway, and in Fig. 5 as a dark area along its downstream slope. In these areas, the directions of the principal stresses are directly related to the angle shown on the calibration circle of the analyser. When the analyser was rotated, the polarizer was turned simultaneously so that the field as seen through the analyser always appeared black. The isoclinics moved across the model when the

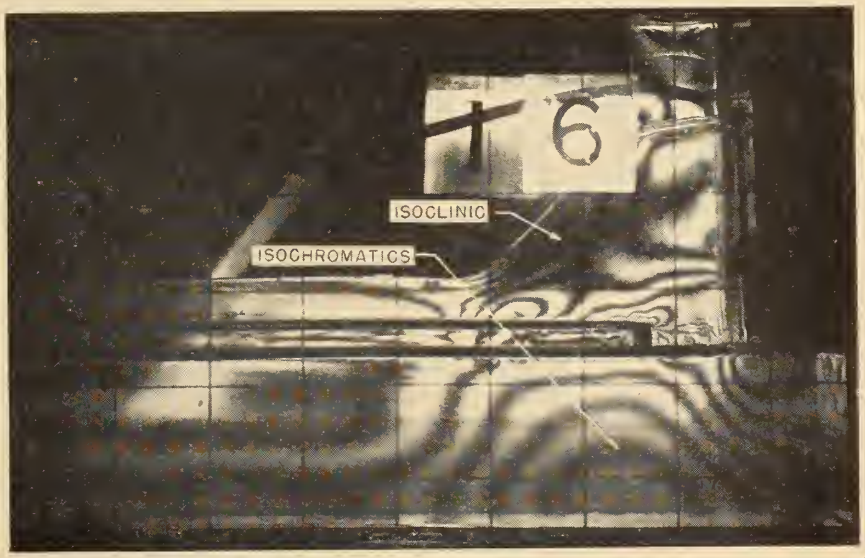

Fig. 5. Print of black and white close-up photograph, analyser rotated 45° counterclockwise from the vertical.

analyser and polarizer were rotated. For each angle of rotation to which the analyser and polarizer were turned, the isoclinics took up different positions in the model. By relating the positions of the isoclinics to the angles of rotation, the directions of the principal stresses were obtained.

The other type of fringe pattern, called an "isochromatic", is shown in Figs. 4 and 5 as dark bands. Each isochromatic fringe represents a path along which the difference in the principal stresses has a given value; these fringes do not move when the analyser and polarizer are rotated. The isochromatic fringes were used to obtain the differences in principal stresses for the points on the model where the stresses were investigated. A complete explanation of isoclinics and isochromatics can be obtained from texts on photoelasticity[5].

In the experiment colour photographs were taken of the loaded model to record simultaneously the isoclinics and the isochromatics. Because the isoclinics are frequently broad and tend to mask the isochromatics, it may be difficult to separate them in black and white, but colour photographs show the isoclinics as dark brown areas and the isochromatics as multi-coloured fringes, of which the green ones were used for calculations. In the experiment, the first photograph was taken at 0°, that is, the polarizer passed light polarized only in the vertical plane, and the analyser passed light polarized only in the horizontal plane. The second photograph was taken at 5°, that is, the polarizer and analyser were both rotated 5° counterclockwise. Subsequent photographs were taken at 10°, 20°, 30°, 40°, 45°, 50°, 60°, 70°, 80°, 85° and 90°. All angles were measured counterclockwise. For any given angle the brown isoclinics obliterated some of the isochromatics, but as the positions of the isoclinics changed with the angle of rotation, the isochromatic fringes obliterated at an angle of 40°, let us say, might be fully visible at an angle of 60°, because of the movement of the isoclinics and the immobility of the isochromatics. Thus the series of colour photographs served to give both the isoclinics and isochromatics. The photographs were developed as transparencies and were later projected full model size on a screen for analysis.

In contrast to this photographic procedure is the one followed when the normal photoelastic equipment is employed. The model is first photographed using black and white film with the quarter wave plates in position. These plates eliminate the isoclinics and so only the isochromatics are recorded. Then the quarter wave plates are removed and black and white photographs are taken at various degrees of the analyser and polarizer, as described for colour photographs. This series of photographs records the isoclinics, although in some areas the isochromatics obscure the isoclinics.

The explanation of isoclinics and isochromatics and the description of the two photographic procedures serve as a basis for the consideration of the four optical differences mentioned above. By using white light and recording the fringe patterns on the colour transparencies, the brown isoclinics were distinguished from the green isochromatics. Thus white light and colour film accomplished the purpose of quarter wave plates in separating isoclinics from isochromatics. Collimating lenses were not required because of the large area of light source and because the camera was placed a considerable distance from the model. It is true that the positions of the fringes near the edges of the model were distorted because the camera was not at an infinite distance from the model, but the positions of these fringes were not critical and the distortion was minimized, not only by the relatively long distance between the camera and the model, but also by the refractive properties of the model itself.

Had quarter wave plates and collimating lenses been used, only a small area, about a 4-in. circle, of the model could have been observed at one time because the maximum diameter of a reasonably priced and readily available quarter wave plate is about 4 in., which is also the maximum diameter of a reasonably priced collimating lens. Therefore, with the normal photoelastic equipment a grid of photographs at about 3-in. centres would have been required, which might have taken too long in view of the short life of the gelatin model. It is to be noted that large cellophane quarter wave plates were tried using monochromatic light, but were not found to be optically suitable.

The optical system used in the experiment permitted the entire model to be photographed on each negative, thereby minimizing the time spent in taking photographs and facilitating the study of the movement of the isoclinics which gave an overall picture of the directions of stresses in the structure.

Design of a Gelatin Model

The design of a gelatin model involves the:

1. Proportioning of the ingredients of the gelatin solution.
2. Design of the physical dimensions of the model.

The following points have bearing upon both these problems:

a. Gelatin content and the sensitivity of the model:
Sensitivity in this sense means the number of isochromatics for a given stress difference. Increasing the proportion of gelatin decreases sensitivity. This indicates that a free-standing prism made of a solution of gelatin in which there is a high, say 30 per cent, gelatin content would show fewer isochromatics than a prism of identical dimensions made of a solution of gelatin in which there is a low, say 10 per cent, gelatin content.

b. Gelatin content and the transparency of the model:
An increase in gelatin content results in a decrease in transparency.

c. Thickness of model and its sensitivity:
The sensitivity increases directly with an increase in thickness.

d. Maximum number of isochromatics which can be distinguished:
The maximum number of isochromatics which can be distinguished using white light is about nine, for monochromatic light about 15. The number of isochromatics depends on the factors mentioned in Points a, b, and c, and also upon the maximum principal stress difference which exists in the model. This last factor involves the dead weight of the model and also the applied loads and can only be roughly calculated prior to actual testing.

e. Gelatin content and the rigidity of the model:
An increase in the gelatin content results in an increase in the rigidity of the model.

The following example of the design of a gelatin model will help illustrate the above points:

1. Prepare three rectangular parallelepiped prisms of photographic gelatin, distilled water and sodium benzoate, each prism having dimensions of 6 x 6 x 2 in. For one prism use a gelatin content of 10 per cent of the total weight, for another 20 per cent and for the third, 30 per

cent. For all prisms use a sodium benzoate content of about 0.1 per cent. After removing the moulds, place each prism upon a horizontal glass plate which is lubricated with mineral oil. Examine the prisms in a polariscope, with the prisms placed so that their 2-in. dimension is parallel with the light. Determine the sensitivity of each prism by counting the number of isochromatics, the translucency by using a photoelectric light meter and the rigidity by observing the deflection of each prism under a given load. From these three prisms, the gelatin content which is most desirable for reasons of translucency and rigidity can be determined.

2. Assume a certain height and length of a model keeping the thickness equal to 2 in., the same thickness as the prisms. Calculate the applied load against the model if it represents a structure such as a dam; knowing the physical dimensions of the model, and its applied load, roughly evaluate the maximum principal stress difference which might occur in the model. Knowing the approximate value of the principal stress difference and the sensitivity of the most desirable gelatin content as obtained from the three preliminary prisms, the number of isochromatics can be calculated.

If, let us say, a 20 per cent gelatin content is desirable for reasons of translucency and rigidity and the use of white light is anticipated, but the calculated number of isochromatics is below nine, then the following steps or a combination of these steps could be taken to increase the number of isochromatics. It is to be noted that if too few isochromatics appear in a model, the accuracy of the stress calculations suffers from a lack of information of principal stress differences.

a. The number of isochromatics could be increased by increasing the thickness of the model. Such an increase would entail a decrease in translucency.

b. The height and hence the loading of the model could be increased. Such a step to increase the number of isochromatics would result in a decrease in the rigidity of the model.

As illustrated by the above example, the design of a gelatin model involves some preliminary experiments and rough calculations. For the model shown in the illustrations, horizontal and vertical scales were 1/16 in. = 1 ft. for a gravity dam 100 ft. high with foundation depth of 90 ft. The thickness of the model was 5 in., and the sensitivity for a thickness of gelatin of 1 in. was an isochromatic for every increment of stress difference of 0.17 per sq. in. A maximum of nine isochromatics was observed using white light (this value was checked using a monochromatic filter) and the gelatin concentration was 20 per cent by weight.

Limitations of Gelatin Models

One limitation of a gelatin model is that it should be tested within a few hours of its removal from the moulds. Gelatin models suffer severely from the drying effects of the atmosphere which cause shrinkage of the surfaces and consequent distortion. It is possible that by keeping the model in an atmosphere of 100 per cent humidity, the drying might be successfully combatted.

Another limitation is that its thickness causes a diffusion of the isoclinics in areas which are relatively small and over which the principal stresses experience a considerable change in direction. In such areas it is possible that a principal stress having a vertical direction might be almost juxtaposed to a principal stress having a direction 45° to the vertical. In this particular case, if the polarizer emitted light polarized in the vertical plane and the analyser were crossed with the polarizer, then the first principal stress should appear as a dark spot, and the second principal stress should appear as a light spot. However, the thickness of the model causes a diffusion which results in a merging of the dark and light spots so that they cannot be properly distinguished. It should be noted that this limitation has not been conclusively proved, but it has been experienced in specific instances. Its practical significance is that gelatin appears to be unsuited for models having intricate shapes where the principal stresses undergo considerable change of direction over a small area.

A third limitation arises from the problem of obtaining similarity between model and prototype [4]. Unfortunately, Poisson's ratio for concrete differs from that for gelatin and it is suggested that in analysing the fringes to obtain stresses by the "Integration along Straight Line Method"[5] corrections could be made at each integrating step. It is also suggested that Poisson's ratio for gelatin may vary with the temperature in which case rigorous temperature control might prove beneficial.

Conclusion

The gelatin model used in the experiments described in this article revealed the stress conditions in a solid gravity concrete dam having an unusual foundation condition and provided a check of the design of the heavy steel reinforcement which was placed in the dam in the regions where tension stresses were excessive. The dam is at present functioning satisfactorily under its normal head.

Despite the limitations of gelatin models, they have given valuable information regarding stress conditions in statically indeterminate structures in which dead weights are of consequence. It is hoped that this article, in mentioning a special type of gelatin and a special optical arrangement, will be of benefit to the engineering profession.

Acknowledgments

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Induction Motor Torque and its Measurement

by

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The purpose of this article is to discuss the torque characteristics of induction motors, particularly speed-torque characteristics from standstill to near synchronism, and to describe methods of measuring torque.

The torque of an induction motor is generally expressed in most text books as:

$$T = \frac{p\,V_1^2}{4\,\pi f_1} \times \frac{Sr_2}{(Sr_1 \times r_2)^2 + S^2\,(x_1 + x_2)^2} \quad ..[1]$$

In this equation the torque is expressed in watt-seconds per phase. Since one watt-second is equal to $\frac{550}{746}$ lb. ft., it follows that the torque above can be expressed as

$$T = .0586 \times \frac{p\,V_1^2}{f_1} \times \frac{Sr_2}{(Sr_1 + rr)^2 + S^2\,(x_1 + x_2)^2} \text{ lb. ft.} \quad .....[2]$$

where V represents the voltage across the phase group.

If terminal voltage instead of phase voltage is used, then, representing this voltage by E

$$T = .0586 \times \frac{p\,E^2}{f} \times \frac{Sr_2}{(Sr_1 + r_2)^2 + S^2\,(x_1 + x_2)^2} \times n \text{ lb. ft.} \quad .....[3]$$

will represent the total torque, where n is equal to unity for star-connected stators, to three for delta-connected stators and to two for two-phase stators. Of the other quantities in Equation 3, p is the number of poles; f, the supply frequency; s, the slip; r and x the phase resistances and the reactances of stator and rotor, all referred to the stator. Equations 1, 2 and 3 neglect the effect of the magnetizing or no-load current.

When the constants r_1, r_2, x_1, x_2 of a given motor are known, the torque characteristic can be calculated by assuming various values of slip covering the speed range desired; when such results are plotted the curves are smooth and regular. These are sometimes designated as "idealized" characteristics, to distinguish them from the actual irregular characteristics.

Instead of smooth-curve torque characteristics the true torque characteristic often contains irregularities or parasitic harmonics. Some of these are transient in nature, while others remain at fixed values. These harmonics may be in large or small number, and are divided into "time" and "space" harmonics. The former have little effect on the operation of the motor; the latter are the more troublesome. Space harmonics are due to variations in the magnetomotive force and the permeance of the magnetic circuit, because of the number of stator and rotor slots, slot combinations, coil pitch, irregular air gaps, saturation in parts of the magnetic circuit, skew, etc. These harmonics in the speed-torque curve of induction motors produce three main steady state effects; 1) locking at starting, 2) sub-synchronous rotor crawling, 3) synchronous operation at sub-synchronous speeds.

In addition to what might be termed "fixed" or "steady" state harmonics that appear in the speed-torque characteristics, there are transient values which show up when the stator is energized, particularly at starting or on plugging. There are instances where an induction motor has been applied to drive a load with large inertia, and where trouble has been experienced with shafts, apparently due to high starting torques. Investigation might reveal that the starting torque of the motor, observed in the usual way, appeared to be of too low value to cause the trouble.

A transient starting torque may exist which may be many times the nominal starting torque. The condition may be still further aggravated when the line contactors do not close simultaneously on all three motor leads. Another difficulty arises when the natural torsional frequency of the rotor, coupling and connected load is relatively large and approaches the supply frequency.

Several methods are in vogue for the measurement of motor torque. Possibly the best known consists of using some opposing forces to balance the motor torque, and determining the torque from these known forces. For example, an arm

This paper describes a new and easy method of measuring the torque characteristics of induction motors. The results obtained check well with those of other methods and available in a much shorter time, so that the new method should have a wide appeal. The illustrations have been taken from a paper presented by Mr. Chirgwin to a meeting of the American Institute of Electrical Engineers.

resting on a scale or spring balance and fixed rigidly to the shaft, can be a simple method of measuring steady state or nominal values of starting torque.

When measurements are desired with the motor running, the general method is to balance the motor torque against a dynamometer torque which can be readily determined. If a speed-torque characteristic is desired over a wide range of speeds, a disadvantage of the dynamometer method is that it requires running the motor under test at some low speeds. This results in rapid rise of motor temperature and consequent change in its characteristics, so points at low speeds are likely to be unstable and difficult to measure correctly.

The same criticisms apply to running the motor against its field to obtain torque measurements at slips greater than unity. A test for torque over a wide range of speeds by the dynamometer method thus requires a long time. As the method is one of observing point after point, care must also be taken that exceptional features of the characteristic are not missed.

A method of a different type depends on determining the torque by noting time-intervals required to accomplish measured speed changes. In this method the motor is started from rest, and simultaneous readings of speed and time are taken, generally on graphic recording instruments. The WR^2 of the motor rotor or connected load is known or can be calculated and the torque is obtained from an equation such as

$$\text{Torque} = \frac{WR^2 \times \text{change in r.p.m.}}{308 \times \text{time required to accomplish the speed change}} \quad [4]$$

The torque will be expressed in lb. ft., when WR^2 is expressed in lb. ft.^{2} and the time expressed in seconds. By dividing the total time of acceleration into small intervals and by noting the change of speed during these intervals, the torque curve can be plotted from standstill to synchronism. This method gives a fairly accurate picture, but requires the observations mentioned above and the subsequent calculations.

Another method is one which has been used with success by the English Electric Company of Canada, Limited, in the last two years or so. It was looking for some way of observing torque characteristics quickly, not that it was primarily interested in actual values of torque, so much as in the relative values of its several parts. It finally adopted the method to be described and has been particularly well satisfied with it, as it can be adopted to indicating transient as well as normal torques. Furthermore, the test is completed in a few seconds and testing with full voltage on the motor is standard procedure. The apparatus is simple to use, there is little to go wrong, and no calculations nor plotting are needed in arriving at the final torque versus speed curve.

In this apparatus the motor being tested is allowed to accelerate against no load. Under these conditions practically the whole of the torque output of the motor is used

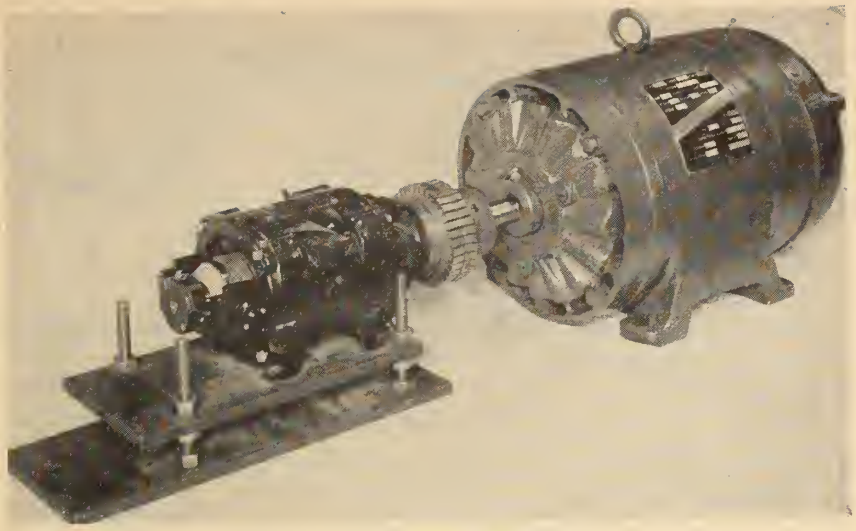

Fig. 1a. Motor and tachometer.

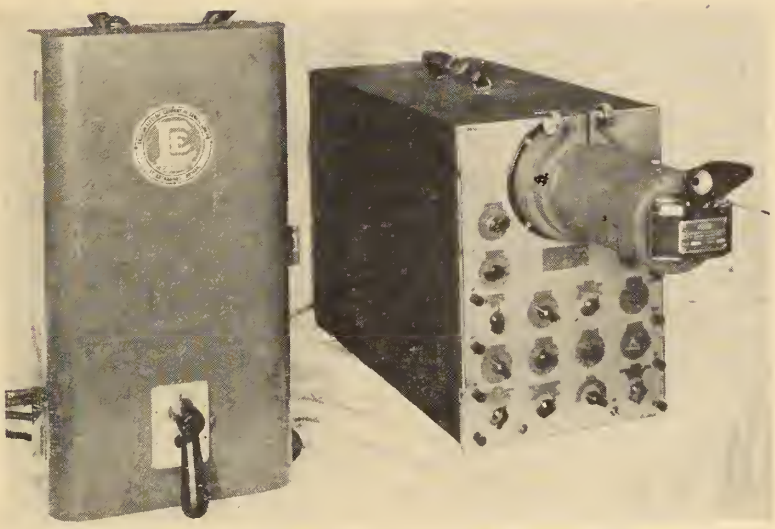

Fig. 1b. Controller (left), oscillograph and camera.

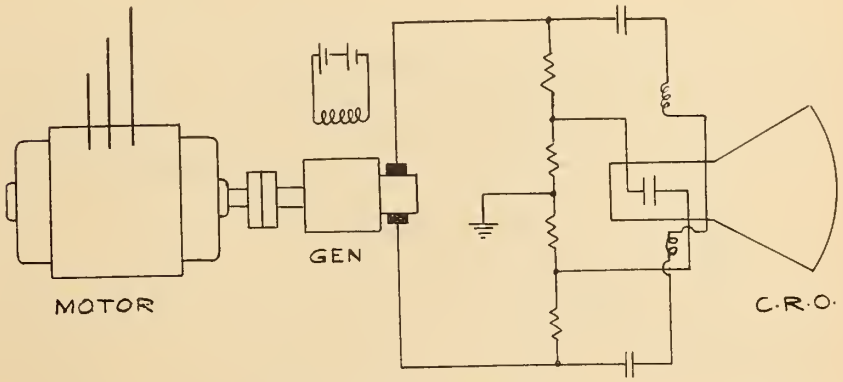

Fig. 2. Circuit diagram.

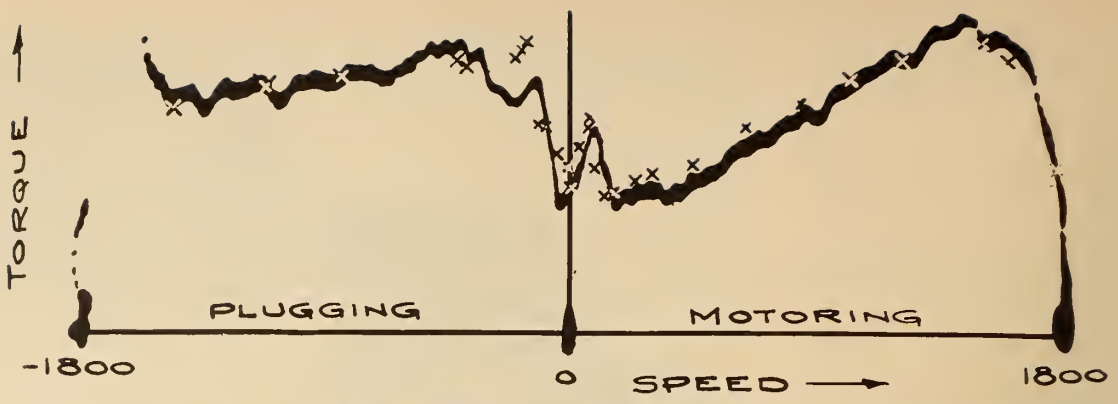

Fig. 3. Curve showing experimental verification of the apparatus. Points *X* from dynamometer readings.

to accelerate the rotating parts. This acceleration may therefore be used as a measure of the motor torque.

The apparatus makes a continuous record of both speed and acceleration of the motor, as it comes up to speed. These two quantities are plotted one against the other on a cathode ray oscillograph. A photograph of the oscillograph screen gives a permanent record of the torque versus speed curve of the motor. The two axes are also recorded on the same photograph.

The motor under test is direct coupled to a small d-c. tachometer generator which is excited from a battery. The output voltage of this generator is used to detect both the speed and acceleration of the motor. It is fed through a control mechanism and coupling circuits to a cathode ray oscillograph; and a camera is used to photograph the screen of the oscillograph. (See Fig. 1.)

Figure 2 shows the coupling circuits. The voltage from the generator is fed through a resistance voltage divider directly to the deflecting plates of the oscillograph to produce a horizontal deflection of the trace proportional to the speed of the rotation of the motor. The same voltage is also applied to a capacitor, divided into two sections to preserve symmetry with respect to ground, the function of which is to differentiate the voltage. The current flowing in the capacitor is fed through magnetic deflecting coils on the oscillograph to produce a vertical deflection of the trace proportional to the acceleration and to the torque of the motor. The combination of these two deflections produces the torque-speed curve.

The control mechanism consists of a reversing contactor to plug the motor, and a number of auxiliary switches to suppress either deflection of the oscillograph.

The operating handle of the controller has four positions. In the first position, the apparatus is off. In the second, the motor accelerates to full speed forward, the speed deflection is suppressed and the spot traces the vertical axis. In the third position, the motor is plugged, so that it decelerates to zero speed and then accelerates to full speed backwards, the torque deflection is suppressed and the spot traces the horizontal axis. In the last position, the motor is again plugged so that it decelerates to zero speed and then accelerates to full speed forward, both deflections are in operation and the spot traces the torque-speed curve for both the plugging and motoring regions.

This repeated plugging of the motor is used, first, to avoid having to wait for the motor to coast to a stop between positions of control; and second, to provide the whole of the plugging region for torque transients to die out, so that the curve passes through the zero speed point at its steady state value. This is important, as the steady state value of the start torque is usually of interest and this is the point used to calibrate the torque scale of the curve.

Experimental verification of the apparatus has been carried out. Figure 3 shows good agreement between the photograph of an oscillograph curve and points obtained from a dynamometer test on the same motor.

The apparatus described has been used extensively and has proved itself to be reliable and versatile. It is so easier and quicker to use than previously available apparatus that there have been many opportunities for test and investigation that would otherwise have been ruled out on account of time and cost. Some of these investigations, such as high plugging torque, have been in areas relatively unexplored and offering scope for further study.

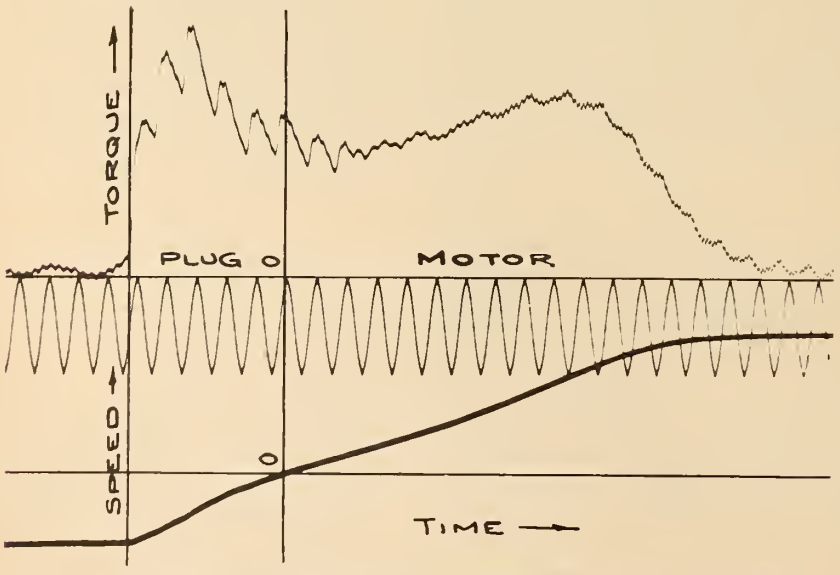

Fig. 4. Curve showing transient torque pulsating at supply frequency.

"Progress of Engineering Science" Part 1

From the London Quarterly Review,
October, 1863

ART. I.—1. *Lives of British Engineers.* By Samuel Smiles, 3 vols. 8vo. London, 1862.

2. *Proceedings of the Institute of Civil Engineers*, 1842 to 1863.

3. *Sir W. Armstrong's Address delivered at the Meeting of the British Association at Newcastle*, 1863.

Among the various definitions which have been proposed, in order to distinguish man from the lower orders of beings, few are more characteristic than that which describes man as a Tool-using animal. Whatever powers other animals exert, or whatever functions they perform, are due to the strength of their teeth, or claws, or to the adaptability of some member, which they inherited with their birth, and which is an essential part of their being. On the other hand we nowhere find man so uncultivated, that he cannot use a club or spear, and we very rarely find him unable to twist a fibre into a thread, or unable to use a bow and arrow. The latter, in fact, is a tool of no mean complexity, and requires, on the part of the individual using it, longer practice and more skill than need be developed by the man who tends the most complicated machinery in our modern factories, or who guides the gigantic powers of our largest steam engines. The essential difference is that the tool of the savage is the product of his own hands, and its successful exercise depends on his own individual skill, whilst the factory of the civilised man is the result of the combination of thousands, who have aggregated their experience in inventing it, and united their energies to work it.

There is still another definition which is as characteristic as that just quoted, though it has not yet found its way into books. This would describe man as a Road-making animal;—understanding by this, not the path which an animal wears with its feet as it goes from its lair to the feeding-ground; but those organised means of communication, by land or sea, by which a man seeks to barter the special results of his own industry for those of other men; and which enable every country to interchange its products with those of every other climate and soil.

These two definitions are worthy of far more attention than they have hitherto received, inasmuch as they practically are the foundation of the modern science of engineering. It may be that we, living in the midst of progress, and being as it were part of the great work, are not aware of the importance of the changes that are taking place through the instrumentality of this, the youngest of the professions; but it is not too much to say, that the invention of the steam-engine, and its application to the various arts and manufactures, are as important to mankind as the invention of the printing-press was some four centuries ago. What printing did for the intercommunication of ideas, and the development of intellectual power, steam is doing in increasing the material well-being of mankind: and in bringing together all the nations of the earth, so that none can now remain much longer strangers to the other—and all may unite for any purpose, good or evil. It is no hyperbole to say that already, within the last hundred years, the engineers have doubled the mechanical power, and more than doubled the productive resources of mankind; and they have reduced the dimensions of the globe, measured by time, to less than one-fourth of what they were in 1763.

India can now be reached in a month; China and Australia, in six weeks; and if a line of steamers were established, *via* Panama, a man might go round the world with ease in three months. But these are only the beginnings; we all know that, in a very few years from this time, there will not be an important port on the face of the globe which may not be reached from London in

October, 1863 — Queen Victoria has recently celebrated the twenty-fifth anniversary of her accession, the American civil war is at its height, Confederation is nearly four years from birth, and the "London Quarterly Review" publishes an article on the "Progress of Engineering Science" by an unknown author.

At first, we thought of trying to digest this article, with frequent quotations, but have come to the conclusion that the flavour of the original would be wholly lost by any interference with its continuity and so have decided to publish it in full in four instalments. We hope our readers may enjoy as much as we have the relaxing rhythm of the writer's Victorian prose, the profundities of his rhetoric, his prophecies — right and wrong — his comments on current engineering projects and his breathless admiration for the engineers of his day.

To turn the author's pounds sterling into 1953 Canadian dollars, multiply by fourteen.

the short space of one month,—and very few with which there will not be telegraphic communication. When all this network is once fairly established, it is impossible that any nation can remain segregated from the rest; and when a thousand millions of human beings come to take an interest in each other's affairs, and can combine to influence one another or to effect any given object, the results must be such as have not yet been dreamt of in our philosophies.

There were of course engineers in all ages of the world, but their efforts were sporadic, and the value of their works depended upon the cleverness of the individual more than upon the advanced state of the science; and it is only within the last hundred years, that the professors of engineering have attained that organisation without which nothing great can be done. It is only within the same period, and only among the more civilised nations, that people have been prepared to spend the enormous sums of money which have been required to effect the progress that has already been made.

There are still many village communities in not very remote parts of the globe, where the shepherd and the husbandman share with the carpenter and blacksmith the produce of the soil, or the result of their skill or industry—microcosms, where men live nearly as unprogressive as the Anthropoids, and little raised above them in intellectual development, living and labouring only to supply their immediate material wants, and dying only to be forgotten.

Among these the engineer has no place; but gradually the stagnant pools of intellectual sleep are being drained, and mankind are being formed into larger masses. In former years this was effected by the rude but ready mode of conquest, or of pilgrimage—Alexander's glorious raid did more to bring the East and West together, than had been effected by the trade of the Egyptians or Assyrians; and it paved the way for the more systematic conquests of the Romans, who nearly united all the known world into one great empire. When that broke down, as sooner or later all systems based on violence must, it was the Crusades that first awakened Europe from the torpor and isolation of the dark ages; and the pilgrimages to the shrine of St. Peter at Rome, or to the Caaba at Mecca, prevented the two great families of mankind from resolving themselves into a multitude of incoherent atoms. During the last three centuries the tendency has been to combine mankind into a certain number of larger empires; but to define these by strictly marked boundaries, and to prevent intercommunication by custom-house and police regulations. Steam and rail are now tending to sweep away these barriers, and to fuse all the families of the earth together.

This is not the place in which to speculate with the sanguine whether war and international jealousies will cease through this better knowledge and greater familiarity of men with one another, or to attempt to prophesy with the desponding, the greater evils that may arise from this gathering together of the nations. Nothing but a frightful catastrophe, of which we have no suspicion, can now stop the progress of road-making or the development of manufacturing industry. But, accepting that progress and that development as facts, it is well to endeavour to trace how and why the impulse was given, in order that we may more clearly see the direction in which the movement is tending.

The mechanical engineer naturally takes precedence of his road-making brother—in point of time at all events—inasmuch as it requires only one man to make or use a tool, and it requires many to make a road or build a ship; and man's progress in all material or useful arts is measured much more by his power of combination, than by his individual intellectual development. There are besides certain accidental aids placed at man's disposal, which he availed himself of at a very early period. We can hardly go back to the time when the hunter and the shepherd had not enlisted the dog to assist him in watching his flocks or in capturing game; or even to the time when the patient ox had not lent his assistance to draw the plough and to thrash out the grain. It was only at a much later stage that the less domestic horse was broken in to work for man, though he became, until the invention of steam, the most useful and the most versatile of all the assistant powers which man had borrowed from nature. He not only did all the work that had formerly been performed by the ox, but carried his master in war or the chase, bearing him or his goods on long journeys by land, or dragging waggons or coaches when roads were made, and turning mills for almost every kind of manufacture. Horse-labour, however, is expensive, and horseflesh heir to many of the ills of humanity; so wind and water were early enlisted to assist it—how early we hardly know—on land at least. On water the wind was in very ancient times entrapped to fill the sail and waft the frail bark of the savage across the lake, and afterwards even on the ocean, and it has since the invention of a keel and the increase in the size of ships done an amount of work in the carrying line far greater than could be done by all the horses in existence. On shore, however, its services have been far less readily available. The most obvious way of using it would evidently be to construct a machine like the paddle-wheel of a steamboat, and encasing one half of it, to allow the wind to act on the other half. This has been frequently tried, but the exposed surface is so small, and the resistance of the enclosed part so great, that practically a sufficient amount of power cannot be obtained without a great expenditure of means, or unless it is blowing a gale of wind. A far more practical mode is the ordinary screw-mill, which is one of the most ingenious inventions of modern times, though when it was invented, or by whom, is by no means clear. We pride ourselves somewhat on the application of the screw to the propulsion of ships, but the employment of the same instrument to turn a mill, was a far more difficult and less obvious problem, the one being the exact converse of the other. In the wind-mill the passing air acts on the blades of the screw, and its force is transmitted to the circular mill which it works. In the ship the mill turns the screw, and its action in a fluid at rest forces forward the body containing the machine. Nothing can well be more ingenious than this mode of applying the power of wind; but then calm days frequently occur when the work is most wanted; or gales supervene when it is dangerous to loose the sails, and then all connected with the mill must remain idle. Thus uncertainty is the real defect of wind-power, which no ingenuity can overcome, and which will consequently, in spite of its cheapness, always limit its usefulness. Notwithstanding this a great deal of corn is ground in many parts of the world by wind-power, and much water raised in Holland and other low countries by its agency; but it is too uncertain for the great combinations of manufacturing industry, and therefore will probably never be developed to a greater extent than at present; in fact, it may fall into disuse as other powers become cheaper and handier, in

consequence of their more regular and consequently more economical application.

If, however, there is no great scope for mechanical ingenuity, and no great power to be obtained from so impalpable and so uncertain an element as wind, water forms a far more stable and more tangible agent for assisting man in his labours. It is uncertain how far the Romans ever used water as a power. If they had mills, they were probably only wheels supported on two boats anchored in the current, such as are seen on the Rhine or Danube at the present day. To throw a dam across a stream, and conduct a regulated quantity of water to a fixed wheel in a house, required a mechanical organisation which the Romans had not apparently reached, and may also have been unsuited to the 'fiumaras' of Italy. Very early, however, in the Middle Ages, corn-mills became common on the more constant streams of Northern Europe, and soon superseded hand-grinding as completely as the spinning-frame and the power-loom have done away with hand-spinning or weaving in this country. At the present day an immense quantity of hard work is done by water-wheels. Some of vast diameter have been erected where the fall of water is great, and others of great breadth where the stream is heavy and the fall small. Practically almost all our corn is still ground by water-power, and a great deal of forging and many mining operations are carried on with its assistance. The great inconvenience is that in most cases the manufacture must be taken to the power, as local circumstances generally prevent the power being conveyed to the spots most suitable for its application. The convenience of transport and the facility of subsistence generally limit the localities of large centres of manufacturing industry to fertile plains, and in these water-power is seldom available to any great extent.

Recently a new application of water-power has been effected by the inventive genius of Sir W. Armstrong. He first applied it at Newcastle, where the general level of the town is very much above that of the wharves of the harbour, and the waterworks in consequence provided a very tall column of water at the lower levels. Of this he availed himself by applying the pressure so obtained to force a piston along a watertight cylinder, and with a simple multiplying gear the cranes on the quays were made, by the mere turning of a cock, to raise any weight their construction could support. By applying the water-power alternately on both sides of the piston, and acting on a cranked axle —as done in the steam-engine—a water-engine was next invented, capable of exerting any amount of power that could be obtained from the height of the column of water and the amount of supply. When a sufficient head of water is available, or where the work is intermittent, this is certainly one of the most successful applications of water-power yet invented. At Great Grimsby Dock and at Birkenhead pipes are laid under the pavement from a reservoir at the top of a tall tower, to every part of the dock premises. At the foot of every crane, under the piston of every hoist, at every dock-gate, unseen and noiseless the power lies dormant; but a woman's hand applied to a small handle will set in motion a force sufficient to raise a mass weighing fifty or one hundred tons, and either to place it in the hold of a ship, or deposit it in any spot within reach of the arms of the crane. With equal ease the gates of locks one hundred feet in width are opened or shut, and the smallest as well as the heaviest works of the dockyard done without a stranger being able to perceive what it is that sets everything in motion.

As an accumulator of power Bramah's hydraulic press surpasses anything that has yet been invented, and may be carried to any extent that the strength of the metal will stand. The presses which were used to raise the tubes of the Menai Bridge when worked by a 40-horse power engine were capable of exerting a power equal to that of 14,200 horses, and raised one-half the tube, of 900 tons, slowly but steadily, through the 100 feet at which they were to be placed above the level of the water.

Air is, perhaps, too elastic to be ever practically used as an accumulator, but as a transmitter of power it nearly succeeded in the Atmospheric Railway in superseding the locomotive, and might have done so if engineers had been able to make a durable air-tight valve; and if they ever do so now it may again come into play. In the meanwhile a most ingenious combination of the working and transmitting power of air is employed to carry out the great tunnel through the Alps, which, without its aid, would be difficult in the extreme.

The tunnel under Mount Cenis is to be rather more than seven miles and a half in length, and as it is one English mile below the summit of the mountain, no air-shafts could be sunk from above; and the first difficulty was to ventilate a cul-de-sac that at one time, at least, must be nearly four miles in length. This has been accomplished most successfully by M. Sommeiller the engineer, availing himself—on the Italian side—of a stream of water eighty feet above the mouth of the tunnel. This is used to force air into a chamber, where it is kept at a constant pressure of six atmospheres by a stand-pipe 165 feet (50 metres) in height. From this it is conveyed in pipes to the innermost end of the excavation, where it is set to work to bore holes in the face of the rock for blasting purposes. There are eight perforators, each of which sinks ten holes three feet deep in the face of the rock in six hours. It takes some time to dry each of these, and to charge it with gun powder; and it takes four hours to clear away the débris and to make all ready for commencing another set of perforations. So that practically only two sets are bored in twenty-four hours, and the progress is consequently six feet per day. At each blow on the head of the jumper a portion of the compressed air escapes, as steam does in a high pressure engine. Its expansion is sufficient to cause a draft outwards, and keep the place perfectly ventilated; and even immediately after a blast the tunnel is freed from the products of the explosion very rapidly, and no inconvenience felt. By improvements in the machinery the engineer hopes to bore one set of holes in eight hours; and as the more work it does the more air it blows off, not only will the work be expedited, but the ventilation improved by the more rapid working.

There are numberless other methods by which air and water can be and are applied either separately or together, according to the locality or the nature of the work to be performed. They are invaluable assistants in mechanical operations as transmitters or accumulators, and when certain mechanical difficulties are conquered, will no doubt be much more used for these purposes than they have been hitherto; but as workers they are daily sinking into insignificance as compared with steam, which, whether used for locomotive purposes at sea or on land, or in stationary engines, bids fair to perform most of the heavy work of the world.

Without doubt the invention of the steam-engine is the greatest mechanical triumph which man has

yet aehieved. The use of horse-power, or of wind or water, was merely catching a portion of those forces which were already in motion on the face of the earth, and putting them into harness in order to extraet as mueh work out of them as their inconstant nature would admit of; but the steam-engine owes its power to forces which were absolutely dormant till called into action by proeesses in its own interior, and which ean be stopped or regulated at the will of those who have eharge of it. The nearest approach to sueh an invention before its time was that of gunpowder. It showed great cleverness to eollect certain substances and mix them together, to put them into a retort, and then, by raising their temperature, eause them suddenly to expand, so that they should strike a blow on a pieee of metal with such force as to send it in a certain direetion through the air. All this was very like what is done in the steam-engine, but it has hitherto been ehiefly used to destroy man and his works, and it is by no means elear how it can well be used for any less violent purpose. It, no doubt, has had a wonderful effeet in arousing the energies of man, and foreed him to exertions which have had the most benefieial effect on advaneing his eivilisation. But a counterpoise was wanted which should be as essentially productive as gunpowder was destructive. This has been found in steam. Although the invention of a praetical engine is hardly more than eighty years old, and it is little more than half that time sinee its real value eame to be appreeiated, the mode in which engines have been multiplied and improved during the last forty years, and the thousand new purposes to whieh they have been and are daily being applied, is perhaps the most extraordinary fact in the industrial history of the world. It eertainly is the one, the magnitude of whose results we are the least able to grasp.

One of the greatest advantages of the steam-engine, besides the power of placing it anywhere, is the wonderful flexibility with which it can adapt itself to almost any work it is set to perform. The difference between an elephant and a race-horse is not greater than between a Cornish pumping-engine and an express locomotive. The perfection of the former arose from the necessity of importing every ounce of fuel to be used in Cornwall, and frequently of carrying it for miles over bad roads. This set engineers calculating how fuel could be saved, and with such success, that at one time a pound of eoals did twice the quantity of work that it did elsewhere, though this difference is fast vanishing now.* To any one aecustomed to the noisy aetivity of most marine or manufacturing engines, nothing ean be more remarkable than the sleepy quiet of those of Cornwall. The fire-bar area is so great, and the boiler arrangements so roomy and so carefully appropriate, that all the fuel and all the smoke are consumed, and none issues from the chimney. In the engine-room nothing is seen but one great cylinder, hooped with wood, and looking more like a beer-vat than a part of an engine, and almost as eool to the touch. A few slender bright rods extend from the roof through the floor, and to these are attached some delicate bright handles, of rather faneiful forms, but these suffiee to open and shut its valves and to regulate its expansion. As the stranger enters, all is quiet and at rest; no burst of smoke, no smell of oil, no escape of steam, and no noise; presently there is a cliek-elick among the handles, the great beam lazily raises itself and lifts 100 or 200 fathoms of heavy pit work some ten feet upwards, and then as quietly drops it again into its place. Having done this giant's work it goes to sleep again for ten to twenty seeonds, as the case may be, till ealled upon to make another effort. This it repeats at stated intervals during the whole twenty-four hours, week after week, or for months together, without rest or intermission.

Contrast this with the express engine, rushing past at a speed of 50 or 60 miles an hour, making 1000 or 1200 pulsations in a minute, eonsuming eoals with reekless wastefulness, and easting its vital heat and life's blood to the four winds at each beat of its valves. Nothing that man has done eomes so near to the creation of an animal as this—even the most unimaginative can hardly help drawing comparisons between the steam-horse and his quadrupedal competitor. There is indeed more in the comparison than appears at first; especially when we see the monster fed with great spoonfuls of cooked blaek vegetable food, from which it evolves its vital heat in its capacious lungs, whieh, after circulating through its tubular veins, is launched into the air with the waste products of combustion.

The point in which the comparison fails is, that while all of Nature's creatures elaborate within themselves sufficient intelligence to feed themselves, and perform all the functions for which they were created, man's engines, without the direct and constant aid of his hand and intelligence, become mere complex masses of iron or of wood, as dead and as useless as if resolved into their original ores or earths, and buried again in the recesses of the mountains. The steam-engine might be, and probably will become, more like an animal yet, but nothing has been done for the sake of imitation: everything has grown out of use, and for once, too, man has conceived what nature did not even suggest, for among all the myriad forms of life none has been detected progressing on wheels with cranked axles. In this, as in most things, the steam-engine is strictly original, and, strange to say, no new principle has been invented since Watt left it, and no new form added which he did not at least foresee. The immense progress that has been made sinee his day has been due to the daily growing perfection of workmanship, and more perhaps to the careful adjustment of every part, and of every engine to the exact special work it has to perform. The progress is practically due to the knowledge which is obtained by the daily experience of those who watch the working of all these engines, from those which make three strokes in one minute, to those that make 1,000 in the same time, as well as all the intermediate grades between these two extremes, which are hourly performing every class of work under the most completely various eircumstanees.

There does not seem to be any theoretieal limit to the size of a eylinder of a steam-engine, or consequently to the power that may be given to it, but, praetically, it is generally found more expedient to use two or more engines to do a given amount of work than to increase to any very great extent the power of one. Pumping-engines with cylinders 100 inches in diameter, and with 10 feet stroke, are eommon in Cornwall, and those used to drain the Haarlem lake were 144 ineches in diameter; and in the 'Warrior' and 'Achilles' the pair of engines are nominally 1,250 or 1,300-horse power, but really work up to 5,000 or 6,000-horse power.

(*Continued on page 1449*)

* The usual duty of a Cornish engine is one million of pounds raised one foot high for every pound of coal consumed. According to Sir W. Armstrong the average duty of engines of all classes is not more than one-third of this.

Exporting Capital Goods

by

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In Canada in the last ten years, technical development has progressed amazingly and Canadian organizations have pioneered much of this activity. In fact there are a number of leading professional service companies capable of making analyses and reports on a proposal that ultimately becomes an economic development. Such action is normally followed by the manufacturer of equipment.

In spite of this, Canada imports each year millions of dollars worth of professional engineering services. The reason is not lack of opportunity for Canadian professional firms but almost entirely lack of process knowledge for the preparation of flow charts and for the design and development of large equipment for production. In some fields, however, Canadian organizations are as competent as any to undertake engineering work and basic process development right through to completion of construction and turnover of plant. This is especially true of pulp and paper, hydro-electric power, base metal mining, canals and transportation and harbour terminals. Canadian organizations have specialized in aerial, geophysical and geodetic surveys and in forest management, but most of these projects have been undertaken in Canada.

Demand from Foreign Countries

The Colombo Plan has stirred up interest among Canadian engineering industries and constructors generally in the need for engineering and capital goods in foreign countries. It therefore seems timely to re-examine the position of the capital goods industries and the services which they may have to offer in fostering foreign business. Among the factors which affect their prospects are technical capacity, competitive pricing, and access to finance. There is a tendency for capital goods exports and foreign investments to go together. Even where this does not hold true, dollar scarcities may continue to be a problem for Canadian export and engineering services, except in hard currency areas, or where the United Nations agencies are providing the finance. However, Canadian capital may be interested, in whole or in part, in certain types of projects.

Experience in several countries proves that engineering "know-how" has become a valuable export—and indispensable to increased sales abroad of capital goods. (Reprinted from "Foreign Trade", Ottawa, March 14, 1953.)

Association of Companies Needed

Experience has shown that the individual specialty consulting organization is not the type of engineer needed for export business. It requires rather a consortium of responsible companies to look after engineering, construction and erection. One organization of this type—the first of its kind for Canada—has already been formed here. Already it has undertaken an assignment outside Canada, an important project that will benefit Canadian industry to the amount of nearly six million dollars.

Because of the needs of the defence program, little has been done towards developing this type of service for export in the last two years. But if we are to compete in the export market, we must have a consortium of companies organized to meet this situation. Foreign inquiries for plant equipment seldom include prepared drawings and specifications. Often they originate in countries without facilities for design and development and the pattern of the tender calls for not only the sale of blueprints and economic and engineering surveys, but for the shipment of tailored plants and machines, erection, supervision in initial operation, and the training of foreign experts.

Exporting Technical Knowledge

Exports of technical knowledge almost always go hand in hand with exports of materials and equipment. Once the technical knowledge has been exported, it will bring recurring orders for products, spare parts, replacements and additional equipment. Technical assistance is exported primarily to nations which are industrializing—some of these nations, especially in Latin America, at a rate comparable to Canada's. It is in this part of the world that Canada has designed, built, shipped, erected and supervised in the early stages large hydro-electric installations. This policy of foreign investment in recent years in Latin America has not only paid off in substantial dividends, but has also brought to Canadian industry orders worth millions of dollars.

In the United States technical knowledge is now a leading export, exceeding $500 million a year. Literally hundreds of large industrial plants abroad, now in operation,

have been built and supervised for a time by American engineering firms and manufacturers. The Americans describe this commodity as "know-how" and the variety of enterprises making up know-how exports is astonishing. These projects range in value from a few thousand to many million dollars. Other American engineers and firms are selling their skills to private companies and to foreign governments striving to modernize and expand their industries.

British Experience

British engineering firms have had experience all over the world and their work is perhaps more diversified than that done by engineering firms of any other country. Their achievements can be seen practically everywhere and include dams and reservoirs, hydro and thermal electric power stations, water supply, irrigation and sewerage schemes, steam and electric railways, harbours and docks, structural work for large buildings, chemical and other industrial plants. A number of British organizations are today carrying out important work both for governments and industrialists in many countries—and they fully understand why the services they have to offer are becoming increasingly necessary.

This is an era of specialization and advice must be obtained from companies which specialize in a particular field of engineering. There are three main divisions — civil, mechanical and electrical — but within these three are further degrees of specialization. Some of the larger firms cover practically the whole field of any one of the main divisions but if so, they contain a number of special departments. Modern engineering is far too complex for any one person, or a small number of people, to have completely up-to-date knowledge of every branch.

Investigating New Developments

In its report for the year 1950-51, the Department of Scientific and Industrial Research in the United Kingdom said: "It appears incontrovertible that, if we are to advance or even to maintain our industrial position, we must as a nation aim at such developments in scientific and industrial research as will place us in a position to expand and strengthen our industries and to compete successfully with the most highly organized of our rivals." This view is still sound.

Many factors are involved in the creation and maintenance of the manufacturing activity of a community. But in these days of scientific development, the practical application of the latest advances, and investigation leading to new ones, become of first importance in building up and sustaining industrial leadership. The British people realize that the way of the exporter is not easy, that the seller's market of the last seven years has gone and that competition has intensified.

It was British engineers who created the steam engine and the first textile machine and who pioneered in the use of coal in the production of iron. As a result of the steam engine, British mechanical engineering received its greatest stimulus, the great railway boom which followed. When the rest of the world wanted railways and docks, Britain was ready with the plant, the experience, the capital and the skill to supply them.

One of Britain's main contributions to engineering recently has been the jet aircraft engine. The United Kingdom holds world patents on it and receives substantial royalties from countries now making this type of engine under licence.

German Engineering Achievements

In Germany, the most important early developments in engineering practice were in the mining and metallurgical industries. The first steam engines outside of the United Kingdom were built in Germany and the rapid increase in the use of steam power was the greatest single factor in the development of industry in the first half of the 19th century. Among important German contributions to railway engineering was a locomotive built in 1904 which attained a speed of over 90 miles an hour. In 1925 Germans produced the first high pressure locomotive using a boiler pressure of 900 pounds per square inch and in 1927 the first turbine-driven locomotive.

Germany pioneered in the production of steel and at the great 1851 Exhibition held in London, Germany showed a solid, flawless ingot of cast steel weighing two tons—and caused a sensation in the industrial world. Soon afterwards, Germany developed welded steel tires for railway vehicles and made great strides in artillery and weapons of war.

Among other great developments in German engineering during the last century was the electrical industry. The many inventions included telegraphic apparatus, insulation for cables and the principle of self-excitation for dynamos. German engineers played an important part in the development of the internal combustion engine and the principal credit for the development of liquid fuel engines, (more commonly known as "diesels") goes to German engineers. It is unfortunately impossible to draw any direct comparison between the German engineering industry and those of Great Britain and the United States. Germany, however, has been able to reap a rich harvest by systematic development of design and manufacture of plant. This has enabled the Germans to maintain a large and valuable export trade in this field.

Dutch in the Field

Dutch engineering organizations have for many years placed their knowledge and experience at the disposal of other nations. Dutch engineers have specialized in and gained a unique experience of hydraulic engineering. For years Dutch engineering has been sought for dams and reclamation works, harbours and canal projects and, later, for dredging operations in practically every country. The desire of Netherlands engineering companies to export engineering "know-how" has led to the establishment of Nedeco, the central organization for Netherland engineering consultants. Its job is to study, plan and advise on public and private engineering projects in other countries. Dutch experience includes that gained by Dutch engineers in Indonesia and in the West Indies under tropical and sub-tropical conditions.

As early as the 17th century, Switzerland was among the most highly industrialized countries in Europe and today industrial products rank high in the expansion of Swiss foreign trade. The late 16th century saw the rise of industrial activity in Switzerland. This expansion ran parallel to the development of foreign trade. Switzerland built up new industry and expanded old crafts by a policy of taking in French, Italian and Dutch refugees. Switzerland is probably best known for its watchmaking industry introduced by a French refugee, but her present production is by no means confined to watchmaking. By adopting new production techniques and gradually eliminating the domestic crafts and tools, Switzerland introduced the universal engineering production which today characterizes her foreign trade.

Swiss Design Outstanding

The Swiss machine tool industry turns out machine tools that are

second to none and Swiss design in this field has produced outstanding results. Optimum precision is the most conspicuous feature of Swiss machine tool building practice, perhaps the result of long concentration on watchmaking. Swiss machine tool constructors have worked hard to develop special purpose machines for single operations or a combination of operations, and have evolved original and advanced designs.

Swiss name plates are found on large water turbines throughout the world. Turbine designers have constantly improved their designs, perfecting the details and striving to keep as up-to-date as possible. To test their ideas they have built costly research laboratories where qualified engineers, using modern equipment, apply recent scientific discoveries to turbine design. At the turn of the century, when the construction of piston steam engines in Switzerland was at its peak, enterprising and far-seeing Swiss firms were already designing and building steam turbines and diesel engines. Swiss engineers were working on the gas turbine as early as 1909.

In the electrical field, Switzerland builds large generating units of various types and specializes in equipment which, instead of using atmospheric air, employs hydrogen gas for closed circuit cooling. A number of other engineering companies of international repute make a wide variety of capital goods, drawing on Swiss design and development.

Selling Process Knowledge

Norway, Sweden, Denmark, Belgium, France and Italy also have developed highly efficient engineering industries which contribute in varying degrees to their exports. The geographical position of these countries, and their efficient network of waterways and railways, help to make their products highly competitive. They can compete in world export markets because they have been able to offer exclusive manufacturing processes and can make a direct contribution to the economic and technical development of many other countries.

These examples serve to illustrate the value of the sale of process knowledge, not only to the country giving it, but also to the country receiving it. This is a good time for Canadian professional engineering services and capital goods manufacturers to examine the services which they might offer in fostering foreign business in this field. √

"PROGRESS OF ENGINEERING SCIENCE"

Part I

(*Continued from page 1446*)

When more than this is wanted, it may be expedient to divide it, as was done in the 'Great Eastern', between two sets of engines; for it is not only the cylinder, but the crank-shaft, and all the gear, that require to be increased in the same ratio. Although the power of our factories to produce the immense forgings requisite for these purposes has been increased ten-fold within the last thirty or forty years, and is daily increasing, there are conveniences in dividing power, where there is room to do so, that will probably prevent any great increase in this direction.

The whole progress has been, as is usually the case, one great system of action and reaction. The manufacture of larger engines has required improved tools, and more refined processes in every department of iron manufacture, but neither the one nor the other could have been effected to the extent required without the aid of the steam-engine itself; hand in hand they have gone on improving, and improved, till the great steam-engine factories of England and of the Continent are the glory of the mechanical engineer, and present one of the most remarkable triumphs of mind over matter that the world has yet witnessed. Nothing can well be more astonishing than to see a great mass of six or eight tons of iron being forged under the powerful blows of a Nasmyth hammer; or great armour plates, four or five inches in thickness and ten or twelve tons weight, being fashioned under the gigantic rollers now in use. Nor is it less wonderful to observe the planing, slotting, or turning machinery of these factories, fashioning the hardest iron as easily as wood might have been shaped not long ago, and with a precision of workmanship which was not attained in mechanical woodwork till very recently.

To the engineer this perfection of workmanship is more interesting and more wonderful than the Titanic exhibition of power. With Whitworth's gauges and measuring machines, quantities may be appreciated and worked which the human touch cannot feel, and the eye cannot mark, without instrumental or microscopic aid; and any one who has realized what perfection of workmanship it requires in order that a locomotive or a screw engine should pulsate with such enormous rapidity, without loose joints or heated bearing, well knows that this accuracy is no idle exercise of ingenuity, but constitutes in reality the principal source of power in modern engines. With the same dimensions this perfection of workmanship had doubled their effective work as compared with those in the beginning of the century, and is as characteristic of the machinery as of the power that drives it. Nowhere is this more apparent than in all the delicate processes by which the fibres of cotton are sorted out, laid side by side, and finally spun into thousands of gossamer threads, so delicate that even the effeminate touch of the Hindoo can hardly match them; and this is done with an evenness and uniformity which no human hand can rival. Yet all these fairy fabrics are spun and woven by an iron beast as heavy and as strong as fifty elephants, and without any of those delicate organizations which pervade every living being.

In England it is calculated that, when the cotton manufacture is thriving, there are thirty millions of spindles constantly employed in spinning cotton alone, so that if every man, woman and child in the three kingdoms were to devote twelve hours a day to this occupation, they could not effect as much; and it would require another population of nearly equal extent to prepare the cotton for the spindles, and a very large number of persons to supply the place of the 300,000 power-looms that are employed to weave it, and to supplant all the mechanical appliances that finish it and fit it for the market. All this is required for cotton; but when we add to this the amount of power employed in spinning and weaving flax and wool, and all the different classes of fibres which we have enlisted in our service, the power employed in cotton alone sinks to a mere fraction. √

The ASME Boiler Code

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication, in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in future issues of the *Engineering Journal*, of Boiler Code Regulations, this history is here presented in condensed form. It will appear in several issues of the *Journal*, of which this is the second.

II. History of the Period 1924-1931

The 1924 Edition of the Code, described in a previous instalment of this paper, provided for the submission of specifications of materials other than those given in the Code, wherever available. In section II, paragraphs common to all ASTM specifications on inspection, rejection, reheating, ladle and check analyses, and physical tests were covered in paragraphs S-1 to S-4 so as to shorten the printing.

Specifications for boiler rivet iron, staybolt iron and wrought iron bars were replaced by one for Boiler Rivet, Staybolt, and Extra Refined Bar Iron. ASTM specifications for steel pipe, wrought iron pipe, copper plate, copper bars for staybolts, seamless copper boiler tubes, copper and brass pipe were added.

This Edition also dealt with piping and fittings used on boilers, up to the connections of the first valves from the boiler or steam outlets, feed lines, and blow-off lines. A new formula was added for allowable working pressures for lap welded wrought iron tubes, for water boilers and nipples. A table and formula for copper tubes were given. Thickness of steam piping was given by a formula.

Requirements for feed pipes and blow-offs were covered in paragraphs P-24 and P-25. Seamless construction of drums, shells and domes were permitted, while requirements for reinforcing plates for domes were fully given in paragraph P-193. Stays for wrapper sheets on locomotives were now designed in a new manner, as developed for the Code by the American Locomotive Company.

A number of paragraphs on safety valves were recorded. There were practically no changes in the Appendix, beyond adding Rules for Existing Installations (Part II of the 1918 Edition). The volume closed with section VI, Rules for Inspection.

The 1927 Edition

In accordance with the method of revision developed during the period 1924-1927, the 1927 Edition was to be made from addenda published in *Mechanical Engineering*, and thus submitted to the ASME membership. After necessary revision they were submitted to Council.

When approved by Council they became effective and part of the new printing of the Code, with the notation "to be adopted as standard practice". Thus without a public hearing the 1927 Edition was prepared from addenda submitted to Council in 1926 and 1927. This Edition was printed in December 1927, so that control by the 1924 Edition was extended to that date.

In September 1925, the Committee voted that "all revisions that have been reported to have passed the usual ballot, and that have been published in *Mechanical Engineering* and stood for over 30 days without objections, are to be reported to Council for publication as revisions, and issued as addenda for general distribution."

During 1924-1927, the addenda proposed were open to discussion by members of the Committee. When publication brought serious criticism or objections, committee hearings or discussions were held, after which the addenda were approved, modified or withdrawn. By this means the 1927 Edition of sections I, II, Appendix, and section VI were issued in a single volume. The 1927 Editions of sections III, IV, V, and VIII were issued in separate publications, without public hearings.

The 1927 edition of section IV, Low Pressure Heating Boilers, incorporated a number of revisions published on pink addenda sheets approved by Council in the 1923 edition. The important changes included: removal of the 60-inch limitations on the diameter of a steel plate heating boiler, inclusion of specifications for Steel Plate of Flange Quality for Forge Welding and for the Base Metal in Autogenous Welding, the basing of the relieving capacity for safety valves on grate area rather than radiating surface, and formulas for the thickness of copper tubes.

Section V had few changes from the 1922 and 1924 editions. It included gas burner specifications of the American Gas Association, and the form of the Manufacturers Data Report. Section VIII, Unfired Pressure Vessels, incorporated a few addenda on safety valves, shell plates longitudinal rivet joints, stamping, data sheets, strength of

joints, flanges of heads, and a new specification for steel of two grades to be used in welding. No revisions on autogenous welding were included.

A Subcommittee was appointed in January 1922 to prepare Rules for the Care of Boilers in Service (section VIII). The Subcommittee had revised the earlier draft for a public hearing, and had approval of suggested changes from conferring organizations. It requested approval by the Committee for submission to Council, to approve the report for publication.

The Subcommittee had sent the suggested rules to more than 300 interested parties for comments and criticism, and these were considered by the Subcommittee in September, 1925. One question requiring a Committee decision related to intercommunicating valves between pipe systems with steam at different pressures.

Another was on the subject of caustic embrittlement, and was objected to by the Permutit Company, although other associations had given their approval. Evidence was presented that research had shown some cracking, such as was characterized as caustic embrittlement as it was known and experienced in German boiler practice, and that embrittlement of steel had a definite relation to caustic soda concentration. The rules as originally published were accepted by the Committee, however, and approved by Council in January 1926.

These rules were prepared to assist operators of steam boilers in maintaining their plants in as safe a condition as possible. Section I covered Rules for Putting Boilers in Service; Handling Boilers in Service; Handling Boilers out of Service. Section II covered Rules for Operation and for Maintaining Boiler Appliances. Section III gave Rules for Inspection. Section IV contained Rules for Prevention of Direct Causes of Boiler Failure. Section V contained Partial Rules for Installation.

Tests to Destruction

On September 24, 1926, a standard practice was proposed for the conduct of tests to determine maximum allowable working pressure of a boiler or any part thereof, when no rules were given, or when the calculations of it could not be made with reasonable accuracy. The importance of this communication was evident, and a special committee was appointed to study the outline of standard practice, and to report to the Boiler Committee on the most suitable method of applying it to the hydrostatic test of headers and other parts.

Slight changes were suggested, and the revised proposed standard practice was submitted to Committee members. After a hearing and a letter ballot, which resulted in no criticisms, the report was approved for publication in *Mechanical Engineering.*

Unfired Pressure Vessel Code

During 1925, the Industrial Accident Commission of California sought modifications to the Code on Unfired Pressure Vessels, as suggested by their committee, with a view to adoption of section VIII. This was referred in June to the Subcommittee on Unfired Pressure Vessels. The following April the Boiler Code Committee commented favourably on a letter from the California Commission, regarding the proposed tentative revision of the Air Pressure Tank Safety Orders.

The revision provided for examination of welders, a permanent record of their work, and approval of the manufacturer fabricating the welded vessels. Eight-five per cent of the text was identical with that of the original ASME Unfired Pressure Boiler Code. Public hearings were held in November 1927, and after review by S. W. Miller of the Welding Subcommittee, it was announced in December that since in the main, the rules were identical with those of the Code, and with the changes suggested they would be satisfactory to California, no further action of the Boiler Code Committee was necessary.

In January 1925, in answer to objections to the Code voiced by the American Petroleum Institute, the exemption of pressure vessels was allowed for pressure vessels above 600 p.s.i. In September 1925, following requests by the American Electric Railway Association for changes, the Subcommittee on Welding approved the inclusion of Specification ASTM A-89-23T, and recommended that a stress of 8,500 p.s.i. be allowed in Grade B material of 50,000 p.s.i. It also recommended that 8,000 p.s.i. be allowed in paragraph U-82, and that the diameter with 1/8-in. steel plate be increased to 16-in.

Welding Tests and Methods

Late in 1925, the American Welding Association proposed comprehensive tests to secure information on welding, to be conducted by the U.S. Bureau of Standards. The Boiler Code Committee approved the program, and stated the results would be considered in revisions of the Code. Tests to destruction were planned on tanks of 3/8-in. plate, 2-ft. in diameter and 6-ft. long. Interested manufacturers were to supply tanks of various sizes. The testing was to be done under direction of a Pressure Vessel Committee of the American Welding Society.

A special Joint Committee on Fusion Welding for Pressure Vessels was set up in December 1926, by the Boiler Code Committee, on invitation from the American Welding Society, with five members from the Society, five from the ASME, one each from 16 organizations, and three independent experts.

In March 1927, the Interstate Commerce Commission called a hearing on Rules for Welding on Locomotive Boilers. Tentative rules governing the use of fusion welding on locomotive boilers were prepared. In general these rules for new work conformed to the requirements of the ASME Power Boiler Code. During 1927 the I.C.C. prepared Rules for Welding on Locomotives under Federal Jurisdiction, and members of the Subcommittee on Welding were asked for criticisms.

At a meeting in December 1927, a method of arc welding used by the Petroleum Iron Works at Sharon, Pa., was outlined by E. E. Shanor. The Boiler Code Committee requested him to suggest procedure for welding pressure vessels to be constructed by this method. At the same meeting, a welding process used by the Thomas E. Murray Co. was presented. This was described as an electric butt weld resistance process, using currents of 150,000 amperes per square inch in place of the usual 400/500-amps of the Thompson method. Committee members took the view that this method was really one of forge welding, and should come under that section of the Code.

American Marine Standards Committee

A subcommittee of the Boiler Code Committee had been set up in 1924 to co-operate with the American Marine Standards Committee. In March 1926, Dickinson N. Hoover, Inspector General of the Steamboat Inspection Service, suggested a review of all established Codes, with the purpose of preparing a set of rules which would include the best of all, and to make these legal for use of the Steamboat Inspection Service.

The appointment of a co-operating committee from the Boiler Code was made and accepted. At a meeting the same month of Subcommittee 9-9 of the American Standards Committee for the purpose of recommending a procedure for forming an official unified Boiler Construction Code for Marine Boilers, the suggestion was approved of using the rules of the American Bureau of Shipping.

When the final form of Rules for the Construction of Marine Boilers was reported, however, it was found that the ASME Boiler Code had been disregarded, rules of the American Bureau of Shipping and the Steamboat Inspection Service being used. Correspondence failed to bring about any change in attitude on the part of Mr. Hoover, other than to invite criticism by the Boiler Code Committee.

Miscellaneous Activities and Hearings

During 1925, requests from the Babcock-Wilcox Company and the Ladd Water Tube Boiler Co., for approval of changes in specifications for steel used in heavy forged drums, indicated the need for a specification for seamless-steel drum forgings, which was adopted by addenda in 1926 for the 1927 Edition of the Code.

Other applications to the Code Committee during 1926 and 1927 related to testing materials from long butt straps; specifications of a heat resistant alloy for superheater tubes; a specification for sheet nickel for boilers; use of cast aluminum alloy for miniature boilers; seamless steel boiler tubes and the use of Armco ingot iron for low pressure boilers. For these, changes were made in the Code, or the matters were referred to appropriate subcommittees.

A hearing was held in January 1927 of representatives of the American Petroleum Institute, respecting elimination of telltale holes in staybolts on small locomotive boilers used in oilfields. The Committee appointed a subcommittee to consider a form of revision of paragraph P-194, in line with Canadian Interprovincial Boiler Regulations.

The Committee decided there should be no ruling to suit every case, as to the lowest safe water level for the location of fusable plugs from manufacturers of different types of hot water boilers. Statements in section IV should stand, and each special design must meet the requirements of the inspector.

The Subcommittee on Material Specifications recommended for approval in September 1926, ASTM specifications in place of the modified forms used in the 1924 Code for Lap Welded Seamless Steel and Boiler Tubes, Welded and Seamless Steel Pipe, Copper and Brass Pipe, Carbon Steel Castings for Valves etc. for High Temperature Service and Carbon and Alloy-Steel Forgings.

Following a meeting in February 1927 for the discussion of four papers dealing with requirements for dished heads, and their amendments under the Boiler Code Committee, a special committee was appointed to report with special reference to modifications or revision of the rules for the design of dished heads. Another committee, appointed to consider rules on cold flanging, reported in May 1927, giving five requirements based on a very thorough investigation and practical tests.

Period—1928 to 1931

The years 1928-1931 mark the final approval of autogenous welding, now called fusion welding, for the shells and parts of pressure vessels, and for power boilers, low pressure heating boilers and miniature boilers, after long years of endeavour to satisfy demands of boiler fabricators. This slowness in the full recognition of fusion welding was not due to any objections of the Committee to changes in the rules, but was solely because it did not know how to form rules for safe welded vessels when advocates of the different methods could not agree on rules to produce a reliable structure.

In 1930, new editions of sections I, II and VIII of the Code were produced from addenda published between the last printings and the times of printing the new additions. In section VIII the "Recommended Procedure for Fusion Welding of Pressure Vessels" was that upon which the Committee based its belief on safe construction; and in reality it was the dawn of a new day for vessel construction under the Code.

In 1928 a single volume containing all sections of the Code was published, but it was still called the 1927 Edition. Addenda published before the time of printing was included, as well as the specifications for Steel Plate for Forge Welding and Brazing.

Fusion Welding and Forge Welding

The revised and less extensive program for testing welded tanks at the Bureau of Standards, previously referred to in an earlier chapter, required ASME approval. The committee, although approving and realizing the importance of the tests, believed a method of procedure in forming welds, and their inspection, was as important as the knowledge that safe welds could be made. This belief was shared by all members of the Committee, and by its Subcommittees on Welding, Unfired Pressure Vessels, and Heating Boilers.

To one member, S. W. Miller, rules of procedure were paramount. His paper, "The Most Important Thing in Welding", presented before the International Acetylene Association in November 1926, pointed out that "procedure consisted of six elements: design, materials, methods, operators, supervision and tests. Such procedure control in welding had shown its value in many cases, not only in better work, but in reducing costs and increasing production." Mr. Miller suggested that the term "autogenous welding" be changed to "fusion welding". The term was then adopted for the new edition of the sections of the Code.

The Recommended Procedure of Fusion Welding of Pressure Vessels followed very closely the outline of Mr. Miller's paper of 1926. It was intended for application to a vessel to conform to the requirements of the ASME Unfired Pressure Vessel Code, but was applicable to all fusion welded pressure vessels. In April 1928, the American Welding Society appointed a Committee on Welding Code for Pressure Vessels, to study the recommended procedure. This Committee's report was reported to the Boiler Code Committee for adoption at its April 1929 meeting.

Certain amendments proposed therein were voted upon by the Committee, and the report was then referred to the Executive Committee, for study and with power to authorize its publication in *Mechanical Engineering*. This revised "Recommended Procedure" covered the same subjects as those submitted to the Committee of the American Welding Society in April 1928.

Tests

In June 1928, the Joint Research Committee on Welding of Pressure Vessels asked the Boiler Code Committee's assistance in securing co-operation of tank manufacturers in inaugurating a series of tests. Co-operation was promised in April 1929 from eleven companies. The

first set of tests was reported in December 1930, on pressure vessels of light gauge, fabricated by a resistance welding process.

Six tanks were tested under hydrostatic pressure. Results indicated that the welds were 60 per cent stronger than the plate. The strains indicated that the modulus of elasticity was 25,000,000-p.s.i. for the plate and about 15,000,000-p.s.i. for the welds. The pressures at failure ranged between 600 and 1,075-p.s.i. for the five tanks failing. Although the tests proved the reliability of the method, this method of welding was not at this time included in the Code.

In September 1929, a specification was submitted by the Babcock-Wilcox Co., for Electric Arc Welding of Pressure Vessels, based on another series of tests made on seven full-size boilers, and drums 3-ft. to 3½-ft. diameter. These tests indicated the value of the specifications, as well as the suitability of arc welding with coated electrodes, and of riveted joints with steel of high tensile strength.

The form of electrodes was discussed by the Committee, and needs were referred to the Subcommittee on Welding and to the AWS Conference Committee, which expressed the opinion in January 1931 that . . . "it was not practical at that time to specify the chemical composition which should be used in making desirable welds."

The B & W fatigue test, however, indicated the superiority of coated electrodes. The Lincoln Electric Co. had developed an equilibrium curve for welding steel, stressing the composition of parent and filler metals, after an 18-month investigation of weld porosity. Reporting on the curves, in June 1931, the Welding Subcommittee stated that, since use of the curves would require many tests, they could not be included in the Code.

The testing of structures for soundness by X-rays, and its continued use, suggested to the Committee the application of X-rays for non-destructive tests on welded joints. In June 1930 a symposium on specifications for fusion welding had been held by the National Board of Boiler and Pressure Vessel Inspectors, and another by the American Welding Society. The information was referred to the Conference Committee of the AWS. In September, recommendations of this Committee were considered by the Executive Committee.

Although some groups were opposed to the proposed rules, others at the committee meeting spoke so enthusiastically in favour of them, that this much larger and more detailed section of the Code was substantially adopted for the 1931 Edition. Adoption of the magnetic method of analysis of ferrous material, to determine imperfections in weld used by the Ferrous Magnetic Corporation of New York, was deferred in March 1931 by the Committee.

Welding of Vessel Parts

A number of items were submitted to the AWS Conference Committee for consideration, and were reported by the chairman of the Subcommittee on Welding in February 1929. The actions taken are briefly outlined as follows:

1. The Conference Committee recommended that welding of angle irons, etc., to forged seamless steel drums by fusion welding depends on the type of weld, and that because of strains set up in the plate by the welds, such should only be used when the plate did not exceed ¾-inch in thickness and carbon did not exceed 0.25 per cent. The Boiler Code Committee suggested the weld be considered equivalent to a hole twice the maximum dimension of the weld, in figuring the strength of welded or forged seamless drums.

2. The Boiler Code Committee permitted the use of fusion welding on calking edges of riveted joints in the 1931 Edition, limiting it to plates of not more than 0.3 per cent carbon, and to cases where the shell was more than 1 8-inch thicker than the seamless shell for same diameter, shell and pressure.

3. The welding of the ends of tubes of water tube boilers or superheaters could be practiced after expansion into the walls of drums, in such manner that they were accessible for good welding.

4. When the carbon of boiler plates did not exceed 0.35 per cent, the heat effect of arc or oxygen cutting would not extend more than ¼-inch from the cut, and no harm would result.

5. Welding of holes and redrilling for rivet holes should not be in the Code, as it meant a change in rivet spacing and should be decided by the inspector.

6. The effect of removal of a piece of weld metal attached to a plate was such that it should not be in the Code, and was a question to be decided by the inspector.

Thermit welding of tube ends was discussed at meetings in March and October, 1930. At a later meeting it was voted that when thermit was to be used only for heating the surfaces to be joined, and where no extraneous metal was added, this method might be considered as forge welding.

Stress Relieving

In the development of welding practice, it became known that stresses were set up in the metals. Heating of the welded metal became necessary to eliminate the stresses. "Stress relieving" became the term to replace the term "annealing", used under forge welding in the 1927 Unfired Pressure Vessel Code.

The 1930 Edition was altered to require a temperature of at least 1,100 deg. F. for stress relieving, to be reached by a slow process and held there for at least an hour for each inch of thickness, followed by slow cooling in air. A new paragraph was added, fixing the temperature at 1,100 deg. F., except for vessels which might thus be distorted, but setting 1,000 deg. F., for such structures.

The 1931 Edition called for this treatment on all class 1 vessels, and for certain wall thicknesses on class 2 vessels. Temperature remained at least 1,100 deg. F., and up to 1,200 deg. F. or higher if this could be done without distortion.

In October 1930 the Griscom Russell Co. submitted to the Boiler Code Committee a mechanical method of stress relieving, and suggested changes in paragraph U-23 on the extent of fusion welding. Their report was studied by the AWS Conference Committee, and in January 1931 that Committee reported that this method had merit which could be recognized for certain classifications. The determination of such classifications for stress relieving would require tests, such as the breathing test, to give data for such a purpose, before it could be added to the Code.

Gases for Forge Welding

The use of natural gas or other heating mediums for forge welding was brought before the Committee in October 1929 (case 636), in an enquiry whether it was permissible under the Code to use high grade natural gas as the equivalent of water gas. This was answered in the negative by the Committee, though it was annulled as a case in December 1929.

In January 1930, a report based on experience of the M. W. Kellogg Co., to the Committee, showed that the flame temperature with water gas could be controlled better,

giving the best oxidizing flame. Natural gas and other hydrocarbons required three to four times more air; uniformly perfect welds could not be secured for commercial use; the burners had to be larger, and spreading of the flame was more difficult.

This and other reports on the use of natural gas were referred to the Subcommittee on Welding and the AWS Conference Committee. The Subcommittee reported in October 1930 that sufficient data on natural *vs.* water gas was not available. The AWS Conference Committee reported, however, that evidence was favourable to the case of natural gas in Ohio as equivalent to water gas as a heating agent, and recommended that paragraph U-85 be broadened to admit other compositions of heating gases.

Allowable Stresses—Dished Heads—Opening and Connections

Steam temperatures in boilers built during the early days of the Code were not high, and as the critical temperature of steam was just over 700 deg. F., the known decrease in metal strength at high temperatures was not considered in early editions. Yet temperatures of superheated steam were increasing in the thirties' and this decrease in strength could not be ignored.

A paper on "Working Stresses of Steel at High Temperatures" was presented at the ASME meeting in December 1929, at which were discussed stress concentrations, passing of elastic limit, limits of working pressures, and related questions. The Committee voted that this data be prepared in form for addenda to the Codes, and published in *Mechanical Engineering*.

Mechanical Engineering

The Special Committee on Dished Heads suggested in January 1928 that desired revisions to the Code be submitted to the Executive Committee so as to avoid delay in publication. In April 1928 these revisions were reported with certain changes. As these changes permitted the use of elliptical heads, the use of such was greatly increased.

The Worth Steel Company complained that it was impossible to meet the requirements unless some small departure from a true ellipse was permitted. The Committee appointed a special committee to submit recommendations. Its report, in March 1930, recommended that elliptical heads be designed on standard inside radii, starting with 24 inches and progressing by 6-inch increments. With slight changes this passed the Executive Committee, and was approved in April 1929.

On inquiry of the Bigelow Company in May 1931, regarding design of a special dished head of an electric steam generator, a special committee was set up for a study of this inquiry. This Committee reported that the head came under various sections of the Power Boiler section of the Code, and recommended a hydrostatic test under P-247, as it had earlier for many other structures of this Company.

The question of openings and connections were discussed by committees and by members on various occasions between March 1929 and May 1931. In May 1931 the Committee appointed a special committee to consider rules for reinforced openings, asking it to report especially on a conflict between paragraphs U-59 and U-77, as well as on bearings of these paragraphs on Cases 686 and 689.

The committees reported in September 1931 that they were trying to find a formula to replace the Jones formula for unreinforced openings, and the maximum permissible diameter of holes in boiler and superheater headers. More time was needed, they stated, and comments of the Boiler Committee were requested.

Materials

Changes in specifications, reported at many committee meetings by the Subcommittee on Material Specifications, were for the purpose of making these identical with, or in substantial agreement with, those of the ASTM. The ASME Conference Committee met with similar conference committees of the ASTM and AASM, the three forming the Subcommittee on Materials Specifications.

In March 1929, this Subcommittee recommended the specifications be made more uniform in the matter and arrangement with those of the ASTM. By 1931, nineteen specifications were identical with those of the ASTM. During this period, the ASTM Specifications for the Arbitration Test Bar and Tension Test for Cast Iron, ASTM A-124-29, was accepted in January 1930, and became S-14. A proposed specification for nickel steel boiler plates was accepted as suitable for a special boiler, permitting this practice of approving new materials.

The ASTM Specification for Open Hearth Iron Plates of Flange Quality was adopted in September 1930. Later the ASTM included electric furnace steel with open hearth steel in many of its steel specifications. In February 1930, electric furnace steel was ruled to be the equivalent of open hearth steel when all other Code requirements were met, and in March the Subcommittee was asked to prepare specifications for high carbon seamless steel tubes.

Miscellaneous Matters

During this period also, two Benson boilers and other boilers for high pressure, as well as the G. E. Mercury boiler, were brought before the Committee for examination, and approved as special installations under parts of the Code giving authority for such action. The support of the Nicholson Thermic Siphon was brought before the Committee in May 1929, by the Industrial Accident Commission of California. The chief boiler inspector of the I.C.C. advised the Committee that adequate stays should support the load from the siphon.

It was announced in March 1931 that the Code had been adopted by Mexico City, the first case of adoption by a foreign city. A new report on cold flanging was made by an enlarged special committee in December 1928. As this problem was no longer before the Boiler Code Committee in 1931, further consideration of the Rules for Cold Flanging for the Code was discontinued in May 1931. Tests to determine allowable working pressure under paragraph P-247 on structures were carried out in 1921, 1930 and 1931.

In 1930 joint co-operation of the Boiler Code Committee was requested in the formation of an International Standards Association, at a meeting of the proposed association at Paris in May 1930. The Committee could not recommend a delegate, not knowing what was contemplated by this international group. A paper on the work of the Boiler Code Committee was presented at the World Power Conference in Japan, September 1928.

American Marine Standards Association

During 1927, the special committee appointed to co-operate with the American Marine Standards Association gave considerable study to the proposed Code covering design and installation of marine boilers, and made nine suggestions for changes in the Code. A copy was sent to the Supervising Inspector General of the Steamboat Inspection Service. The report on steel specifications of the proposed Code

was referred to the Subcommittee on Material Specifications.

Meeting at the New York Customs House in February 1928, the AMS Committee on Rules approved changing the heading to "Cylindrical Shells of Internally Fired Boilers"; a factor of safety of four with proper addendum; a construction factor of safety to allow ample margin for deterioration; and the tensile strength in the allowable pressure formula for boiler shells to be made the minimum of the range.

The appointment of a special committee was also approved, to consider proper construction and factor of safety for water tube boilers. This subcommittee met in February 1928, and adopted a factor of safety of four, in view of foreign marine codes and because of the effect of a higher factor when foreign built boilers came under American jurisdiction.

The Boiler Code Committee was asked for its sanction. After discussion in February 1928, this Committee reaffirmed its endorsement of the suggestion made by its own special committee for changes in the proposed Code, including the use of ASME Code Tables for Tubes of Water Tube Boilers, as well as the use of a factor of safety of 4-1/2.

At a Boiler Code Committee meeting in October 1928, resulting from failure of the special subcommittee to reach an agreement at two meetings following the one in February, lengthy discussions of the proposed rules, particularly that referring to the factor of safety, took place. Finally, a wording, "the factor of safety used in determining the maximum allowable working pressure on conditions actually obtained in service shall not be less than 4," was approved. The ASME table for seamless tubes was approved by those present, though AMS Committee approval was not assured.

The special committee appointed to co-operate with the AMS Committee reported in April 1929 that certain changes were required in statements contained in the AMS Code. Copies of the Rules of the Steamboat Inspection Service, approved by the Board of Supervising Inspectors, were obtained for the Boiler Code Committee. Copies were sent all over the country to shipping interests, boiler manufacturers, technical organizations, and those interested in marine boiler construction, for comment.

The Subcommittee on Marine Boiler Rules reported at a meeting in October 1929 that after a thorough study of the proposed rules they had six corrections to offer. These were sent to the Steamboat Inspection Service, in the hope they would be adopted.

Certain protests made to the U.S. Secretary of Commerce, the Hon. R. P. Lamont, in 1929, resulted in a request from him that those interested in the Code should settle their differences and report back to him. A new committee appointed by the Boiler Code Committee, consisting of Messrs. Frost, Gorton, Obert and Jacobus, met with the Secretary of Commerce in January 1930, and were told that another committee representing the American Society of Naval Architects and Marine Engineers had complained of the conflict between the two proposed marine boiler codes.

The Secretary asked for a new committee to iron out the differences between the Marine Standards Committee and the Steamboat Inspection Service, expressing the hope that the ASME could assist. Since preparation of this Code was in the hands of a committee of six, newly appointed, no further action was brought before the Subcommittee on Marine Boiler Rules during 1931.

API-ASME Code

A conference was held in May 1931 at ASME headquarters, between representatives of the American Petroleum Institute, the ASME, and the Boiler Code Committee, to discuss a proposal that the American Standards Association organize a sectional committee to prepare a Code for Unfired Pressure Vessels for Inflammable Liquids and Gases. W. R. Boyd, vice-president of the API, observed that the petroleum industry should have the final say for pressure vessels used in its refineries.

Secretary C. W. Rice of the ASME pointed out the advantages of working with the Boiler Code Committee. The establishment of a Code under the Association, he believed, would be duplicating the Unfired Vessel Code, and would lead to confusion. President Roy V. Wright of the ASME endorsed these views. It was finally agreed that a special committee of members appointed from the API and the ASME be formed to prepare a Code, particularly adapted to the petroleum industry.

1930 and 1931 Editions of ASME Boiler Code

The addenda from the revision sessions of 1928 to 1930, published in *Mechanical Engineering*, resulted in the Edition of 1930 being printed in December of that year. Changes or additions appeared therein for paragraphs P-186, Welded Joints; P-93, Reinforcing Plates; P-195, Dished Heads; and P-268, Nozzle Openings. Specifications of section II were given designating titles S-1 to S-24.

All specifications had been brought into closer agreement with ASTM Specifications. New tables appeared in the appendix for steel flanged fittings, using recent ASA standards. Tables covered pressures up to 1,350-p.s.i. and temperatures up to 750 deg. F. During 1931 addenda were published and approved, so that fusion welding could be used on power boilers when the 1931 Edition was published.

The 1931 Edition contained new paragraphs P-101 to P-111 on Rules for the Fusion Process of Welding. Paragraph P-102 called for efficiency to be 90 per cent when welds met test requirements of joints, with definite types of various specimens.

Materials to be used were defined in P-103; while paragraphs P-104 to P-109 covered preparation for welding, joints, dished heads, connections, stress relieving, hydrostatic and hammer tests. Paragraph P-110 was on Inspection, while paragraph P-111 on Distortion completed this new epochal section of the Code. This new method of fabrication required a change in the formula for maximum allowable working pressure.

This edition recognized the reduction in strength of materials at temperatures above 700 deg. F., using a factor of safety of 5 for steels of different strengths. A new formula for thickness of flat heads appeared in paragraph P-198. Paragraph P-257, on Calking, was enlarged to permit fusion welding on edges of circumferential joints. Specification S-25 for Open Hearth Plates of Flange Quality was added, and a few minor changes were made to Rules for Inspection.

The 1931 Edition of section III, Boilers of Locomotive, contained no further mention of fusion welding than that given in 1927, which permitted welding where any load was carried by parts of the structure other than the welded joint.

The 1931 Edition of section IV, Low Pressure Heating Boilers, was prepared from addenda to clarify statements of the 1927 Edition. Other changes included transfer of steel plate specifications for welding to section II, changes in paragraphs

H-40 and H-93 on valves, enlargement of paragraphs H-44 and H-97, changes in paragraph H-64 on fusible plugs, and paragraph H-120 was enlarged to provide for use of nonferrous plate.

The portion of the Code on Autogenous Welded Boilers was given the new title, "Fusion Welded Boilers". In section IV none of the new Rules of Fusion Welding of sections I and VIII of the 1931 Code were included when it was approved in July 1931.

In section V, Miniature Boilers, the 1931 Edition recognized fusion welding by adding Paragraphs MA-1, MA-2 and MA-3, fixing responsibility of the welding on the manufacturer, providing for tests on welders and permanent records on welders, type of joint and procedure, kinds of specimens and their tests.

This Code called for recognition of materials other than those in section II, when available, and provided for the construction of miniature boilers by welding. Paragraphs M-1 to M-20 provided for small changes, while paragraph M-19 related to hydrostatic and hammer tests for welded joints. In section VI, Rules for Inspection, paragraphs I-19 and I-21 were changed, and a new paragraph I-32 (b) was added on Tolerances for Ellipsoidal Heads.

Section VII, Suggested Rules for Care of Power Boilers, was unchanged from the 1927 Edition, but careful study had been made by the Subcommittee regarding a proposed revision for paragraph CA-5, respecting cracks and embrittlement. This revision was accepted by the Committee, but in February 1931 the Subcommittee proposed a more complete revision, and asked that the original revision be withheld for further report. Section VII was therefore not altered until the 1932 Edition.

Section VIII, Unfired Pressure Vessels Code, 1928 Edition, had embodied little change from the 1927 Edition. In 1929 many addenda were made, however, and from these a revised form was prepared and approved by Council in November 1930. Limitation of sizes and working stresses were increased when Recommended Procedure for Fusion Welding of Pressure Vessels was used in fabrication, and shown in paragraphs UA-10 to UA-21 of the appendix.

Changes were made in sections on Dished Heads and Braced and Stayed Surfaces. Paragraph U-57 on Strength of Rivets in Shear was enlarged. "Threaded Openings" became "Nozzle Openings", and was increased. Paragraph U-59 was enlarged. The term "annealing" was changed to "stress relief".

Paragraphs U-67 to U-69 on maximum stresses for welding were rewritten and enlarged. Paragraphs U-76 and U-77 on connections were combined. An appendix UA-1 to UA-9 was added on Hydrostatic tests. The edition was approved by the Committee in October 1930 and by Council in November.

1931 Edition of Section VIII

At a meeting of the Boiler Code Committee in December 1930, a Committee of the Compressed Gas Manufacturers Association presented a proposed set of Rules for Storage Containers for Liquefied Petroleum Gas. This did not come under ICC Rules, nor would the Unfired Pressure Vessels Codes apply, because of limitations of 55,000 gallon capacity and 200 p.s.i. pressure.

These rules were presented for confidential consideration, and were referred to the Subcommittee on Unfired Pressure Vessels. They provided for ten classes of vessels, using Boiler Code Steels and ASTM Steels. With certain alterations, approval was given in February 1931 to transfer as much of the recommended procedure as was still applicable to the Code, from the Appendix in the Code proper. These revisions were published in *Mechanical Engineering*, and later adopted by the Committee in June 1931.

In the 1931 Edition of section VIII, recommended procedure was included in various sections by rewording or additions. Parts of the 1930 Edition were also reworded or enlarged in scope, and a table of allowable stresses for steel at lower tensile strengths was added. Two paragraphs were added to U-27, and U-31 was enlarged. Paragraphs U-38 and U-39 were combined. Paragraph U-52 on Calking was enlarged.

The Rules for the Fusion Welding Process of 1931 covered 28 pages, in place of six pages in 1930. Paragraphs were designated U-67 to U-79 in both editions. The U-68 vessels were those that could be used for any purpose; U-69 vessels could be used for any purpose except for lethal gases and liquids. Paragraph U-70 referred to class 3 vessels usable for substances other than lethal gases and liquids, for thicknesses not over 5/8-inch when pressures were not over 200 p.s.i. and temperatures not exceeding 250-deg. F.

Paragraph 72 (new paragraph), covered Preparation for Welding; Paragraph 73 covered joints; paragraph 76 on Stress Relieving, was more extensive than in the 1930 Edition. Inspection, paragraph U-78, was new in the 1931 Edition. The new paragraph U-18 referred now to Fusion Welded Vessels. Paragraph U-69 ruled that the test by one manufacturer would not qualify a welding operator to do work for any other manufacturer. In 1931, paragraph U-77, Stress Relieving—had three parts covering the three classes of vessels U-68, U-69 and U-70.

After discussion the Committee voted to recommend to Council the revisions of the Code for fusion welding of pressure vessels, drums or shells of power boilers as a standard of the Society. Council approved this in July 1931.

Welded Steel Bridge

This unique, all-welded steel bridge that spans the Rio Blanco River near Vera Cruz, Mexico, was constructed by Mexican engineer Camilo Piccone from a design conception by Dr. Thomas C. Kavanagh, chairman of the department of civil engineering at New York University's College of Engineering. Its "basket handle" effect is heightened by the use of colour—the curved ribs are orange and the horizontal tie-girders cherry red. The bridge, which was opened in May, 1953, is 250 feet long and accommodates three lanes of traffic.

Smoke Prevention An Engineering Problem

by

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A paper presented before the Montreal Branch of The Engineering Institute of Canada, November 27, 1952.

Pointing out that smoke abatement is primarily a problem of combustion, the author discusses the various types of fuel; coal, wood, coke, sawdust, refuse, oil and gas, and assessed the extent of air pollution from each of them.

A description of the various types of equipment; boilers, furnaces and burners follows, with comments on the capacity of each for smoke prevention and on how greater efficiency of prevention may be secured. Realization that air pollution is strictly an engineering problem, he believes, is resulting in more realistic smoke prevention legislation today.

The problem of smoke prevention is only one part of the greater and more complex problem of air pollution, which is getting universal recognition from year to year. Realization that solution of the problem of air pollution is one for the engineer rather than for the over-zealous reformer is resulting in more realistic legislation than has existed before. Smoke Prevention is an engineering problem.

The abatement of smoke is essentially a problem of combustion. We may define combustion as a special form of oxidation, in which fuel particles and oxygen combine rapidly with the liberation of considerable heat. While combustion is in itself a purely chemical reaction, most problems associated with it are mechanical. Fuel must be prepared for burning, it must be brought into active contact with sufficient amounts of oxygen, and the resulting burning has to take place under conditions that insure completion of the process. Each of these steps,—preparation, mixing and burning, depends on mechanical actions and devices.

Smoke prevention is first a problem of fuel, since the selection of fuel is of major importance. It is, secondly, a problem of boilers and furnaces, as these must be properly designed to insure perfect combustion of the fuel. It is also a problem of special equipment, which is, in many cases, necessary either to complete the combustion process or to prevent the emission of large quantities of fly-ash and cinders to the atmosphere.

Any kind of fuel can be burnt smokelessly, if the type of equipment used is in perfect conformity with the conditions of the fuel. Therefore, fuels must not be condemned as such, but their use may be in certain cases limited by the type of boilers or furnaces they are fired in.

Bituminous Coal

By far the most easily found industrial fuel is bituminous coal. It is produced in United States and Canada at the rate of half a billion tons per year. Despite the fact that petroleum products are becoming more and more easily available, it is foreseen that the consumption of bituminous coal may reach a billion tons per year before 1970. This is due to its increased use in power plants.

Proven reserves of bituminous coal would provide enough fuel at the present rate of consumption for another 1,000 years. There are sections in the United States and in Canada where it will be, for many years to come, more economical and practical to use this fuel than any other type. On the other hand, development in atomic energy may revise all our present concepts, so that in a few years time smoke control engineers will no longer be needed in large cities, and will become available for more constructive work.

Bituminous coals include many types, ranging from the so-called smokeless species, with a content in volatile matters of around 19 per cent, to the highly volatile coals containing over 35 per cent hydrocarbons. In the burning of bituminous coal we may consider three phases: lighting, distillation and combustion; at normal air temperature, combustion is not spontaneous.

The coal must be lighted, which means that a portion of the coal bed must be submitted to a temperature high enough to distill the volatile matter. This lighting-up temperature is therefore higher with coals containing less volatile matter. When the coal is lighted, it entrains the distillation of the volatile matters present in the surrounding area. The products of distillation comprise hydrocarbons and carbon monoxide which, in contact with a sufficient supply of oxygen and at

proper temperature, will burn into water and carbon dioxide.

Bituminous coals, because of their high content of volatile matter, will produce a long flame, and are what we call good steaming coals. But on the other hand if the air supply is not sufficient, if the mixing of the hot gases with the oxygen is not intimate enough, or if the furnace temperature is not up to the necessary level, we may have imperfect combustion, either due to incomplete oxidation or to chilling of the gases over cold surfaces.

Montreal By-laws prohibit the use of bituminous coal containing more than 25 per cent volatile of matter, unless there is special equipment in the boiler to prevent the emission of dense smoke, such as stokers, air jets or steam jets, or other approved types of smoke preventing apparatus.

Anthracite

Whereas bituminous coal is an industrial fuel in all its forms and sizes, the same cannot be said of anthracite. Anthracite in the large sizes, from chestnut to broken, is mainly a domestic fuel. The smaller sizes, however, ranging from pea coal to No. 4 buckwheat, and screenings, constitute fuels of industrial value, because of their availability at low prices. Anthracite is a coal of older geological times. Pressures exerted by later deposits have gradually driven out the volatile matter, so that the percentage of free carbon generally averages well over 90 per cent of the overall analysis, moisture and ash free.

This relative absence of volatile matter makes anthracite harder to ignite. It is not in itself a good steaming coal, but can give good performance under special circumstances. There is little possibility of any emission of smoke from burning anthracite only. On the other hand, because of its rather high ash content, specially in smaller sizes, this type of fuel often presents a problem of fly-ash.

Smaller sizes of anthracite are used for industrial purposes, particularly screenings which are one of the lowest priced coals on the market, when available. Screenings can give good results in boilers with low settings, where no high pressure is needed and where additional air can be introduced by a blower. There are also certain types of industrial stokers which may use anthracite, specially the chain grates.

One of the most important aspects of anthracite coal in industry is its use as an admixture to bituminous coal. It will reduce the volatile content of the coal as fired. It will also prevent excessive clinkering, and therefore reduce the emission of dense smoke. Such mixtures are often used successfully, either in boiler fired by hand or mechanically and best results attained when both coals are of about the same size. Experience has proved that in underfeed stokers a mixture of the finer sizes of anthracite such as barley, with bituminous slack coal is quite practicable, and that less smoke will be produced.

Many field tests of various mixtures of anthracite and bituminous coal were tried during the last war by the U.S. Bureau of Mines. These were fuel-conservation measures to utilize a large surplus of the finer sizes of anthracite. It was found that less smoke was always produced, and that it was possible by that means to change, or adjust to an improved condition, the characteristics of a fuel bed of bituminous slack coal.

Coke

Coke has much the same value in smoke prevention as anthracite. It is the residue of the distillation of bituminous coal in closed chambers in a reducing atmosphere. Most volatile matters escape, and are used either as manufactured gases or under a myriad of other forms.

Larger sizes of coke (excluding metallurgical coke) have no industrial significance. They are mainly used for domestic or institutional heating boilers. Blower coke, however may compete in price with good stoker coals, and coke breeze with either bituminous slack or anthracite screenings. Blower coke and breeze burn without smoke, and can be used in chain grate stokers, as at the Montreal General and Royal Victoria Hospitals, or in mixtures with bituminous coal in hand-fired boilers. Such a mixture is used today with good results in all the schools of the Protestant School Board of the Greater Montreal district, which are still fired by hand.

Wood

Cord wood has no longer any more industrial significance, though the same cannot be said of sawdust and shavings. These by-products of many industrial operations often present an ample source of fuel, which is sometimes more than sufficient to operate the entire boiler plant of the industry concerned.

Shavings and sawdust are generally distributed pneumatically or by gravity over the fire-bed, although there are cases where they are simply shovelled in. A fur-processing plant in Montreal uses large amounts of fine sawdust for curing its furs, and later burns it as fuel in its boilers. We had a lot of trouble with that particular plant, because they were shovelling the sawdust into their boilers without any special smoke abatement device. Conditions were made even worse due to the saw-dust containing animal grease from the pelts and dyes. The problem was finally solved by the addition of steam jets to distribute secondary air over the fire bed.

This addition of secondary air is practically the perfect answer to all smoke problems due to wood. The temperature of the bed is generally very high, due to the easy burning of the distillation products of the wood, which contain mostly methanol. Primary air cannot easily go through the grates, which are solidly packed with fuel, while secondary air only will give the proper amount of air and turbulence to complete the combustion.

Industrial Refuse and Garbage

Burning of industrial refuse or garbage constitutes one of worst headaches for a smoke-control engineer. There is no way of trying to avoid this crucial problem. The fuel value of industrial refuse is almost impossible to evaluate; there is too much variety, not only from place to place but also from hour to hour, and each case might be considered a different problem. In shoe factories, you will have leather, cardboard and rubber cuttings; in textile factories, cotton, rayon or wool wastes, wood and paper; in slaughterhouses, carcasses, offal and similar wastes. In most cases you may add to this garbage from cafeterias and all type of floor sweepings.

The main trouble rests with the fact that some industries would like to burn all these in ordinary boilers, which are not fit for such purpose. The same may be said of garbage burnt in domestic incinerators. The fuel value of garbage will vary from day to day, as its composition varies literally from soups to nuts.

Oil

Under this name we classify a large group of liquid petroleum products ranging from gasoline, which is a light distilled oil, to bunker-C oil which is a heavy fuel made of cracked tars and residues.

The lighter products of cracking, gasoline and tractor fuel, are used only for internal combustion engines, whereas the heavier may be used either for diesels or for firing boilers.

Some people are still under the impression that oil cannot smoke, yet one of the largest and most modern oil fired boiler plants in Montreal is still facing a serious smoke problem after more than eighteen months of operation. Unless proper mixture of the atomized droplets and oxygen is attained, and unless there is a sizeable excess of available air, we can have smoke with practically all grades of oil.

Atomization, either through steam, air, or other mechanical process must be as perfect as possible, and to achieve this perfect atomization, it is necessary to preheat the heavier oils. Whereas No. 5 can be fired without preheating, better results are obtained when it is warmed up to 130°F. As for bunker-C oil, it must be preheated to a minimum of 180°F. when burned with stream-atomizing burners. This temperature may be dropped to 150°F. with rotary cup burners.

Heavy oils may smoke; so do the light oils. Fuel oil will form carbon and smoke in a domestic installation if the air is not adjusted properly. Even kerosene sometimes used in some chimneyless heaters may give considerable trouble, as when a wick-type kerosene fired heater spreads a thick blanket of slimy soot all over the place.

Proven reserves of petroleum are rather short-lived; less than 15 years at the present rate of consumption. There is some hope of extending this period to another 100 years, if the present pilot plants to recover liquid petroleum from oil shales give good results, both industrially and economically. On the other hand, as liquid or gaseous fuels are much easier to handle than solid fuels, we can be assured that still more research will be done towards conversion of coal into liquid fuels. Both the Bergius and Fischer-Tropsch processes, which are widely used in Europe, would be unable to compete financially with natural petroleum. However, the U.S. Bureau of Mines maintains a Bergius-type pilot plant, so that up-to-date information for the construction of full scale plants will be available whenever needed.

Gas

The only types of gas now marketed in the Montreal area have little industrial significance for heating or industrial purposes. City gas produced by coke-ovens is a poor fuel, limited practically to the minimum of 450 B.t.u. per cubic foot, fixed by law. Propane gas, which has a much higher heat value, is rather expensive, and is generally used only for cooking or laboratory purposes.

Natural gas may, however, change the overall picture, whether it comes from Texas or Alberta. The Quebec Hydro is preparing for this, and will be readily in a position to offer contracts for industrial uses of the gas. Straight natural gas may not be offered, but rather a mixture of natural and manufactured gas, with an heat value somewhere above 600 B.t.u. per cubic foot. Even gas is not a smokeless fuel, but as it diffuses readily in the furnace it is more readily burnt than any other fuel. Provided there is a reasonable excess of air and enough furnace volume, we may be pretty sure that the operation of gas-fired boilers will be trouble free.

Boilers, Furnaces and Burners

Fuel has its importance, but still more importance must be given to the problem of how and where it will be burnt. Without going into a discussion of the respective value of boilers or mechanical burners, it is possible to review briefly certain details of importance in smoke prevention.

One of the most important aspects of smoke prevention is the design of furnaces giving ample combustion volume to the fuel fed. The combustion volume is fixed by the heat release permitted. We have found that we generally get good smokeless conditions with the following values for heat release: for coal with underfeed stokers, 45,000 B.t.u. per cubic foot per hour; with overfeed stokers, 25,000 B.t.u., per cubic foot per hour or with an efficient fly-ash collector 35,000 B.t.u. per cubic foot per hour; for coal, hand fired, 25,000 B.t.u. per cubic foot per hour; for oil, steam or air atomizing, 35,000 B.t.u. per cubic foot per hour. Once the figures for heat release are set, it is then possible to determine the setting height necessary to insure this value. There are some set rules that are generally followed and which give good results.

HRT Boilers

Horizontal return tubular boilers remain even to-day the most popular type on the market. They are specially adapted for small and medium-sized industries, and are built in any sizes from 25 to 250 hp. Their facility to meet easily fluctuating loads makes them desirable in many cases. They can be fired with any type of fuel, including industrial refuse. The setting height of HRT boilers is fixed by the following rule: the minimum distance between the grates and the shell must be equal to the diameter of the shell up to a maximum of six feet. This is true for hand firing as for mechanical firing with coal.

With sawdust and shavings the fire-box is usually enlarged by the addition of a dutch oven, due to the low heat release permitted for this type of fuel. For industrial refuse burning, good results may be achieved by the addition of a deflecting baffle of firebrick or refractory tile, over which the products of distillation are heated to higher temperatures and further mixed with the air to complete the combustion.

Water Tube Boilers

For nearly all cases where boilers are required with a capacity of 150 hp., or more, water tube boilers are preferred. They can be fired with almost any type of fuel. Their combustion room is generally large enough not to require any dutch oven, even in the case of sawdust and shavings. Good turbulence is provided by baffles made of refractory tile, which help maintain the temperature of the combustion gases at a high level. The overall efficiency of water tube boilers is the highest of any type of boilers.

From the point of view of smoke, these boilers are generally the most satisfying when everything is in order, and the most unsatisfactory when trouble comes. They are seldom fired by hand. They can use any type of mechanical firing with oil or coal. Sawdust and shavings, as well as other industrial refuse, can be burnt readily without the addition of dutch ovens.

Vertical Boilers

Vertical boilers are far from being the most efficient, whether they be fire tube or water tube. In the fire tube type, the gases of combustion escape vertically through the stack without any passes whatsoever, such as arches or baffles. Whenever used with bituminous coal, they are heavy smoke producers. They are generally used when space is limited, and due to the restricted dimensions of the furnace, will give better results with anthracite or coke. Vertical boilers should only be considered as temporary measures, and whenever it is necessary to use them with stokers or oil burners,

dutch ovens become necessary to help complete the combustion before carbon and soot are precipitated out through contact with the cold walls of the tubes.

Scotch Marine Boilers

Scotch marine boilers, once restricted to steamships, are more and more coming into common use in industrial plants; they are extremely economical of space and permit a rather high heat release. Since the corrugated steel shell cools the flame rapidly, care must be exercised in the selection and mounting of the burner or stoker to avoid incomplete combustion. To offset the effect of the large cold surfaces, refractory surfaces, either rings or baffles, must be provided. There are some in use in the Montreal area, and their performance with oil is generally good.

Cast-iron Boilers

In domestic installations and for small apartment houses, cast-iron boilers are generally used. They seldom cause smoke trouble, except when improper fuel is used. They are best designed for hard coal or coke or light fuel oil. They can also be used with underfeed stokers of the single retort type with hard or soft coal. In this case, care must be exercised to select the proper setting height of the boiler, to provide a large enough combustion chamber.

Steam-package Units

We find on the market today a great variety of compact units where oil is burned under pressure instead of a vacuum: heat releases up to 250,000 B.t.u. per cubic foot per hour are obtained in these units. These boilers are small, easily installed, efficient, but in general they do not answer easily excessive variation in the steam load.

Still higher heat releases are found with the type of steam boilers used on railway diesel engines. Compactness must be the rule, and oil-fired boilers have been designed to release 1,250,000 B.t.u. per hour per cubic foot of furnace; you may have a boiler not bigger than a good-sized garbage pail and able to deliver 100 hp., or more.

Incinerators

Whereas in all heating boilers we have found generally conditions that are compatible with our work of smoke prevention, the same cannot be said of the incinerators that we meet by thousands in our City. With the exception of a few, all domestic incinerators are of poor engineering design. Fortunately, larger incinerators are of a somewhat better design and can generally operate without trouble, specially when, as in the industries or commercial buildings, there is a separation of the refuse to be burnt, and good supervision.

In the small apartment-house incinerator, a chute directs the garbage, containing anything from waste paper to empty whisky bottles, to a small combustion chamber slightly larger than the chute, where a careless janitor may light the whole collection of eatables and uneatables. There is no special chimney; the chute used for dumping carries out the combustion gases with smells, odours, small pieces of partially burnt paper, soot, etc. Everything is easily carried up because the draft is strong. The building by-laws provide that an inverted basket made of $\frac{1}{2}$ in. mesh be placed over the chimney, but these baskets cannot really prevent the distribution of soot and carbonized paper over all the neighbourhood. What stand Montreal shall take on the subject is something still to be decided upon. The City of New York has adopted a by-law to totally curb the present type apartment-house incinerators, by requesting that they include both primary and secondary combustion chambers, and where necessary, auxiliary heat and fly-ash arrestors. The City of Montreal is contemplating similar action.

Stokers and Burners

Hand firing is fast disappearing from our industry, and better and improved forms of stokers and burners are designed every year to meet the ever-increasing demand for high efficiency.

Underfeed Stokers

These distribute coal from below. They are of the screw or ram type. The latter is preferable, as it distributes the coal evenly on both sides of the distribution channel, whereas the screw fed stoker permits larger accumulation of coal on one side, resulting in an uneven distribution of the fuel bed thickness, and sometimes dense smoke, due to indiscriminate poking by the fireman. Even the ram or plunger type of underfeed stokers may easily offend from the smoke standpoint, due to failure to balance the fuel and air properly.

Smoke is also usually produced by the start and stop method of operation, when the stoker burns all the fuel required to carry the load, during operating periods of perhaps one third of the total elapsed time, thus requiring intermittent high combustion rates and standby periods. This method of operation causes an excessive fuel bed temperature during operating periods, with a rapidly cooling condition during the cut-off. Consequently, an operator frequently must break the clinker and hard coke formation, caused by the high temperature when the combustion rate is abnormally high. This condition is greatly improved by adjusting the stoker so that its operation is as nearly constant as possible. This will maintain a uniform but lower rate of combustion with lower fuel bed temperatures, usually less than the fusion temperature of the ash, thus requiring less frequent working of the fuel bed.

While the fuel bed is being worked or broken up, dense smoke is given off. Smoke is also emitted when the stoker is stopped by the pressure switch, due to the fact that distillation of gases continues with insufficient air available for combustion. Consequently these gases will be emitted as smoke. Provisions must be made for secondary air to be drawn into the furnace, to help complete the combustion, though not to such an extent as to carry ash particles out, thus creating a fly-ash problem.

Overfeed Stokers

This type was among the first to be developed and sold. They deliver coal on inclined grates in the form of a wide V, on which it is gradually coked and burned until it reaches the bottom of the V. These stokers are now obsolete, and the few still in operation in Montreal should be museum pieces rather than parts of modern power plants. All of them are responsible for serious smoke nuisances.

Spreader Stokers

These are a modern variation of overfeed stokers, where the coal is spread over the grate either by mechanical or pneumatic feeding devices. This latter type is now practically limited to railway locomotive boilers. Spreader stokers are probably capable of burning coals of a wider differing analysis than any other type. Much of the coal is burnt in suspension, while the heavier particles will rest on the grates and burn there. Grates may be either of the fixed or travelling type. Since the fuel bed is generally thin, the spreader stoker does not operate well under intermittent control. It must be modulated automatically for satisfactory opera-

tion. Because much of the fuel is burnt in suspension, a lot of fly-ash is carried through the chimney. For this reason, all city by-laws will not allow spreader stokers unless there is an efficient fly-ash collector on the line.

Travelling Grate Stokers

Travelling or chain-grate stokers are not in widespread use, although there are several in the Montreal district. They are a variation of overfeed stokers. The fuel is fed in a layer of uniform thickness by manual or automatic adjustment. The moving grate then carries it under an ignition arch, which distills off the volatiles so that they pass over the active fuel fed in their travel through the furnace. Air is supplied to complete the burning of the fuel near the end of the travel of the grate. Secondary air is also introduced over the fire bed by various means. Such stokers are best adapted for small size anthracite or coke breeze, but are also suitable for certain types of bituminous coal which burn best without being disturbed. These stokers, because of the type of fuel they use, are seldom a source of smoke nuisance.

Pulverized-coal Burners

Pulverized-coal burners seldom cause a smoke nuisance, but are responsible for considerable fly-ash through the chimney. This is why all such installations must include efficient fly-ash collectors, as in the case of spreader stokers. Today pulverized-coal operated boilers are limited only to large installations which can improve the combustion rate by pre-heating the primary and secondary air with the flue gases.

Oil Burners

Smokeless combustion of oil results from the combination of adequate pre-heat, efficient atomization, and the proper amount of air introduced in the proper manner. Sufficient volume and time must, of course, be allowed for combustion.

Most industrial oil burners are acceptable, even if some present better engineering design. Steam or air atomizing burners are not necessarily better than the rotary cup type. One can only judge by the smoke, and on that basis, all are equally good, or bad. On small installations, the amount of air may be controlled manually, while on large ones, automatic control is necessary. Pre-heating is essential with No. 6 or bunker C oils and recommended with No. 5 oil.

Most of our smoke troubles are due to insufficient pre-heating, and have been or could be easily corrected by the installation of an efficient heater. Occasionally trouble may arise from the formation of sludge in the oil tank, resulting in poor atomizing and emission of dense smoke. This is best taken care of by using a recognized solvent. Constant emission of smoke from an oil burning installation is inexcusable, and can be corrected by examining, in the proper sequence, burner condition, preheat, air and oil mixture, boiler condition, and control of draft.

Other Boiler Equipment

Certain other parts of boiler equipment are important in smoke prevention, such as the breeching and chimney, the forced and induced draft fans. Proper sizing of all these is important for perfect combustion, as they regulate the amount of primary air needed to complete the oxidation process.

Smoke Prevention Demands Special Equipment

Perfect combustion generally will result in smokeless operation. There are cases, however, where standard boiler-room equipment is unable to solve the nuisance completely, and where special types of equipment are needed. Among such equipment we may list the air or steam jets, smoke indicators and fly-ash collectors.

Air or Steam Jets

Overfire jets have long been used to prevent smoke and improve combustion efficiency. They force air into the furnace where needed and mix it with unburnt gases. If excess air is already present, the jets mix this air with the combustible. Air can be introduced by moderate or high-pressure blowers or by high-pressure steam-jets. The latter are generally used to siphon in air from the boiler room, through venturi tubes placed in the front or in the side-walls.

Better results can be obtained with air at higher temperature, and it may be advisable to have the power fan intake near the boiler room ceiling. Great care must be exercised to determine not only the angle of the jets, but also their penetration in the furnace. These jets may act as blow-torches to melt down the firebrick side walls or the bridge, or otherwise damage the tubes, if the pressure is excessive. A manometer should be installed with the jets, and tests made to determine under which pressure they should be operated.

It is generally assumed that air jets give better results than steam jets. On the other hand, they are the only ones that can be used when the boilers operate at pressures lower than 50 p.s.i. For the sake of operating economy, air jets are superior to steam-air or plain steam jets, because they require less power. A proper mechanical blower will supply enough air to operate air jets for about 2 per cent of the power generated. Steam-air jets may consume up to 20 per cent of the total amount of steam generated, with a good average figure of 5 per cent for well-engineered jobs.

It would be unwise to let air jets or steam jets operate all the time. With underfeed stokers, for example, some smoke may be produced when the stoker starts and stops; jets may therefore be designed to operate only during periods when they are needed. There have been cases where the firemen let their steam jets operate continuously during the summer, using twice as much fuel during that period of low load. Besides, poor adjustment of the jet pressure caused damage to the bridge wall. Addition of manometers on the steam line, and automatic control through smoke indicators have helped to solve this problem.

Some industries, sawmills specially, have to employ some type of smoke abatement equipment and generally resort to steam-air jets. These plants burn their own refuse and generally face an over-abundance of fuel. The jets improve the combustion by introducing turbulence and excess air, and as available steam usually exceeds demand, jets may be run continously without any disadvantage. Steam jets are now standard equipment on railway locomotive boilers.

Smoke Indicators

This is not a piece of equipment for reducing smoke in a boiler; it is merely an indicator showing that there is smoke. In many plants, particularly in large office buildings, the firemen cannot see the top of the chimney. A smoke indicator will tell them exactly what is going on. A smoke indicator is composed of a light source and a photo-electric cell, facing each other across a section of a breeching or a stack. It may be used to light up a pilot lamp, to sound an alarm or to register the densities of smoke.

Indicators are generally set to sound the alarm when the density of the smoke passing the photo-electric cell is equal to Number 2 of the

Rintelmann Smoke Chart. In modern installations smoke indicators generally operate automatic controls At a given smoke density relays will start air jets or steam jets, or an induced draft fan, or operate a draft control damper, thus corrective measures are applied at the very moment they are needed.

Fly-ash Collectors

Fly-ash collection is required by all City by-laws where coal is fired by spreader stokers or pulverized-coal burners, and also wherever the total amount of ash and other particulate matter in the flue gas exceeds a given amount; in most cities of North America this amount is 0.85 pound per 1,000 cubic feet of gases. Collectors for fly-ash are being increasingly used; everybody has heard of electrostatic type collectors, the Cottrell being best known, or of the mechanical types.

Many types of mechanical fly-ash collectors are on the market. Choice must be guided by the efficiency required. The coarser particles can be easily trapped by sudden changes of velocity in the gas flow, with plenum chambers, or by sudden changes of direction, or through impingement against small baffles. Coarse and medium size particles, down to 5 microns in diameter, may be collected by separation through centrifugal force induced by a power fan, or by installing cyclones, specially of the small diameter type. If we want to gather fumes and gases as well, we may pass the flue gases through a water screen or a scrubber. Washing is ineffective on small fly-ash particles which do not wet easily; efficiency may be improved by proper wetting agents.

Removal of the very fine particles may be necessary. We can in such cases rely on the electrostatic collectors, in which the dust and fly-ash particles are charged electrically by passing near electrodes bearing high direct current voltage. This charge attracts them to collecting electrodes having an opposite charge.

The efficiency of electrostatic precipitators is quite high, even for particles 1 micron or smaller in diameter. In large plants, it is usual, in order not to overload the precipitators unduly, to place ahead of it a multiclone type collector to retain most of the larger size particles. The efficiency of such a train of collectors may be as high as 99 per cent by weight of the total particulate matter. The pressure drop through collectors is generally quite high, thus an auxiliary fan should always be added to compensate for it.

Conclusion

We have reviewed the problem of smoke as an engineer must look at it, and have described the work of the Smoke Control Division of the City of Montreal There is still smoke in Montreal, but complete control of the situation is somehow out of our hands. The Harbour and the railroads are not subject to City by-laws. While a Federal ordinance regulates the amount of smoke emitted by railroad engines, it does not apply for harbour installations or steamships. Steps have already been taken, however, to correct this abnormal situation, and it is hoped that in a near future a definite answer will have been given to all the problems that are still unsolved.

Another Dry Ice Cofferdam

In the *Journal* for July, 1950, an article appeared describing repairs to bridge piers in Winnipeg made under the protection of cofferdams formed by freezing an ice wall around the working area with dry ice.

These examples prompted J. F. Cunningham, M.E.I.C., district superintendent of dredges, Federal Department of Public Works, at Winnipeg, to use similar methods to build a cofferdam along the sides and across the open end of the marine railway at Selkirk, Manitoba, when it recently became necessary to unwater this slip for repairs. The frozen wall was 100 ft. long.

The methods used were substantially the same as those described in the paper referred to above, but Mr. Cunningham gives a few practical hints not mentioned there. To shut off leaks, the leaky area was either packed with a few blocks of dry ice if unsubmerged, or "dosed" with a block of dry ice lashed to a pole if submerged. In the latter case, stove pipe was used to carry the evolved CO_2 to the surface, so that erosion currents would not be set-up. During excavation, if a pick penetrated through the frozen material, the hole was plugged with a "pencil" of dry ice.

Trimming the bottoms of trenches smooth with adzes speeded freezing, as did packing dry ice tightly into all corners.

Temperatures were relatively high—35°F. during the days and seldom below zero at night—though the work was done in January, 1953. Trench walls were protected from the sun by tarpaulins. About 29,000 lb. of dry ice was used, at 6c per lb.

For shallow winter cofferdams, this method would appear to possess distinct advantages, especially in economy. Certainly no conventional type could have been built in cold weather for a material cost of only $1,750.

A frozen trench. Note the bracing bulkhead: these were six to eight feet apart.

L'Ingénieur et les Ports Nationaux

par Brigadier Maurice Archer, M.E.I.C.
Vice-Président, Conseil des Ports Nationaux, Ottawa

Jetée No 3 presque terminée, illustrant galerie et élévateur à grain. Vancouver. Septembre 1953.

This paper gives a brief summary of port administration abroad, with a closer look at our own National Harbours Board. It is one of a series delivered before the Quebec Branch of The Engineering Institute outlining the various activities of engineers. The English version is not a translation, but rather a summary. Those who can, should read the original rather than the summary.

J'ai accepté avec empressement de présenter cette conférence, intitulée l'Ingénieur et les Ports Nationaux, car j'envisageais avec joie cette soirée parmi mes confrères et amis de Québec. Elle fait partie d'une série, dont le but est d'exposer le rôle de l'ingénieur dans les différentes sphères de la vie. La prépondérance de son rôle dans les opérations d'un port m'oblige à en aborder tous leurs aspects. Il peut être bon de signaler que trois des ports océaniques, au Canada, sont gérés par des ingénieurs, qui exerçaient auparavant leur profession. Ce sont MM. G. A. Murphy, L. Beaudry et R. Yuill, à Montréal, Québec et Saint Jean, N.B., respectivement.

D'une façon générale on peut décrire un port comme étant le trait d'union qui relie le transport terrestre au transport maritime, et vice versa.

Nous allons maintenant énumérer les principales considérations qui doivent guider celui qui a à étudier l'aménagement d'un port, et chacune d'elles sera accompagnée de quelques notes explicatives signalant sa fonction et ses caractéristiques. Elles sont d'ordre économique et géographique, et je traiterai seulement de la deuxième catégorie.

Exemple d'un quai développé le long de la rive, Anse-aux-Foulon, Québec. (Photo Spartan Air Services Ltd.).

Exemple de quais comprenant môles et darses, Port de Montréal. (Photo Spartan Air Services Ltd.).

1. C'est un *abri* des vents gênants et de la mer (houle, courant, glaces) où les navires peuvent se présenter avec sécurité et avec le minimum de manoeuvres à leur poste d'opération.

2. Les *quais* ont à remplir trois fonctions distinctes (voir coupe schématique):

   a) celle d'organe d'accostage;

   b) celle de mur soutènement;

   c) celle de support des engins de manutention, de la marchandise, des voies ferrées, des hangars, etc. Ils sont tracés de manière à utiliser au mieux l'espace et sont ordinairement développés le long des rives comme à l'Anse au Foulon ou avec endentures comprenant môles et darses, tels que plusieurs de ceux à Montréal et la plupart à New-York. Il y a les quais pour huile, charbon, céréales, etc., qui ont souvent leur propre individualité. Bien entendu, tous ces quais doivent être munis d'accessoires tels que bollards, drainage, éclairage, etc.

3. *Outillage* — Il est évident que dans notre siècle de mécanisation avancée, les opérations de chargement et déchargement, effectuées à bras d'homme, n'ont plus leur place. Il faut prévoir des engins qui accélerèrent ces opérations. On peut les diviser en deux classes:

   a) Engins courants, par exemple: grues sur rail, qui chevauchent les voies ferrées, et d'une capacité de 3 à 5 tonnes. Toutefois, ces grues sont peu utilisées en Amérique — où on préfère les engins de bord du vaisseau, ou le système Burton, bien qu'elles soient un élément indispensable dans tous les grands ports d'Europe.

   b) Engins spécialisés qui le sont soit en raison de la nature de la marchandise, ou soit en raison du poids de la marchandise. Comme exemple des premiers on peut citer les réseaux de courroies convoyeuses et les chaînes à godets pour céréales manipulées en vrac. Les grues flottantes sont un exemple d'appareils utilisés pour la manutention de marchandises lourdes.

4. Les *hangars* de transit servent à abriter la marchandise des intempéries et du vol pendant le transfert entre le navire et le chemin de fer ou camion, et vice versa. Généralement on y permet un séjour de quelques jours seulement. La considération principale qui en conditionne la disposition est la grosseur du navire, car la cargaison doit pouvoir y être logée intégralement — compte tenu de quelques évacuations. Ils sont généralement à un étage et on a recours à deux étages s'ils sont prévus pour de très gros navires, ou si l'espace à l'arrière du quai est restreint. L'espacement des colonnes, la hauteur libre, le nombre de plates-formes, services pour camions sont des facteurs primordiaux qui doivent être dûment considérés. Je tiens tout particulièrement à souligner qu'afin de concilier les intérêts du camionnage toujours croissant avec ceux du port il est avantageux de prévoir de larges plates-formes à l'extérieur du

Déchargement d'une locomotive de 50½ tonnes à destination de Bombay, Indes. Halifax. (Photo The Halifax Herald Limited).

hangar même pour y permettre le chargement et le déchargement des grands camions. On doit restreindre au minimum la circulation des camions à l'intérieur du hangar dans le but de réaliser une économie d'espace et parfois de diminuer les larcins.

5. La voie de *circulation charretière* devrait permettre le stationnement oblique, l'évacuation rapide de la marchandise et ne pas ralentir le camionnage.

6. Le choix du nombre de *voies ferrées* varie et dépend de la marchandise à manipuler. Ici au pays on en préconise une ou deux sur l'espace entre la face du quai et le hangar de transit, et 1 à 3 à la partie arrière. Il est préférable d'être généreux dans le nombre de voies de garage.

7. La quantité de matière à être draguée doit être étroitement surveillée, et on doit éviter les endroits de renouvellements trop fréquents.

8. On doit tenir compte de plusieurs autres facteurs, tels qu'entrepôts frigorifiques, espaces pour les douanes, qualité de la main d'oeuvre, abris pour remorqueurs, postes de soutage et de ravitaillement, aménagements de débarcadères pour passagers, endroits pour réparations, etc.

Ceci termine notre bref aperçu des fonctions et des caractéristiques d'un port.

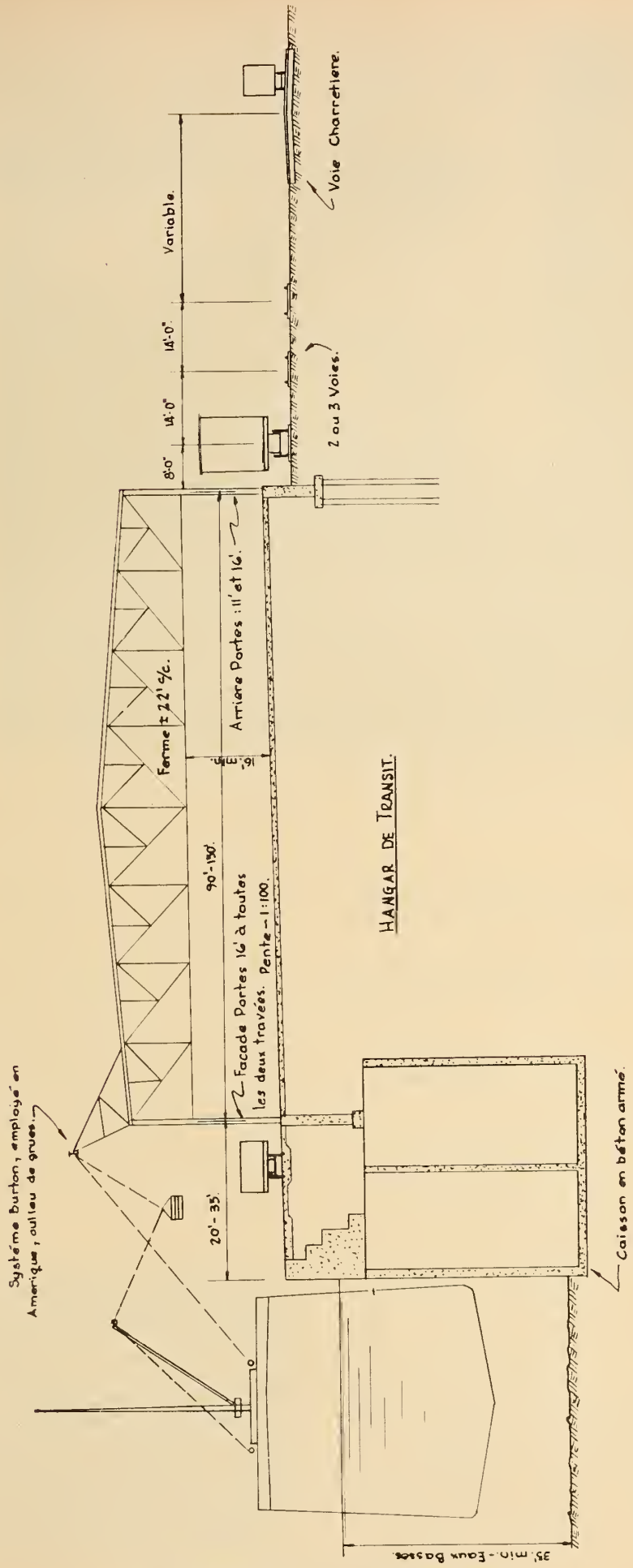
Passons aux régimes administratifs et examinons-en les diverses formes à travers le monde.

En France, les ports appartiennent à l'État. L'outillage et parfois le port même, font l'objet de concessions dont les titulaires habituels sont les Chambres de Commerce, et alors ils deviennent des ports autonomes. Les travaux neufs sont payés, à part égale, par l'État et les intéressés locaux, tandis que les travaux d'entretien sont entièrement défrayés par ces derniers.

En Italie, ils sont gérés par l'État, représenté par le Ministère des Travaux Publics.

En Belgique, l'exploitation est confiée aux villes maritimes, comme Anvers.

Les systèmes d'administration en Angleterre sont très variés. Les petits ports sont municipaux. L'exploitation des grands ports comme Liverpool, Londres, est confiée à des "Boards", composés d'éléments intéressés à la vie du port comme armateurs, négociants, banquiers, et il n'y a pas d'intervention de l'État.



Coupe schématique d'un terre-plein type.

En Amérique du Sud, on trouve des concessions assez nombreuses, notamment le Port de Rosario, construit et exploité par une compagnie française.

Une partie des ports aux États-Unis sont municipaux, tels que New-York, Nouvelle-Orléans. L'administration d'un certain autre nombre est confiée à un "Port Authority" par l'État dans lequel est situé le port. A New-York il existe "The Port of New-York Authority" qui est la création de deux États, New-York et New Jersey. On lui confie l'exploitation de tous les aéroports importants, La Guardia par exemple, des principaux tunnels comme le Holland et le Lincoln, les ponts George Washington, Bayonne et Goethals, le fameux terminus d'autobus, complété il y a à peine deux ans. La section maritime du P.N.Y.-A. n'exploite pas les quais de New York (qui appartiennent à la ville) mais exploite le port de Newark. Le but principal de sa création est de coordonner le développement de tous les moyens de transport — maritime, terrestre et aérien.

Je vous entretiendrai maintenant d'un sujet qui nous touche de plus près, le Conseil des Ports Nationaux. Sa création date de l'année 1936, et il relève directement du Ministre des Transports. D'une façon générale on lui accorda les privilèges et la souplesse relative des agences de la Couronne, permettant ainsi un exercice plus libre de ses fonctions, fortement imprégnées d'un caractère commercial. Le Conseil administre les ports suivants (antérieurement confiés à des Commissions locales): Halifax, Saint Jean, Chicoutimi, Québec, Trois-Rivières, Montréal, Vancouver, Churchill, Prescott, Port Colborne et le pont Jacques Cartier à Montréal.

Il est composé de trois membres, avec bureau-chef à Ottawa, lequel comprend les services suivants: Contentieux, Circulation et Publicité, Finance et Génie. L'administration locale est remise entre les mains d'un gérant, avec un personnel plus ou moins considérable, dont l'importance en est le facteur déterminant.

Le contentieux est composé de deux avocats, et est fort occupé avec l'étude:

a) de baux, soit pour location de terrain, hangars, quais, etc., dont le nombre dépasse 2,000;

b) l'examen des réclamations commerciales pour accidents;

c) la rédaction et la soumission au Conseil d'actes de ventes, par exemple, celui du réseau ferroviaire du Port de Vancouver, récemment acheté par le C.N.R.

Les ports n'opèrent pas dans un but lucratif: toutefois ils cherchent à recueillir les ressources nécessaires pour le paiement des travaux d'amélioration, d'extension et d'entretien. En conséquence, on impose des taxes ou droits aux usagers qui représentent des services rendus. Ils frappent soit le navire lui-même, soit la marchandise et en certains cas les passagers. Les frais principaux sont:—

a) Droits de Port, basés sur la jauge nette du navire. C'est un

The Engineer and the National Harbours

English Resume of Conference on Ports Given at Quebec on March 26, 1953

Three of the National Harbours Board ports, Montreal, Quebec and Saint John, are under the management of engineers: Messrs. G. A. Murphy, M.E.I.C., L. Beaudry, M.E.I.C. and R. Yuill, M.E.I.C., respectively.

Considerations

The main geographic considerations and the principal facilities in the development of a port are:

1. Shelter from wind, current, ice, etc.
2. Wharves for berthing vessels and for supporting sheds, roads, railways, etc. These may be marginal wharves or piers.
3. Loading and unloading gear: cranes, conveyors, etc. In Canada, we rely more upon ships' own gear than we do on land cranes.
4. Sheds for goods in transit. Column spacing, clear height, railway and trucking facilities are important factors in the design.
5. Roads, allowing oblique parking and quick transfer of cargo.
6. Railway spurs.
7. Provisions should be made for cold storage, custom and immigration services, shelter for workers, passenger accommodation and the like, as needed.

Port Administration

In France, ports belong to state and some are leased to local authorities. In Italy, they are state-operated. In Belgium, management is often entrusted to a city, such as Antwerp. In Great Britain, some are under municipal control. Large ports like London and Liverpool are managed by boards representing all interests. In the United States, they have municipal, state and privately administered ports. The New York Port Authority operates airports, tunnels, bridges, a bus terminal and wharves. It should be mentioned here that most of the piers on Manhattan Island are owned by the City of New York.

National Harbours Board

The National Harbours Board, created in 1936, reports directly to the Minister of Transport. It is a Crown agency engaged in semi-commercial operations. It administers the national ports of Halifax, Saint John, Chicoutimi, Quebec, Trois-Rivières, Montreal, Vancouver, Churchill, and the Prescott and Port Colborne Elevators. It is under the direction of three members, has legal, engineering and traffic departments in Ottawa. The individual harbours are under the direction of a port manager.

Port operations are generally not a profit making business; nevertheless, the ports should be, as much as possible, self-supporting. In view of this, there are various fees assessed against users, the principal ones being harbour dues, dockage dues, wharfage fees, anchorage fees and charges for services such as those provided by grain elevators, the use of cranes, water, electricity, etc. In 1952, the national ports handled 42 million tons, the most important commodities being grain, petroleum, coal, newsprint, wood pulp, lumber, iron and steel products.

For capital works, funds are borrowed from the Federal Government, at a fixed rate of interest, which is repaid to it.

The engineering staff in Ottawa prepares plans and specifications for permanent works. The engineers in the ports look after the maintenance. The principal engineering work relates to wharves, sheds, grain elevators, railways, roads and general maintenance of such facilities.

droit d'entrée ou de circulation dans le Port.

b) Droits de Quai, basés sur la jauge nette du navire.

c) Taxes de Terre-plein, imposées sur la marchandise.

d) Droits d'Elévation des céréales, établis sur la quantité manipulée.

e) Droits d'Entreposage des céréales, établis d'après la durée d'emmagasinement dans les silos.

f) Droits de corps-morts et de mouillage, basés sur la jauge nette du navire et imposés pour ancrage ailleurs qu'aux postes d'amarrage à quai.

g) Taxes d'usage des engins de manutention:—
   (i) service des grues flottantes;
   (ii) service des grues locomotives.

h) Droits pour utilisation de certaines installations portuaires, telles que
   (i) service d'aiguillage des wagons de chemin de fer;
   (ii) service d'électricité;
   (iii) service d'eau.

C'est le service de la Circulation qui étudie l'échelle de ces droits, en plus d'encourager l'usage de nos ports. Le mouvement des marchandises dans les Ports Nationaux a atteint, en 1952, le chiffre record de 42,000,000 de tonnes. Les denrées qui indiquent les plus forts tonnages sont en ordre d'importance: Céréales, essence minérale, bois de pulpe, pâte de bois, fer et acier.

Pour la première fois dans les annales du Conseil, on a réalisé des bénéfices nets d'au delà de $1,000,000 après réserve pour renouvellement et remboursement d'intérêts dûs à l'État.

Chaque port a sa propre comptabilité de telle sorte que les bénéfices d'un ne peuvent être assignés à un autre.

Chargement de marchandises avec engins de bord (plateau suspendu aux quatre coins), Halifax, N.S. (Photo The Halifax Herald Limited).

Pour les travaux neufs, on a recours à des emprunts de l'État, et le taux d'intérêt, remboursable au gouvernement, est de 3¾%. Les travaux d'entretien sont défrayés à même les recettes d'exploitation — en autant qu'elles sont suffisantes et au cas ou elles ne le sont pas, un vote du gouvernement est requis pour combler le déficit.

Service du Génie — Le bureau-chef dresse tous les plans pour travaux d'immobilisation. Les travaux d'entretien sont préparés dans chaque port, en autant qu'il y existe un service de génie. Des soumissions publiques sont demandées pour tous les travaux qui s'élèvent à plus de $10,000.00.

Les principaux travaux consistent:

1. Quais des genres suivants:
   a) Caissons en béton, amenés par flottaison à l'emplacement définitif, ou encore caissons de bois qui sont des caisses sans fond, dénommées "Cribworks";
   b) Pieux, soit en béton, acier ou bois.
2. Hangars en acier, béton et en bois en certains cas isolés;
3. Elévateurs à grain;
4. Travaux d'entretien des réseaux ferroviaires, réparation de quais, silos à grain, voies charretières, ainsi que l'entretien général de toutes les bâtisses qui lui appartiennent.

Messieurs, ceci termine notre parcours et j'espère que je suis arrivé à bon port. √

Galerie à grain, Churchill.

Thermit Welding of Rolling Mill Pinions

by

John C. Querido, Jr.E.I.C.*

Maintenance Engineer,
Canadian Tube & Steel Products Ltd.,
Montreal

This article on thermit welding is written from the practical shop man's point of view, rather than that of the engineer. Discussing the theory of thermit welding and describing the process, the author follows the operation of welding new wobbler ends on a number of drive pinions step by step, from designing the mould box, to the completion of the weld. A list of safety precautions is given.

A number of rolling mill drive pinions being used at the Canadian Tube & Steel Products Ltd. plant at Montreal, had broken wobbler ends. Faced with the choice of replacing the pinions or welding on new wobbler ends, it was decided to apply thermit welding to the latter. The first weld was made in February, 1952, under the supervision of representatives of a firm of welding consultants.

Thermit welding, although common in other industrial countries, is not widely applied in Canada. It has a certain usefulness in the repair of heavy parts and for joining large forgings and steel castings to make a part in itself too large to be made as one forging or casting. Because of the necessity for moulds and dams, however, its wide application is limited. It is particularly adaptable to rolling mill machinery repair.

Theory of Thermit Welding

Thermit welding, as distinguished from forge, resistance, gas, and various types of arc welding, is essentially a casting process, which employs a chemical reaction obtained by igniting a mixture of aluminum and iron oxide, thus forming iron and aluminum oxide. This reaction is possible because aluminum has a great affinity for oxygen. The thermit consists of a fine mechanical mixture of aluminum and metallurgically processed iron oxide, containing such carbon, manganese and alloys as are required in the steel weld. If necessary, alloys may be added whilst preparing the thermit charge.

The thermit, unless a special ignition powder is used to start the reaction, is inert, even to the heat of ordinary fires. Thus it presents no safety problem in handling and storage. The ignition powder, when ignited, creates a local heat of 2,800°F., which starts a violent reaction. The heat of reaction is approximately 6,500°F. creating a molten superheated mass of steel and aluminum oxide slag at approximately 5,000°F.

The process requires the use of specially made containers and specially prepared mixtures, together with moulding materials, preheating equipment and various accessories. When the charge is poured into a mould the slag rises to the top, leaving a steel deposit in the lower regions. This means that a quantity of thermit must be used, such that the slag portion of the charge is well above the actual weld. The reaction, regardless of the quantity of thermit, takes about 30 seconds for completion, at which time the weld may be poured.

Setting up the Pinion

A mould box set-up was designed to accommodate the pinion welding. This consisted of a base, moulding boxes, holding attachments and frames to hold the thermit crucible. Various views of this set-up are shown in the accompanying figures. The base consisted of base-end up steel rails, with longitudinal gaps of half an inch between rails, to allow for bolting, supported on steel rails at right angles.

The mould box consisted of steel plates in removable bolted sections, supported by a rectangular angle framework secured to the base. Appropriate sections were cut out of the steel plates to allow for passage of pinion and preheat hole. The box must be large enough to be able to surround the weld pattern, with six inches of moulding sand in all directions. Allowance in height must be made for the slag basin.

The pinion to be welded was supported on the steel rails to the appropriate height, and shimmed to line up with the centre provided for the wobbler end. The pinion was strapped to the supporting rails.

The best weld surfaces are those produced by an oxy-acetylene cutting torch. A dowel was used to connect the pinion and wobbler at their centres, and a screwed centre held the latter in line. The wobbler is a casting, the weld surface of which should be greater in diameter

**Now employed as production engineer with the Foxboro Company Limited, Ville la Salle, Que.*

Fig. 1. Applying the wax pattern to the pinion.

Fig. 2. Pipes in place to pattern preheat hole and pouring gate.

Table I — Thermit Weld Dimensions and Portions Required for Round Sections

Diameter Inches	Gap Inches	Collar Inches	Riser Dia. Inches	Pouring Gates No.	Pouring Gates Dia.	Heating Gates No.	Heating Gates Dia.	Connecting Gates No.	Connecting Gates Dia.	Thermit Required Pounds*	Diameter Inches
2	7/16	1 3/8 x 7/16	3/4	1	3/4	1	1 1/4	–	—	5	2
3	9/16	1 7/8 x 9/16	1	1	1	1	1 1/4	–	—	11	3
4	5/8	2 3/8 x 5/8	1	1	1	1	1 1/4	–	—	25	4
5	3/4	2 13/16 x 3/4	1 1/4	1	1	1	1 1/4	–	—	25	5
6	7/8	3 5/16 x 7/8	1 1/4	1	1 1/4	1	1 1/4	–	—	50	6
7	15/16	3 3/4 x 15/16	1 1/4	1	1 1/4	1	1 1/4	–	—	75	7
8	1	4 3/16 x 1	1 1/2	1	1 1/4	1	1 1/4	–	—	75	8
9	1 1/8	4 5/8 x 1 1/8	1 1/2	1	1 1/2	1	1 1/2	–	—	125	9
10	1 3/16	5 1/16 x 1 3/16	1 1/2	1	1 1/2	2†	1 1/2	–	—	150	10
12	1 5/16	5 7/8 x 1 5/16	1 3/4	1	1 1/2	1	1 1/2	1	1 1/2	200	12
14	1 1/2	6 11/16 x 1 1/2	1 3/4	1	1 1/2	1	1 1/2	1	1 1/2	300	14
16	1 5/8	7 1/2 x 1 5/8	2	1	1 1/2	1	1 1/2	1	1 1/2	425	16
20	1 7/8	9 1/8 x 1 7/8	2 1/2	1	2	1	2	1	2	750	20
24	2 1/8	10 5/8 x 2 1/8	3	2	2	2	2	2	2	1325	24
30	2 1/2	12 15/16 x 2 1/2	3 1/2	2	2	2	2	2	2	2275	30

*Thermit required includes provision for a 10% excess of steel in slag basin for a single pour and a 20% excess for a double pour.
†Includes one separate back heating gate.

Formula upon which above table is based

$$\text{Gap} = \frac{\sqrt[3]{\text{area}}}{3.6}$$

Thickness of collar at centre = Gap.

$$\text{Width of collar} = \sqrt[3]{\frac{\text{area}}{10}} \text{ plus twice gap.}$$

In computing dimensions and thermit required, the following were used:

Length of riser = width of collar.
Volume of collar = 0.8 the rectangular volume of collar.

POURING GATES AND RISERS NOT TAPERED.

Table II — Analyses of Pinion Steel and Thermit Weld

(Weld Mark I — Poured February 14, 1952)

	Pinion	Thermit Weld
Carbon	0.55%	0.16%
Manganese	0.75	0.76
Phosphorus	0.050	0.018
Sulphur	0.032	0.018
Nickel	0.42	0.35
Chromium	0.07	0.10
Molybdenum	0.08	—
Silicon	—	0.51

Table III — Physical Properties of a Test Bar made from Thermit Riser

(Weld Mark I)

Diameter	0.505 inches
Area	0.200 square inches
Yield Point Load	8,000 pounds
Yield Point	40,000 p.s i.
Tensile Strentgh Load	15,100 pounds
Tensile Strength	75,500 p.s.i.
Elongation in 2 inches	13 per cent
Fracture	Straight

than the pinion shaft, to allow for alignment. The gap between the surfaces to be welded varies with their diameters; these gaps are given in Table I.

Preparing the Mould

With the pinion and wobbler set up and aligned in the mould box, the next stage was to prepare the mould. Before applying the wax pattern, the shaft had to be thoroughly cleaned with a wire brush and heated slightly with a torch so the wax would not freeze on application. The pattern wax was then applied to the section to be welded, packed well and raised in a semi-circle above the shaft prescribed in Table I (Fig. 1).

A finish was given the wax by smoothing and trimming with a heated semi-circular tool. The edges were trimmed with a knife. The lower plates were then bolted on the mould box, and high temperature mouldi[illegible]d was packed in solid by an [illegible], without danger bottom of [illegible] wax[illegible]er [illegible]ttern. One or more preheat hole[illegible] were made by running a stepped pipe (to allo[illegible] plugging) from the bottom centre o[illegible] the wax pattern, at a slight downward angle through a hole in the mould box.

To this was connected a vertical pipe to make the pouring gate. The connection was rounded out by pattern wax, to eliminate sharp corners which may be worn off in pouring. The vertical pipe may be held in place while the mould is being built up, by spot welding a rod to pipe and mould box (Fig. 2).

Moulding sand was then applied, and packed to near the top of the wax pattern. At the top centre of

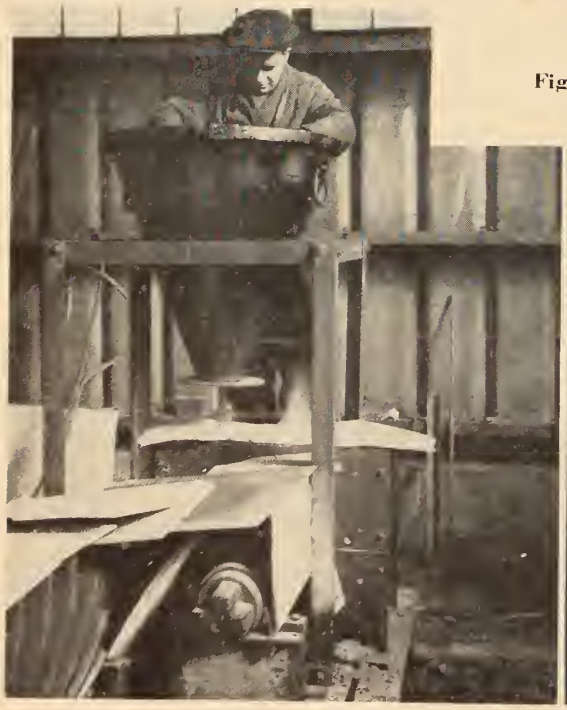


Fig. 3 (above). Slag basin of mould.
Fig. 4 (below left). Preparing the thermit charge.
Fig. 5 (below right). Finished weld. *A*—preheat hole, *B*—pouring gate, *C*—riser, *D*—slag.

the pattern a vertical pipe was inserted as a riser patter (Fig. 2). The moulding sand w n built up ie box, sufficient depth ng to make a lag basin, which should have a minimum volume of eight cubic inches per pound of thermit to be poured.

Moulding sand was packed around the sides of the basin. A depression was made around the pouring gate pattern (Fig. 3) and a smaller one around the riser. A channel was made between the two depressions. The pipes were all carefully removed from the mould. A heated rod was thrust through the various holes to melt out the pattern wax, and thus create chimneys for preheating. The mould was then complete.

Pouring the Weld

The next stage was to preheat the shaft in the region to be welded, to a temperature of approximately 1,700°F. (the colour of the shaft is sufficient indication). A thermit double burner shop preheater was used to preheat, the burner being inserted in the preheat hole. This burner uses water-white kerosene as a fuel, atomized by compressed air. A plug was placed in the pouring gate and an angle over the riser.

The pinion should be shielded with asbestos board (Fig. 4). During the preheat the thermit crucible may be mounted over the mould and the charge prepared. For every pound of pattern wax used in the mould twenty pounds of thermit must be charged.

The first step in charging was to insert a magnesite thimble in the hole in the bottom of the refractory lined crucible. Into this thimble the tapping pin was placed and a metal disc was placed on top. A quantity of refractory sand was added, sufficient to cover the head of this pin to a depth of half an inch.

Thermit was then poured into the crucible, and the necessary alloy such as nickel, etc., was sprinkled throughout the thermit. On top of the thermit charge, *in the centre*, a tablespoon (or more) of ignition powder was placed in a depression made in the form of an "X". Half a dozen matches were inserted in the powder with just their heads showing.

When the weld area was sufficiently preheated the torch was removed, and a steel plug was inserted in each preheat hole, and pushed up to the shoulder. This plug was then backed with moulding sand and a backing plate. The portion of the box where the shaft passes was carefully packed from the outside around the shaft.

The reaction was started by igniting the ignition powder with a red hot rod (since the reaction which takes place is violent, the person igniting the powder should immediately stand back at least ten feet). When the reaction subsided, and was thus complete (about 40 seconds), a rod was used to push up the tapping pin and the molten thermit flowed into the mould. The aluminum slag rose to the top of the mould, i.e. the slag basin. The weld should be left in the mould overnight, so that it may cool slowly into an annealed, stress-relieved condition.

Physical Properties

Any discussion of the properties of the weld should be based on running performance of the welded pinions. With this in mind, records should be kept that will enable us to control the quality of thermit welds in the applications. A prediction of running properties, based on experience in other plants, indicates that the weld may be expected to wear as well as the original shaft, with equal stress resistance.

The machining properties of these welds have been found excellent, with no indication of hard spots or blow holes. The alignment of the pinions was extremely good (within .030 in.) which indicates the set-up was appropriate for the job. Shrinkage approximated $\frac{1}{16}$ in. per inch of gap.

The type of thermit used is customarily specified according to properties and application, rather than a composition to match the material welded; the manufacturer will supply accordingly.

Thermit Safety Precautions

A list of safety precautions necessary with this process are given below:

1. Thermit should be kept in a dry, heated storage place. *Under no circumstances should damp thermit be used*, since it is extremely volatile when wet.
2. No smoking should occur in the region of the igniting powder. This particularly applies when the powder is in contact with the thermit charge. The igniting powder should not be stored in the region of the thermit storage.
3. All inflammables, including acetylene hose, etc., should be placed at a safe distance before igniting the thermit charge.
4. Persons, other than he who ignites and pours the thermit, should stand *at least* twenty feet from the mould, when igniting and pouring. Goggles should be worn when igniting.
5. One pair of asbestos mitts should be supplied to the group making the weld, in order to eliminate the danger of burns when plugging the preheat holes, etc., and igniting the charge. √

Cheap Transportation

In a recent address to the St. Andrew's Society of Toronto, Mr. S. M. Blair, vice-president of the Trans-Mountain Oil Pipe Line Company, quoted figures showing how cheaply oil can be moved by pipe line. Mr. Blair's comparisons were made with the railways, a comparison of bulk traffic in a single commodity with large and small shipments of many commodities moving both long and short distances. Even though the comparison is not strictly "comparable", the figures do emphasize the low cost of moving oil by pipe line.

Taking railway items as 100 each, we get this table from Mr. Blair's statements:

	Oil pipe line
Tons per mile per year	400–800
Steel per mile	65
Fuel per ton-mile	75–85
Employees	10
Stations	20
Freight rate	10–14

As compared to rail transportation, pipe line carriage has advantages other than those listed above. Location and construction are simpler, cheaper and usually faster, there is no non-paying load moved, traffic is not impeded by snow and signalling is less complex, to mention a few.

Mr. Blair hints at the possibility of moving commodities other than oil and gas by pipe line, but does not hint what he thinks they may be.

There is most certainly a place for the railways in our economy. They have, of course, contributed and are still contributing to our development, but it is doubtful if even they themselves would wish to undertake the task of moving the oil of the west to market.

New Canadian Trade Marks Act Assists the Engineering Profession

William R. Meredith, M.E.I.C., Barrister, Ottawa, Canada

The new Canadian Trade Marks Act which has been passed by Parliament will permit trade marks to be registered in respect of engineering services, construction, transportation, repairing and many other services. This is a distinct innovation, since previously trade marks could only be registered in respect of goods.

To take a case in point, let us suppose that a company sold material for airport runways under the trade mark "Tarmacko", but its real business was the construction of runways using this material. Previously no protection was possible except in respect of the material. If another company sold material for a similar purpose and used the trade mark "Tarmacko", this could be stopped, but there was little to prevent a group of individuals styling themselves as "Tarmacko Airport Designers" and thus confusing the public and perhaps trading on the reputation of the company making "Tarmacko."

Many advantages will accrue to the engineering and construction professions by this new Act, and many situations of the type mentioned can be easily imagined.

It should be mentioned that the new Trade Mark Act, although passed by Parliament early in 1953, does not come into force immediately. It is necessary for the Government to issue a proclamation bringing the Act into force, and this is expected to be done as of January 1st, 1954. Those interested in the new Act could ascertain if it is yet in force by writing to the Secretary of State, Ottawa, after January 1st, 1954. It will not come into force before that date, at the earliest.

The other changes made by the new Act are also of interest to engineers, but particularly because of their possible effect on business generally. To explain the principal changes, it is necessary to give a very brief account of the history of trade marks.

Historically a trade mark was a sort of "pen-name" of the maker, to identify his goods. The idea that a trade mark had to be used in connection with goods only, rather than services, was an early concept, which has only now been changed in Canada, although it was previously changed in Great Britain, the United States and many other countries.

Further, because a trade mark identified the maker, he could not let others use his trade mark, nor could he sell his trade mark without selling the whole business with which it was connected. This also persisted until it was changed by the new Act. For example, suppose a steel company owned a trade mark "Magic-H" for structural steel beams or columns, and on account of the cost of transportation it was not economical to ship the structural steel to British Columbia; in that area it allowed another company to use the trade mark "Magic-H" to supply the local demand. Under the former Act, this would absolutely invalidate the trade mark, because of the hoary legal concept that the public would be confused by two different traders using the same trade mark. It did not make any difference that the trade mark owner took steps to insure that the other trader made structural steel of the same quality as his own and sold interchangeable members. If this situation occurred, the owner of the trade mark lost his rights. The only way that another could be allowed to use the trade mark was by selling the other the whole business.

This was obviously very unsatisfactory and no doubt greatly impeded commerce and industrial development. One unfortunate consequence of the prohibition against the use of a trade mark by more than one trader, was that a company could not even permit its wholly-owned subsidiary company to use its trade mark, without danger that its protection under its trade mark would disappear. It has been a matter of common knowledge that many parent companies have allowed subsidiaries to use their trade marks, for example United States companies who operated in Canada and also had wholly-owned subsidiaries here.

The new Act rectifies situations of this type previously existing as follows:

1. In the case of related companies, where the same trade mark was used by more than one of them, either before the new Act comes into force or within one year from that time, possible nullification of the trade mark for this reason is automatically wiped out.

2. Where the traders are other than related companies, the trade mark owner may register the other trader as a "user" at the Trade Marks Office within one year of the time the Act comes into force, and this will wipe out any damage to the trade mark for this reason.

3. Even if the latter step is not taken, the Exchequer Court of Canada may still declare the trade mark not to have been damaged.

The difficulty of restricted assignment, i.e., that a trade mark owner cannot validly sell a trade mark without selling the business along with it has now been changed. One word of caution should here be given: suppose a manufacturer has three trade marks for structural steel members, "Magic-H", "Magic-I" and "Magic-L". Previously he could not sell one without the business, and since the other two were also bound up with the business, he could not sell one without selling the other two *and* the business. The new Act will allow him to sell any one, *but* if "Magic-H" were used by another trader and the original owner continued to use the other two, the three trade marks would lose their distinctive character and would probably all become invalid. If a trader owned trade marks "Superconstructo" and "Magic-H" both for steel members, he could no doubt dispose of one without danger, because of the lack of similarity between them.

One difficulty of the former Act was that a trade mark had to be used before it could be registered. Under the new Act, a registration can be applied for and if the application is approved, the applicant can then use the mark and obtain registration.

A little-known branch of trade marks is that relating to "distinguishing guises." We all know that a trade mark may be a word such as "Coca-Cola" or may have design features such as the "Shell" petroleum symbol. It is not so well-known that a trade mark may also be in a distinctive shape of a container, for example some of the better-known beverage bottles. This was formerly recognized as a trade mark, and is continued under the new Act with some restrictions. An oil drum of distinctive shape may be the subject of trade mark registration under certain circumstances which are too detailed to be discussed here.

An important innovation of the new Act is "opposition". At present anyone may go to the Trade Marks Office and examine pending applications, and the Registrar will consider objections which may be made by any interested party. Under the new Act, when an application has been tentatively approved, it will be advertised in an official publication to which the public will be able to subscribe. Thereafter anyone may oppose the application. The effect of this will not only facilitate the protection of one's own trade mark, for example to allow the owner of "Ajax" for bulldozers to object to the registration of "Ajax" for power shovels by another manufacturer. In addition, this will aid in preventing objectionable trade marks from becoming registered. For example, any manufacturer of steel is entitled to call his product "high-Brinell" if it in fact has a high Brinell number, and it would be unfortunate if such an expression were registered as a trade mark. The Trade Marks Office might not be aware of the scientific sense of a word sought to be registered, and objections from outside will greatly assist the Registrar and staff in giving proper consideration to applications.

There are many interesting features of the new Act, a copy of which can be obtained from the Queen's Printer at Ottawa for twenty-five cents. Its reference is Chapter 49, 1-2 Elizabeth II.

Undoubtedly the new Act will have considerable advantages from the business standpoint not previously available, and will indirectly and even directly affect engineering. Only the most important changes have been referred to here, but there are others which may turn out to be of equal importance in Canada's industrial growth. √

High Alloy Castings Resist High Temperature

Because of the ever-increasing severity of modern industrial processes, engineers must now rely on materials especially suited to high temperature and pressure. According to the Alloy Casting Institute, these conditions are making new demands on metallic components of equipment used in oil refining, heat-treating, gas and steam turbines, jet aircraft, and chemical processing.

The design of such equipment is complicated by hot gas corrosion of metal parts used for continuous or intermittent service above 1200°F. Hot gas corrosion causes progressive scaling, which can eventually reduce the sectional area of an exposed element reducing its load-carrying ability.

Engineers not actively concerned with high temperature design may be unfamiliar with the properties of a group of alloys that retain mechanical strength at high temperatures, and also resist corrosion from hot gas. These are the chromium-nickel-iron cast high alloys, which are divided into corrosion-resistant and heat-resistant groups. In the heat-resistant group, twelve cast alloy compositions are recognized as standard, and within this general classification, there are three distinct types:

A. Iron-chromium castings containing up to 30 per cent chromium and under 7 per cent nickel (HC and HD). Type HB alloy, containing only 18 per cent chromium and useful only up to 1500°F., is sometimes also included in this group. These ferritic alloys offer excellent resistance to oxidation and sulphur-containing atmospheres, although they have moderate hot strength.

B. Iron-chromium-nickel castings 18 to 32 per cent chromium, 8 to 22 per cent nickel, with higher chromium than nickel content (types HE, HF, HH, HI, HK, and HL). Partially or fully austenitic, these alloys have greater high temperature strength and ductility than the straight iron-chromium group, will withstand greater loads and temperature cycles, and can be used in sulphur-bearing, oxidizing and reducing atmospheres.

C. Iron-nickel-chromium castings containing from 30 to 70 per cent nickel and 10 to 20 per cent chromium (types HT, HU, HW, HX). These alloys are fully austenitic, maintain hot strength in applications up to 2100°F., and have good life under rapidly fluctuating temperatures. They withstand reducing and oxidizing atmospheres, do not carburize excessively, or take up nitrogen in a nitriding atmosphere. The high nickel content makes this group unsuitable for use in atmospheres containing substantial amounts of sulphur.

Most of the chromium-nickel-iron cast alloys suitable for high temperature service also withstand the effects of one or more varieties of heat treating atmospheres — oxidizing, reducing, and of sulphur-bearing fuel gas. The following examples show how the alloys provide various combinations of mechanical properties and hot gas corrosion resistance.

Recuperators

Typical of conditions is the combination of hot gas and moderate stress conditions found in recuperator installations. These recuperators are usually installed in waste gas flues, to recover the heat to be used for preheating of air. The waste gases will produce every variety of hot gas corrosion. To meet such demands, an alloy from Group A is indicated.

For this particular application strength requirements indicated an alloy of somewhat better mechanical properties than type HC; so type HD was suggested by the Company which made the castings. This alloy can be used for applications where moderate stress is encountered and for somewhat lighter load-bearing duties. Because of the high chromium content, type HD resists oxidation from high sulphur-containing atmospheres.

Annealing Retorts

A dramatic example of the value of proper alloy selection, and its effect on performance, is provided by the annealing retorts cast and fabricated by the Electro-Alloys Division of the American Brake Shoe Company. Used to protect high-speed tool steel from combustion products, heated by high sulphur-content anthracite producer gas, these retorts were formerly made of seamless carbon steel tubes. Performance was unsatisfactory.

In the annealing process, the furnaces containing the retorts are preheated to 1650°F. and held at

this temperature for 10 hours. The temperature is then dropped to 1400°F., held for two hours, dropped to 1375°F. and held for three hours, after which the stock and retorts are furnace cooled. The total cycle takes 30 hours.

Electro-Alloys engineers recommended that the new retorts be centrifugally cast of ACI type HH alloy. This type has high strength, ductility and corrosion resistance at temperatures up to 2000°F. The HH grade can be produced as partially ferritic or wholly austenitic; the ferritic providing highest hot ductility, and the austenitic highest hot strength. The composition chosen was designed for high strength and maximum resistance to embrittlement.

Previous Experience With Carbon Steel Retorts:

The processor formerly used 20-foot seamless carbon steel pipes. Average life expectancy for these pipes was about 16 passes through the furnace. Replacement was required every eight weeks, primarily because of scaling and flattening, or deformation.

Because of loss of symmetry, the retorts could not be fully loaded or stacked properly in the furnaces, which resulted in poor economy of operation. In addition, cast iron plugs, could no longer be fitted properly after distortion of the pipe. Fire brick and mud were used to seal the open ends of the distorted members. This type of plugging also failed to provide the gas-tight seal necessary for uniform annealing.

Experience With Cast High Alloy Retorts:

Cast in type HH alloy, annealing retorts installed 3½ years ago have given excellent service, and are still in good condition. Since the alloy resists the high sulphur content gases, there is little scaling, and the retorts have retained their uniform wall thickness, insuring uniform annealing of the tool steel. No loss of symmetry has been detected, and the furnaces can still be stacked to maximum capacity.

A cast material rather than a comparable wrought grade was chosen, since the cast alloy is stronger at the application temperature than comparable low carbon high alloy wrought grades. Furthermore, wrought tubing in the sizes required was not available.

Muffle Sections

Gas carburizing atmospheres combined with high temperatures pose a special challenge to materials of construction, a challenge being successfully met by the alloys of Group C, particularly by type HT. Engineers of Michiana Products Corporation, Indiana, have developed high alloy muffle sections for long term reliable operation at temperatures up to 2000°F. in modern mechanized furnaces. In high-volume gas carburizing, the muffles usually function in a temperature range of 1650-1800°F. Analysis of the gas is approximately 33 to 35 per cent H_2, 20 per cent CO, up to 7 per cent CH_4, and the balance is a carrier gas which is about 40 per cent nitrogen.

Prime requisite for the muffle section was retention of strength at elevated temperatures, and resistance to both oxidizing and reducing conditions. Since sulphur corrosion was not a problem, one of the high nickel alloys could be used. Type HT, containing 33 to 37 per cent nickel and 13 to 17 per cent chromium was selected. This type operates satisfactorily at temperatures up to 2100°F. in oxidizing atmospheres, and up to 2000°F. in reducing atmospheres, provided that limiting creep stresses are not exceeded.

Summary

The conclusions can be briefly summarized; in strong oxidizing or reducing atmospheres with possibly high sulphur content, and where only moderate strength is required, alloys in Class A are generally satisfactory. Where high strength is required, as well as resistance to oxidizing, reducing, or sulphur bearing gases, alloys in Class B normally provide good service. Where even greater hot strength and reliability under cyclic temperature conditions is needed, Class C alloys are frequently chosen and will resist attack by nearly all furnace gases with low sulphur content.

To select the cast alloy within each class best qualified to answer a particular design problem, however, expert evaluation of the service conditions is advisable. It is wise, therefore, to consult a metallurgist at one of the foundries specializing in high alloys.

Future Annual Meetings

of the

Engineering Institute

QUEBEC, QUE.—May 12, 13, 14, 1954
Chateau Frontenac

★

TORONTO, ONT.—May 11, 12, 13, 1955
Royal York Hotel

★

MONTREAL, QUE.—May 23, 24, 25, 1956

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

What Causes This Sort of Thing?

Another case difficult to understand, of letting Canadian work to foreign consulting engineers, is at this time of writing being talked about in Toronto. It is a case quite similar to the one in Montreal on which comment was made in the September *Journal*.

The City of Toronto through its Metropolitan Planning Board have engaged or are in the process of doing so, a firm of consultants from the United States to design a lakeshore expressway. This is precisely the same action as taken by the City of Montreal. As would be expected, there is much criticism of the city and much opposition to the proposal. Judging from the press and direct news from Toronto, the opposition is headed up, rightly enough, by the Association of Professional Engineers of Ontario in the person of their director, T. M. Medland.

The *Globe and Mail* is giving tongue in a fine way to inform the people on the Board's action. The people have been surely alerted by the paper's editorials, special articles and cartoons. It is encouraging to have the press take such a helpful part in exposing these actions which to the citizen must seem awfully stupid and wasteful.

What are the complexities of an expressway that put it in the class of a secret process, a patented piece of equipment or a copyrighted procedure that only a foreigner can design? An examination of existing expressways reveals nothing that would not be thought of by any good engineer experienced in traffic matters in association with an equally good structural engineer. The Toronto planning director is quoted in the press as saying "we have got to have a firm that will have the vision to plan the Lakeshore Expressway from the Humber River to Woodbine Avenue". This platitudinous observation seems to suggest that vision is limited to some supermen from outside Canada. It would seem also to indicate that vision is lacking on the Board itself.

When will Canadian employers of engineering services outgrow this idol worship for engineers south of the border? When will they learn to examine carefully into the requirements of the proposal and then make a real endeavour to find Canadians who can do it? Why this persistent policy of engaging foreigners without even giving Canadians a chance to indicate their competence?

To support the suggestion that vision is needed for a thing of this kind, one has only to read a bit about traffic in today's large cities. It becomes apparent that the expressway of a few years ago is not adequate for today, and the one designed today will be inefficient and inadequate a short time hence. Vision and good sense require that the expressway be thought over seriously, not just from the design point of view but from its functional point of view. There are many experts in the traffic field who think expressways are an evil rather than a blessing. With parking conditions as they are today, the more simple and quick access is, to down town the worse traffic conditions become. In other words, expressways encourage more people to drive their cars down town to add to the already crippling overcrowding, thereby aggravating the situation which in the first instance it was intended to relieve.

The Engineering Institute has a committee studying the invasion of Canada by foreign engineers and contractors. Under their instructions a telegram was sent to the Metropolitan Planning Board, and a letter was written to the *Globe and Mail*. The letter which contains also the telegram is reproduced herewith.

October 23rd, 1953.

Sir:

The Engineering Institute of Canada heartily endorses the efforts of the Association of Professional Engineers of Ontario in

Cover Picture

Machining the shaft for a giant power generator is exacting work. The cover picture shows a 30-ton shaft for a 90,000 kva. umbrella-type generator—the largest ever built in Canada—which will go to the Consolidated Mining and Smelting's Waneta Development in B.C.—*Westinghouse Photo.*

endeavouring to secure the employment of a Canadian engineering firm for the preparation of functional plans for the proposed Lakeshore Expressway.

As you so rightly pointed out in your editorial under date of 21st October, the record of accomplishments of Canadian engineers during the past two decades is one of which we can all be proud. It certainly provides little justification for going outside our boundaries in the present instance.

The Institute has a special committee studying means by which more Canadians might be encouraged to give their work to Canadian engineers and contractors. The Toronto matter has been discussed by the committee and on their instructions I have sent the following telegram to James Maher, chairman, Metropolitan Planning Board, Toronto.

"The Engineering Institute of Canada deplores the proposal to engage foreign consulting engineers to plan the Lakeshore Expressway at Toronto stop Such action would be taken as an insult to Canadian engineers who for this type of work as well as for most others are as competent as any in the world stop In the interest of good engineering practice and value for your dollar we believe this work should be given to Canadians not as detailers for a foreign consultant but as the prime consultants stop The Institute supports fully the protest of the Ontario Association of Professional Engineers."

The engineers of Canada owe a debt of gratitude to the *Globe and Mail* for its support of Canadian Engineering skill.

The Tour Begins!

The first branch visited by President Dobbin was the new one known as Huronia. Reference to that occasion was made in the October *Journal*. The first real tour followed immediately after and took the president to the Lower St. Lawrence, New Brunswick, and Prince Edward Island.

Starting out from Montreal on Sunday night the president and general secretary detrained at Rimouski about 4.30 a.m. Monday was a busy day with a tour of the city and nearby country, visits to the plant of the Canada Wire & Cable Company and the Marine School. A meeting with the executive in the afternoon and dinner with the branch coupled with a Rotary Club luncheon at which Mr. Dobbin was the speaker, and a band concert in the evening, made up a fair day's work.

On Tuesday the branch chairman, Leo MacLaren, and the secretary,

Rimouski

Left side of table, Leo Doyon, Marcel Lanouette, Auguste Albert, Marcel LeBel. Right side, Hugh Stevens, Paul Beauchesne, Gabriel Gagnon, Marcel Fradette.

President Dobbin and Secretary Menard discuss musical matters with the leader of the famous band of the Garde Nationale.

The head table, left to right: R. L. Dobbin, Leo G. McLaren, T. A. Bernier, Jean R. Menard.

Head table at Rotary Club where Mr. Dobbin was the speaker. Left to right: T. A. Bernier, Leo G. McLaren, R. L. Dobbin, Aubert Brillant, Rotary President, Jean R. Menard.

The president signs the golden book for Mayor Thibault of Matane. Others in the picture are Jean R. Menard, A. Bellavance, Maurice Gagnon, Gaston Fiset, Marcel Fradette and Leo G. McLaren.

Baie Comeau. Left to right: Peter Suttie, J. F. McInnis, C. E. Hand, J. M. Pope, R. L. Dobbin.

Baie Comeau. Left to right: J. N. Bodtker, Emil Bodmer, S. J. Simons, Steve Oancia.

Forestville. Left to right: Mrs. Thibaudeau, R. L. Dobbin, Jean Thibaudeau, Gaston Thomas, Mrs. Thomas.

Seven Islands. In the centre of the group is the president. On his right David A. Livingston who located the railway. On his left is Jean R. Menard the secretary of the branch.

Seven Islands. Ready for the flight to Knob Lake. The general secretary, the president and B. M. Monaghan.

Jean Menard, drove the visitors to Matane when after a reception by Mayor Leandre Thibeault, M.P., the local engineers joined with the group for lunch. That afternoon with Jean Menard as guide the president and general secretary flew across the St. Lawrence to Seven Islands.

The Seven Islands program was unusually interesting and bulging with events. There was a meeting of members at the Yacht Club on the first night. On the morning of Wednesday with Mike Monahan in charge there was a visit to the power development on the Marguerite River and in the afternoon with the project manager, Clare McManus, as host, the president and general secretary were flown up to Knob Lake to see the location of the mining operations. The party arrived in the midst of a heavy wet snowstorm which for September 15th was an unusual experience for the visitors. Here John Stubbins in a miniature jeep took the visitors

Fredericton. Left to right: Colin Mackay, president University of New Brunswick, L. Austin Wright, Clarence Burke Swan, winner of the E.I.C. Prize at the University of New Brunswick, R. L. Dobbin, Earle O. Turner, Dean of Engineering, University of New Brunswick.

Above left, head table, Saint John, N.B. Left to right: J. B. Stirling, Mrs. Watt, J. M. M. Lamb, president of the Association of Professional Engineers of New Brunswick, R. L. Dobbin, A. G. Watt, Branch chairman, Mrs. R. M. Richardson.

Above right, Saint John. Left to right: D. O. Turnbull, C. N. Wilson, president, Saint John Dry Dock, and Mrs. Wilson.

Taken at the Canadian General Electric Company's reception. In the picture are J. B. Stirling, H. M. Turner, president of C.G.E., and R. L. Dobbin.

Above, left, Bathurst. A general view of one of the tables.

Above right, Bathurst, head table, including W. C. Baggs, R. L. Dobbin, R. C. Eddy, L. L. Marshall.

At right, Moncton. Left to right: V. C. Blackett, Mrs. Leighton, W. D. G. Stratton, Mrs. Sansom, R. L. Dobbin, R. T. Sansom, Mrs. Eagles, M. F. K. Leighton, Mrs. Stratton, N. B. Eagles, Mrs. V. C. Blackett.

At right, A.W.W.A. meeting at Amherst. This is the head table and includes I. P. Macnab, C. G. R. Armstrong, Mrs. Armstrong, R. L. Dobbin.

At left, reception at Government House, Charlottetown. W. R. Brennan, R. B. Smith, The Hon. T. William L. Prowse, Lieutenant Governor, and R. L. Dobbin.

Below left, Charlottetown, head table. Left to right: James Hearn, G. J. Hayes, the president, R. B. Smith, chairman of the Branch, and K. C. Martin, secretary.

Below right, Charlottetown, general view.

over the jumps (no fooling!). The whole trip was a thrilling affair which gave one some slight conception of this gigantic project.

On the way north the plane came down at Manihek and the Institute officers had an hour or so for a hasty drive over the blood-red slippery roads to see the power development. Mr. J. L. Carey was the guide who demonstrated not only that he was an engineer but that he was a skillful chauffeur as well. A pleasant surprise was to meet a group of engineers who had gathered in the construction office to meet the president. It was an odd experience to find this weather-beaten, mud-spattered, snow-wet group of engineers, together in that place which to the visitors seemed so remote, so cut-off from the rest of the world. However, they seemed to be taking it in their stride, and apparently it was all commonplace to them.

When the plane left Seven Islands the weather was beautiful—just a perfect September day. Ten minutes after take-off it ran into heavy, dark, ominous looking clouds. However, it was possible to follow the line of the railroad under construction. It was strange to see individual groups of workers at different points along the line, seemingly without connection with each other. Ordinarily a railroad is built from some one or more settled points, but here there were no settled points. The work at some of the bridges, at Knob Lake and at Manihek was made possible without waiting for the railway, or for a highway by flying in men, materials and machinery. The company operates nineteen planes.

Just how anyone could locate a railway in that north country is difficult to grasp. At times the number of lakes seemed so great that the earth's surface was almost all water. And yet a railway 358 miles long has been located and is being built. The direct distance by air to Knob Lake is only 18 miles shorter which makes the railway location just that much more remarkable. David A. Livingston was location engineer.

Back at Seven Islands late in the afternoon, the president dined at the staff house with about twenty-five engineers. After dinner the group adjourned to the Yacht Club for a social hour. Here at a not too early hour the president concluded not only a busy day but perhaps the most thrilling day that any president has experienced on a branch visit.

Baie Comeau

By air on the morning of Thursday the party arrived at Baie Comeau. This well-developed, well-planned and long-established community made quite a contrast to the newly created, bustling centre of Seven Islands, but the time is not so far distant when it too was on the edge of civilization.

As part of a tour of the town under the guidance of J. F. McInnis, the party visited the power development at Manicouagan, and did a quick "run through" of the plant of the Quebec North Shore Paper Company. In the evening the local engineers entertained the visitors to dinner at Hotel Auberge du Roc.

Bus Ride

The plans for Friday were to fly from Baie Comeau to Forestville, but Nature took a hand in it and dropped down a curtain of fog that made the flight impossible. The alternative was a three and a half hour bus ride, which turned out to be much more pleasant and interesting than had been anticipated. The route was through beautiful scenery including a stop at the Bersimis Indian Reservation, and a ferry ride across the great Bersimis River. From the river on, the road

ASME Meeting, Rochester

Left to right: R. L. Dobbin, Hon. R. H. Winters, L. Austin Wright.

Left to right: R. L. Dobbin, Oscar S. Field, president, Rochester Engineering Society, Frederick S. Blackall, Jr., president, American Society of Mechanical Engineers, J. Foster Petree, of London, England, editor of "Engineering".

lay for almost the entire distance in burnt-out forest lands. It was a shock to see the devastation and to realize that some of these fires had occurred many years ago, and yet new growth was hardly noticeable. One portion had been destroyed just this summer and the dust and ashes still lay there as though it had been but yesterday. The forest is one of the so-called renewable natural resources, but it doesn't renew very quickly after a fire.

Forestville

On arrival at the Hotel des Quatre Chemins a group of engineers and their wives sat down with the president for dinner. Next morning, Saturday, a quick tour was made of the expanded airport and the town which right now is looking as though something had struck it, which indeed is the case. The Quebec Hydro's gigantic power project on the Bersimis River is about 80 miles north, and Forestville, for the time being at least, is the base of the operations. It is a busy, bustling community.

That afternoon, once more crossing the broad St. Lawrence by air, the party returned to Rimouski, greatly impressed with the resources and the developments of this frontier area. The tour of the Lower St. Lawrence Branch of the Institute surely gave a graphic indication of the fabulous wealth of this grand new country. Already it is a source of employment for countless numbers of engineers—and it is yet only in the early stages.

To the East

Four-thirty a.m. again saw the party at the railway station on Sunday the 20th, on the way to Amherst, N.S., where the Maritime Division of the Canadian Section of the American Water Works Association was holding its meeting. Mr. Dobbin was the dinner speaker. It was quite a meeting with lots of E.I.C. members participating.

Late Tuesday afternoon the president motored to Moncton where he met with the branch on Wednesday. There was an executive meeting in the afternoon at the City Hall followed by a dinner meeting at the Curling Club.

Prince Edward Island

Thursday noon saw the president and general secretary in Charlottetown where they were met at the airport by the chairman of the branch Ron Smith. In the afternoon the Lt. Governor The Hon. T. William L. Prowse received the group at Government House, and later the acting premier received them in his office at the Parliament Buildings. That evening the branch meeting was held at the Queen's Hotel.

After the meeting the entire group—thirty of them—came to the president's suite where a business meeting was held. The agenda trailed out of business and into a social sphere, promoting as useful and as pleasant a meeting as any president could hope for.

Friday was a day off, spent touring "The Island" and very beautiful it was too. That evening the executives and their wives with the president and general secretary met at the home of Ron Smith. Even as this is being written, at this late date and remote place, the oysters and lobsters served there in such abundance, bring palpitations to the palate and a longing to return.

Saint John, N.B.

Saturday afternoon the 26th, after a short flight, the party arrived at Saint John. On Sunday afternoon there was a very pleasant tea party for the executive at the home of Mr. and Mrs. T. C. Higginson in Rothesay.

Monday was a big day with a meeting with the executive and a special meeting with the Council of the Association of Professional Engineers. In the evening the branch meeting took the form of a dinner at the Admiral Beatty Hotel with the ladies present and with Branch Chairman A. G. Watt presiding.

Fredericton

The trees of New Brunswick never looked lovelier in their brilliant coloring than on the days the president was motoring in the province. Tuesday the party drove with Mr. D. O. Turnbull through the new army camp now under construction, to Fredericton where the president was welcomed by Dr. Colin B. Mackay, the new president of the University, and was introduced to the students by Dean E. O. Turner. The student's prize was presented to Clarence Burke Swan.

The executive joined with the party for dinner at which Branch Chairman C. E. Weyman presided. Many points of interest to the branch and the Institute were discussed in considerable detail. The meeting broke up in time to allow the men to return home for their wives. The program concluded (at a late hour) with a very nice dance in the ballroom of the Lord Beaverbrook Hotel.

Bathurst

Wednesday was a beautiful day—perhaps even lovelier than all the previous days, and even the trees looked lovelier. The drive to Bathurst with D. J. Brewer was something to remember. At Bathurst the chairman of the branch, R. C. Eddy, picked up the party at the hotel to attend an executive meeting at the office of the Bathurst Power & Paper Company. A dinner meeting followed at the Legion Hall and the tour wound up with the president and general secretary catching the Maritime Express at 1.35 a.m. for Montreal.

"To Be Continued"

Starting November 1st, the president visits all the branches in Nova Scotia and Newfoundland thereby finishing off everything east of Quebec City. Visits in Ontario and Quebec during November and December leave only the west to do in late January and February and early March.

For some time it has been agreed by Council that no president should be expected to visit all branches and branch sections. However for this term the president has retired from his post with the City of Peterborough so he could devote his full year to the Institute. Thus it is that all branches and several spots where there are no branches will have the pleasure of a visit from Mr. Dobbin. This is likely to be the last time it will occur—all of which is an indication of growth and progress, but a bit sad as well.

Nominees for Office

A list of nominees for office, as reported by the Nominating Committee, appeared on page 1322 of the October 1953 issue of the *Journal*. This list was printed prior to full confirmation of the nomination for president, and through a printer's error the heading "President" appeared over a list of vice-presidential nominees. Following is the corrected and complete list:

President	D. M. Stephens	Winnipeg, Man.
Vice-presidents:		
*Zone B (Province of Ontario)	B. G. Ballard	Ottawa
*Zone C (Province of Quebec)	J. O. Martineau	Quebec
*Zone D (Maritime Provinces)	N. B. Eagles	Moncton

The list of nominees for councillor was correct as published.

* One vice-president to be elected for two years.

Canadian Conference on Prestressed Concrete

The Canadian Conference on Prestressed Concrete will be held in Toronto on January 28 and 29, 1954, in Hart House Theatre at the University of Toronto. The Conference is intended to be a concise review of Prestressed Concrete for Canadian engineers, architects and builders. Although at the moment, the use of Prestressed Concrete in Canada is relatively limited, interest in it is increasing rapidly, as is evidenced by the recent formation of a Prestressed Concrete Development Group.

All the speakers at the conference are acknowledged experts in their particular fields, and it is expected that many problems peculiar to the development of prestressed concrete under Canadian conditions will be discussed. Preprints of the papers will be available at the time of the conference and considerable time has been allotted to the discussion of each paper.

The conference is sponsored by the Extension Department of the University of Toronto, with the support of other interested bodies. The organization of the conference is being carried out by the following committee:

Professor C. F. Morrison, Dept. of Civil Engineering, University of Toronto—Chairman.

Mr. H. Fealdman, Structural Research Department, The Hydro-Electric Power Commission of Ontario—Secretary.

Mr. J. A. Gow, Office of the Secretary, Faculty of Applied Science and Engineering, University of Toronto.

Professor M. W. Huggins, Dept. of Civil Engineering, University of Toronto.

Professor T. R. Loudon, Head of Depts. of Civil Engineering and Aeronautical Engineering, University of Toronto.

Mr. R. H. Macdonald, Steel Company of Canada.

Mr. M. MacMurray, representing the Toronto Branch of the Engineering Institute of Canada.

Mr. E. P. Muntz, Consulting Engineer, The Hydro-Electric Power Commission of Ontario.

Mr. D. O. Robinson, Canada Cement Company.

Mr. R. B. Young, Concrete Consultant, the Hydro-Electric Power Commission of Ontario.

The registration fee of $10.00 includes a copy of the preprints of the papers and admission to a reception and buffet supper on the evening of January 28.

Inquiries about the conference should be addressed to the Department of University Extension, University of Toronto, Toronto, Ontario.

Following is the program:

Canadian Conference on Prestressed Concrete

Dates

January 28 and 29, 1954.

Place

Hart House Theatre, University of Toronto, Toronto, Ont.

Program

Thursday, January 28

8:30 a.m. Registration. Fee $10.00 (Registrations may also be made in advance by writing to the Department of University Extension, University of Toronto. Cheques should be made payable to the University of Toronto).

9:45 a.m. Address of welcome by Professor T. R. Loudon.

10:05 a.m. Introduction, with special reference to applicability to Canadian construction, economic aspects, future possibilities, by R. F. Shaw, vice president, the Foundation Company of Canada.
Discussion.

11:00 a.m. Intermission.

11:15 a.m. Strain gauge tests of forty and sixty foot prestressed concrete beams, and some practical observations on the use of these beams in an industrial building, by A. T. Waidelich, vice president and manager of research, the Austin Company Cleveland, Ohio.

12:30 p.m. Informal Lunch.

2:00 p.m. Quality control of concrete, and suggested specifications by R. B. Young, concrete consultant, the Hydro-Electric Power Commission of Ontario.
Discussion.

3:25 p.m. Intermission.

3:35 p.m. Quality control of steel for prestressing and suggested specifications, by Prof. M. W. Huggins.

6:30 p.m. Reception and Buffet Supper.

Friday, January 29

9:15 a.m. Significant features of Prestressed Concrete, by Prof. G. Magnel, member of the Royal Belgian Academy and professor of Reinforced Concrete at the University of Ghent.
Discussion.

10:45 a.m. Intermission.

11:05 a.m. Basic theoretical consideration of Prestressed Concrete, by Dr. T. O. Lazarides, Lazarides, Lount and Partners, Structural Consultants, Toronto.

12:30 p.m. Informal Lunch.

2:00 p.m. Reports on Prestressed Concrete Researches, by A. L. Parme, Structural and Railways Bureau, Portland Cement Association, Chicago, Illinois.
Discussion.

3:25 p.m. Intermission.

3:35 p.m. Panel Discussion of Prestressed Concrete, by a group of authorities.

Saturday, January 30

8:30 p.m. At Convocation Hall, University of Toronto.

Joint Meeting of the
Royal Canadian Institute
and the
Toronto Branch of the
Engineering Institute of Canada

Prestressed Concrete Arch Bridges in Venezuela by Mr. Robert Shama, Ingénieur Civil des Ponts et Chaussées, Managing Director and Chief Engineer, Empresas Campenon Bernard de Venezuela, Caracas.

IATA Meets Again at Montreal

The International Air Transport Association returned this year to Montreal, after eight years, for its ninth annual general meeting, held October 5 to 9, 1953. Attended by some 200 delegates representing some 70 member airlines from over 40 countries, which carry 95 per cent of the world's air traffic, the opening session was greeted by Mayor Camilien Houde and by Col. G. R. Roche representing Premier Duplessis. Appropriately, the conference hall was decorated with blue and white fleurdelisé flags, bearing witness to IATA'S diplomatic observance of local tradition and pride. Dr. Walter Berchtold, president of Swissair, turned over the Association's presidency to the incoming president, Gordon R. McGregor, president of TCA.

Addressed by Director General

Sir William Hildred, director general of IATA, told delegates member airlines had carried over 45 million passengers a distance of 40 billion passenger kilometers during 1952, and this year will carry over 50 million. They had 3,000 aircraft, while airline personnel number over 300,000 in scheduled airlines alone. Although cargo traffic had increased only 6 per cent over 1951, to 950 million tonne kilometers, he expressed confidence the billion mark would be passed this

year. Mail carried had increased 9 per cent over 1951 to a quarter of a billion tonne kilometers, and this year's results would depend on the extent that mail rate cuts were passed on to the public.

Airlines, he said, have cut fares as much as 50 per cent since the end of the war, in spite of a 50 per cent increase in the cost of living. Warning that they are operating perilously close to the economic margin and stand to suffer from any recession in world trade, he made a plea for the elimination of the fantastic contradiction whereby airlines receive subsidies, supposedly to enable their survival while these subsidies have to contend with taxes and other charges which will help to submerge the carriers.

Declaring that the greatest danger to airlines now arises through governments increasing the various charges and taxes payable by them, he urged co-ordinated control by governments to cut charges where rates are presently excessive. The airlines, he pointed out, have taken great risks in assuming traffic will increase and prosperity continue. They have a right to ask for more than to be allowed to continue on a subsistence level.

He denied that tourist fares had been introduced merely for bringing larger profits. He predicted that "tourist service has come to stay." It was designed to provide cheap travel for the millions; but he warned tendencies to add frills to tourist class travel must be strongly resisted. International air transport, he said, must be 100 per cent safe, faster, and cheaper.

He claimed substantial benefits to airlines and to the public through the efforts of IATA, ICAO, and the International Chamber of Commerce, which have brought about reduced frontier documents and formalities, and the cost of visa fees. Yet, while progress was being made in cutting red tape, surface carriers still operate under more liberal regulations than do airlines.

Committee Reports

Ronald McCrindle of BOAC, chairman of the Executive Committee, reported creation of a new Traffic Advisory Committee to facilitate the working out of rates and fares in IATA traffic conferences. Referring to international airmail rates, he said that despite IATA attempts to relieve the problem of 'combination' rates of compensation, the combinations will to some extent continue.

Enlargement of the IATA Enforcement Office which enforces compliance with IATA traffic conference resolutions after government approval, was announced, which should reduce violations to a minimum. More and more nations, he said, are eliminating visas for non immigrant passengers or are considering adoption of the standard form.

J. S. Woodbridge of Pan American, chairman of the Financial Committee, warned against the alarming growth of revenue accounting costs, for which IATA was seeking a solution. Accuracy, he said, was costing more than it was worth. This affected carriers other than airlines. One railroad, for example, is examining the possibilities of settling inter-railroad accounts by the technique of sampling.

Negotiations with OEEC, he said, have resulted in freeing airlines and their passengers from postwar currency controls, as well as transfers and transactions in connection with aircraft repair and air transport equipment. A committee of legal and financial experts, he reported, had advocated an international monetary travel unit, which would be applied to the rate of exchange of each country, and fares would be determined immediately. Such a unit might be in the nature of the international postal franc, used by governments in handling mail. Such a plan could be adopted without government ratification.

Henry J. Friendly, vice-president of Pan American, chairman of the Legal Committee, reported substantial gains in cutting away the legal underbrush in the path of simple and easy interline bookings of passengers and cargo. He urged the IATA traffic conference to adopt the new Uniform Conditions of Carriage, which will standardize conditions under which passengers and freight are accepted for transport over two or more carriers. The committee, he said was working on projects which, it hopes, will provide simpler and legally satisfactory documents and procedures for handling cargo and cargo claims on an interline basis. The general meeting was requested to go on record as supporting ratification of the new Draft Convention on Liability for Air Carriers to Third Parties on the Ground (the Rome Convention).

Minister of Transport's Address

The Hon. Lionel Chevrier, Federal Minister of Transport, told the meeting that most of the funds provided for civil aviation by Canada over the next five years would be used for terminal buildings, especially at airports used by international airlines. He promised a start next year on a new large terminal building at Dorval airport. A new terminal building might be built at Ottawa. Further improvements and extension of facilities at Gander, Newfoundland would be undertaken this year. Limited civil building facilities at Goose Bay were being discussed with the R.C.A.F., and consideration was being given as to whether Ottawa could be officially designated as an alternate to Montreal for transatlantic flights.

Noting that the subject of the granting of traffic rights by national governments was not on the agenda, Mr. Chevrier nevertheless said he considered the subject of utmost importance. Canada, he said, was not satisfied with the present system of no multilateral air agreements, and suggests that all airlines reexamine their attitudes towards some world-wide agreement governing air traffic. It may be there is little hope of achieving a multilateral system respecting the granting of traffic rights and the provision of frequencies and capacity on international routes, but the airlines have a responsibility to find a constructive solution to the problem.

Prime Minister—The Guest Speaker

One of commercial aviation's greatest contributions to Canada had been the big part it had played in developing national unity, declared the Rt. Hon. Louis St. Laurent in addressing IATA delegates at their annual dinner. "No country has so greatly benefited from aviation and the development of air transport," he said. "Millions of our acres of mountain, lake, forest and tundra were insurmountable obstacles to communication until the advent of the aeroplane."

Canadians, he continued, are an airminded people, and for that reason he believed the decision to locate IATA Headquarters in Montreal was a logical one. IATA had assisted and advised governments in drafting those regulations to control the airways of the world which can only be made effective by joint action of sovereign powers. Canada is grateful, he said, to have had that assistance; world airways could not be operated in the safe efficient manner that they are, were it not for the work of this Association.

"IATA cannot be too warmly

complimented," he added, "for the complex problems it had solved. The fact that IATA has, in so short a space of time, surmounted international barriers of currency, language, technical differences and business procedure to promote safe, regular and economical transport for the benefit of the peoples of the world . . . offers proof that men of good will from many nations, with greatly different political and economic conditions, can work together for the good of all. You have been able to reach agreement, a record envied by those of us who have to deal with international politics."

"No-Shows" A Problem

Reviewing the work of the Traffic Committee, most of whose functions have been transferred to a new Traffic Advisory Committee, Chairman F. Von Balluseck, vice-president of KLM, emphasized that reservation service is the carrier's first contact with potential customers, and this contact should create the right impression. "No shows" (passengers who book but do not show up for the flight) had cost U.S. and Canadian companies many millions of dollars yearly. Carriers had combated the problem by a certain amount of overlooking, but such expedients alone were not a solution.

Lack of more drastic action, he said, was due to difficulty in assessing the degree to which different factors have been responsible for the problem. His Committee urged the creation of an inspection team to check "reservation failures" back through airline records of airline offices to the actual "no-show" passenger.

Dennis Handover of Scandinavian Airlines, reporting for the Traffic Conference, warned that "a positive answer" must be found as to whether carriers should be allowed to carry first class and tourist passengers on the same flight. Though permissible this year, many airlines oppose the practice. A completely new trend is developing, he said, tourist travel is becoming more austere and first class more luxurious. This luxury did not necessarily mean an increase in fares. Costs are stabilizing, he said, and barring the unforeseen, should remain near present levels. The family fare ticket plan would never apply to transatlantic flights.

Medical Committee Reports

Dr. K. E. Dowd of TCA, speaking for Chairman Sir Harold Whittingham of BOAC, told delegates no worthwhile new drugs for air sickness had been marketed since World War II. Nevertheless the RCAF Institute of Aviation Medicine at Toronto had developed a headrest designed to prevent or lessen cases of airsickness, which is brought on by constant movement of the head. Antihistamine drugs and "lightning" cold cures and preventives for motion sickness should not be taken by aircrew when on duty or 12 hours before flight. Sleeping pills should not be used on service except by prescription.

His Committee had found no evidence that men servicing jet aircraft were adversely affected if appropriate ear protectors were used. Early instances of queer reactions had proved to be psychological. Fatigue was rarely encountered in aircrew to a degree which interfered with their duty. Healthy infants travel as well as adults, but babies under 10 days should not be accepted for long flights. Severely ill passengers could safely fly long distances in pressurized aircraft, if selected carefully, and with proper provision for care and comfort.

Technical Committee

Captain J. C. Kelly Rogers of Aer Lingus, Dublin, reported for the Technical Committee that specifications for an "ideal fuel" for turbine powered aircraft were being studied by a high level technical group. Fuel, he said, is the largest single item in direct operating costs. The ideal fuel will be as safe as kerosene, will have a high heat content per gallon, will be generally available, preferably as a marked product, will ensure reliable and cheap engine operation and have lowest cost consistent with other requirements.

The need for close airline analysis of the proposed new International Aircraft Performance Code being considered by ICAO, termed the most important single item on the regulatory side of aeronautics was urged. Integration of movements of military and civil aircraft in European skies had not yet been fully achieved, he said, and airlines were urged to take every possible step towards ensuring adequate co-ordination.

His Committee was largely concerned with requirements for the development of rotary wing aircraft. Nine recommended requirements were listed, among them prototype testing of helicopters under service conditions; suitable heliports and facilities; research into flight safety criteria; better stability and control at hovering speeds.

Other Business

Several announcements were made. Sir Miles Thomas of BOAC promised the first jet service across the Atlantic would terminate at Montreal. Regular passenger service around the world in 48 hours is planned, one circling the Northern and another the Southern Hemisphere. Max Hymans of Air France forecast individual "skyrooms" in the near future on Montreal-New York-Paris runs. Henri Zeigler, president of Air France, complaining that delays on arrival and departure were becoming more acute as traffic increased, demanded more efficient procedures and accommodations for passengers going through frontier formalities.

Mr. Zeigler also proposed that IATA should admit non-scheduled airlines membership. The proposal was referred to the Executive Committee, but feeling was that the question was "too drastic to discuss at this meeting".

The entire Executive Committee was returned to office.

The Athlone Fellowships

1. The Athlone Fellowships are awarded annually by His Majesty's Government in the United Kingdom to enable Canadian engineering graduates to take post-graduate training in the United Kingdom.

2. The Fellowships fall into two groups:

A. 28 available for graduates on completion of a bachelor's or higher degree.

B. 10 available for engineers who have already spent some time in industry.

3. The Fellowships provide for a period of 2 years in the United Kingdom and are awarded on the understanding that their holders afterwards return to Canada to follow their careers. They are available for any among the following options but the preference of the awarding authorities is for courses involving works experience.

(1) Works training in one or more approved industrial organizations.

(2) Post graduate studies in a

United Kingdom university or college or research establishment.

(3) A combination of (1) and (2).

(4) Research in a United Kingdom university leading to the degrees of M.Sc. or Ph.D. Candidates cannot be considered for this option unless their university recommends them as suitable for research work, and has obtained from a United Kingdom institution an assurance that they will be acceptable if awarded a Fellowship.

4. Candidates receive advice on their proposed course of training from the Athlone Fellowship Committee in the United Kingdom, representative of industry, the Universities, and the United Kingdom Government, and arrangements for their reception and placing are supervised by this body. The Committee likewise concerns itself with the welfare and progress of the Fellows throughout their stay in the United Kingdom.

5. To ensure as wide a distribution as possible of the 28 Fellowships in Group A, selection is made from all Canadian universities having engineering faculties, in accordance with the following table.

	Fellowships
Nova Scotia Technical College, Halifax, N.S.	2
University of New Brunswick, Fredericton, N.B.	1
Laval University, Quebec, Que.	2
McGill University, Montreal, Que.	3
Ecole Polytechnique, Montreal, Que.	2
Queen's University, Kingston, Ont.	3
University of Toronto, Toronto, Ont.	5
University of Manitoba, Winnipeg, Man.	2
University of Saskatchewan, Saskatoon, Sask.	2
University of Alberta, Edmonton, Alta.	2
University of British Columbia, Vancouver, B.C.	4

This quota is reviewed from time to time, to relate it to the numbers graduating at the several universities.

6. Eligibility

(1) The candidate should be a Canadian citizen or a British subject normally resident in Canada, holding or about to obtain a degree awarded by one of the Universities listed above, on the successful completion of a course of study in any branch of engineering. A degree is not an indispensable requirement for candidates in Group B possessing alternative qualifications.

(2) The candidate should not normally have passed his 27th birthday by October 1st in the year of selection for a Fellowship.

7. Value of the Fellowship

The amount covers:—

(i) Cost of travel from home to the United Kingdom and return, and within the United Kingdom as may be approved.

(ii) Cost of approved university or college tuition and other fees.

(iii) Maintenance allowance as under: Cambridge University, £426 (£408 for Fitz William House); Oxford University, £426 (£384 for St. Anne's, St. Catherine's and Barrett House); London, £420; Provinces, £390. Maintenance allowance is payable quarterly in advance. It is not subject to Income Tax, National Health or National Insurance contributions.

8. Basis of Selection

In selecting candidates regard will be had to their academic and technical competence, physical fitness and personal qualities.

9. Method of Application

Application forms may be had from the Registrars of the Universities enumerated in para. 5. Candidates should complete and submit these, together with a recent photograph of themselves, to the Registrar of the University of which they are or will become graduates. A Group B candidate who is not a University graduate should apply to the Registrar at the University in para. 5 nearest to his home. *The closing date for applications is 15th January.*

10. References

References are taken up by Registrars, on receipt of completed application forms, to be available when the selection of Fellows is made.

11. Selection Procedure

A local Selection Board is convened during the month of February by the Dean of Engineering in each University.

The local Selection Board at each University makes the final selection from among that University's candidates under Group A, and successful candidates are then provisionally notified. This is officially confirmed, subject only to successful graduation and medical fitness, when the selection for the whole of Canada has been completed. The Selection Board may also recommend reserve candidates.

The local Selection Board interviews those candidates for Group B Fellowships for whom the University is the most convenient centre. When an applicant in industry wishes to be interviewed at a university other than that at which he graduated, he should explain this to the Registrar of his own University when he submits his application.

The final selection of Group B Fellows is made by persons appointed by the United Kingdom High Commissioner, one or more of whom will be a Chairman of one of the local Selection Boards. All candidates are advised of the outcome without further delay.

12. Reserve Candidates

If the number of graduates recommended by the Selection Board at a university is less than the number of Fellowships offered to that university, or if a selected graduate does not for any reason take up his Fellowship, or if less than the full number of 10 candidates from industry with the necessary qualifications are forthcoming, additional names may be selected by the United Kingdom High Commissioner from among those in reserve, always having regard, as far as possible, to the quota set out in para. 5.

13. Procedure after Selection

The results of final examination are made known to the United Kingdom High Commissioner as soon as they become available. Travel arrangements are then finalised by him and in normal cases sea passages during the month of September are provided.

OFFICE OF THE HIGH COMMISSIONER
FOR THE UNITED KINGDOM
Ottawa, Ontario
October, 1951

News of Other Societies

On the calendar of the **Chemical Institute of Canada,** early in 1954 there are four division meetings of interest, as follows: Analytical Chemistry Division, Royal Hotel, Guelph, Ont., February 18-19; Protective Coatings Division, Montreal, February 25; Protective Coatings

Division, Toronto, February 26; Chemical Engineering Division, Montreal, March 1-2.

The 37th annual conference and exhibition is slated for June 21-23, 1954, at the Royal York Hotel. C.I.C. Headquarters are at 18 Rideau St., Ottawa 2, Ont.

E.I.C. members are reminded of the annual meeting of the **American Society of Mechanical Engineers,** taking place from November 29 to December 4 at the Statler Hotel, New York, which they may attend without registration fee, under the same conditions as A.S.M.E. members.

Sponsored by the **American Standards Association** (70 East 45th St., New York 17) the next five-day seminar on industrial standardization, conducted by Dr. John Gaillard, is scheduled for January 25-29, 1954.

The second conference on scientific editorial problems, to be held December 27, 1953, at Boston, Mass., will form part of the annual meeting of the **American Association for the Advancement of Science,** Boston, December 26-31.

Conference chairman is Marian Fineman, Editorial Branch, Dugway Proving Ground, Tooele, Utah.

Fifty-nine conference sessions are on the program of the three-day Plant Maintenance and Engineering Conference at the Conrad Hilton Hotel, Chicago, January 25-27. The conference will be held concurrently with the Plant Maintenance and Engineering Show, which is scheduled for the International Amphitheatre, Chicago, January 25-28.

The seventeenth Wright Brothers Lecture, sponsored by the **Institute of the Aeronautical Sciences** (2 East 64th St., New York 21, N.Y.) will take place on December 17, at the U.S. Chamber of Commerce Building Auditorium, Washington, D.C.

The annual meeting of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17) will be held at the Hotel Jefferson, St. Louis, Missouri, December 13-16, 1953.

The *Journal* Thirty-five Years Ago

November 1918

Most of this issue is given over to non-technical material, in fact the only technical paper is one on The Problem of City Development, by A. G. Dalzell, of Vancouver. However, it runs to eleven pages, and makes quite a showing.

Proposed Legislation

Perhaps the most interesting item in the whole issue is "A draft of a proposed Act for Engineers". This was one of the early drafts, and was based on the then popular proposal that the Institute would be incorporated in each province, and that the power of administration would rest with the provincial Institute, known in this instance as The Engineering Institute of Saskatchewan.

The principal regulatory clause reads this way: "Only such persons who are members of the Institute, hereby incorporated and registered as such under the provisions of this Act, shall be entitled within the province of Saskatchewan to take or use the name and title of 'Registered Engineer', . . ."

Later, in the editorial section, there is more comment on this and other proposed legislation, which points out that branches in Manitoba and British Columbia as well as other provinces have made suggestions as to changes in the wording. The proposals from British Columbia are unusually interesting. In the first place, the province approves "of the movement to secure some legislation to license registered engineers, and will further the movement within the province on lines agreed upon by the total membership of the Institute, and approach the Legislature as soon as a successful issue is probable".

The B.C. group suggests also that in the first instance legislation be limited to cover only those who undertake public work; also that any registered member of the profession should be free to practice in any province without any inquiry or examination.

Another interesting proposal is "that the suggestions be made to the general Council that the minimum rates of pay for engineers in the various provinces be determined by a commission composed of one member of the provincial cabinet, one member of the provincial university, and one member of the Engineering Institute, to be appointed by the general Council".

The editor concludes the article with a paragraph which, in view of the thinking at that time, was very broadminded indeed. He says "Whatever the form, any legislation that is to be sought may take, it must be founded on the basic principle that in securing the elevation of the profession by those who are members of the Institute, no attempt should or will be made to insert any clause or clauses either designed to force engineers to join the Institute or to interfere in any way with the rights of qualified engineers who are non-members, other than to give them the benefits that they as qualified engineers may gain by any legislation which may be effected dealing with the interests of engineers in general". We shall find more about this interesting subject in subsequent issues.

The Council

The report of Council brings up some interesting subjects. Of course there is reference to provincial legislation for the profession. Council expresses the hope that interested members, who have ideas on this subject, will send letters for publication in the *Journal*.

It is interesting to see that an attempt was to be made to set up a group known as "Associates of the Institute". These were to be "men occupying prominent positions in affairs in Canada". Apparently nothing ever came of it.

One minute of Council discloses the fact that at that time the Society had "A Committee on Friendly Relations". Perhaps in later issues of the *Journal* we may see something of the work of this committee. It sounds interesting.

There is a full page devoted to elections and transfers, which indicates that the membership at that time was enjoying a substantial increase.

The Branches

Branch News is reduced substantially, and the reason seems to be found in the opening sentence of the report of the Montreal Branch: "The activities of the Montreal Branch have been curtailed owing to the influenza epidemic". It goes on to report that the execu-

tive committee had handled a lot of business, but all of it had been done by an exchange of letters and postcards, thereby making meetings unnecessary.

Here again there is a note about professional legislation. It says: "It was accordingly arranged that the first meeting of the branch should be called for Thursday, October 10th, to discuss legislation matters". Unfortunately, the orders of the Board of Health forbidding such meetings prevented this meeting from taking place at that time.

In the Halifax Branch, reference is made to the advantages which are being felt from the recent amalgamation of the Nova Scotia Society of Engineers and the Institute. This advantage was particularly conspicuous by reason of the regional meeting held recently in Halifax "at which there were representatives from all parts of Eastern Canada and a number of places in the United States".

Reference again is made to provincial legislation, although at this time the branches had but little time to discuss it. They are of the opinion, however, that "such legislation is desirable, providing it can be worked out on a uniform basis throughout all parts of the country and in all fairness to everyone concerned". The Branch editor goes on to express some excellent philosophy. He said "At the same time there is a feeling that legislation should be considered more in the nature of the means to an end than an end in itself. If permanent results are to be obtained, and the engineering profession put on a proper footing, engineers themselves will individually and collectively take a more active part in public affairs generally and demonstrate their value to a community".

The Manitoba Branch reports that a special meeting was called "for the purpose of discussing the draft of the proposed Act for the engineering profession in Saskatchewan". One suggestion is "that where the words 'Engineering Institute of Saskatchewan' appear there should be 'Engineering Institute of Canada, Saskatchewan Division'."

As would be expected, the Saskatchewan Branch reports several meetings dealing with the Registration Act. The report says "The branch is eager to have the Act brought to such a form that it will be acceptable to the branches in other provinces and act to some extent as a model for general provincial legislation".

The Advertisers

It is always interesting to see who the advertisers were, and to note whether or not they are still with the *Journal*. In the November issue, these were the advertisers:

Pratt & Whitney Co. of Canada, Ltd.
The John Bertram & Sons Co. Ltd.
Dominion Bridge Co. Ltd.
T. McAvity & Sons, Ltd.
Nova Scotia Steel & Coal Co. Ltd.
Canadian Ingersoll-Rand Co. Ltd.
Canada Cement Co. Ltd.
Canadian Fairbanks-Morse Co. Ltd.
Nova Scotia Construction Co. Ltd.
Engineers & Contractors, Ltd.
Bedford Construction Co. Ltd.
Union Foundry & Machine Works, Ltd.
Dept. of Public Works and Mines of Nova Scotia.
Grant N. Horne.
Shawinigan Water & Power Co.
Cook Construction Co., and Wheat Brothers.
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Rolland Paper Co. Ltd.
Jenkins Brothers Ltd.
Canadian Steel Foundries, Ltd.
Jones & Glasgow, Regd.
Dominion Copper Products Co. Ltd.
Dominion Iron & Steel Co. Ltd.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, October 9, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

J. C. Anderson, *Montreal*
A. P. Balodis, *Ottawa*
D. A. Barnum, *Niagara Falls*
T. W. Eadie, *Montreal*
P. D. Magor, *Montreal*
R. B. McRuer, *Kingston*
Z. Przygoda, *Toronto*
G. E. Smith, *Toronto*
T. R. Torian, *Toronto*
M. A. Van Wamelen, *Toronto*
L. L. Weichherz, *Montreal*

Juniors:

D. J. Barnes, *Montreal*
E. T. Cornell, *Summerside*
A. F. Dudek, *Montreal*
E. A. Fletcher, *Hamilton*
E. Houghton-Larsen, *Vancouver*
H. I. Price, *Montreal*
W. N. Spratt, *Montreal*
Z. Zabner, *Montreal*

Transferred from the class of Junior to that of Member:

M. Bennet, *Calgary*
M. E. Blanchard, *Isle Maligne*
J. J. Grenon, *Chicoutimi*
J. B. G. Goodfellow, *Montreal*
M. S. Hannon, *Montreal*
E. F. Johannson, *Montreal*
D. Laschuk, *Yellowknife*
G. J. Monarque, *Montreal*
J. A. Paget, *Montreal*
F. J. Paine, *Montreal*
C. G. Swift, *Valleyfield*

Transferred from the class of Student to that of Junior:

L. A. Rowe, *Saskatoon*

The following Students were admitted:

K. O. Bartlett, *Univ. of New Brunswick*
D. K. Chapman, *B.Sc. (Mech.) Manitoba 1953*
C. E. Dawkins, *Univ. of New Brunswick*
H. V. Eccles, *Univ. of Manitoba*
D. R. Evans, *B.A.Sc. (Civil) Toronto 1953*
P. T. Hodgins, *Queen's University*
K. I. Krakow, *McGill University*
J. Leibovitch, *McGill University*
F. X. MacDonald, *Nova Scotia Technical College*
M. F. McMahon, *Univ. of New Brunswick*
G. F. Miller, *Toronto, Ont.*
J. J. Napier, *B.Eng. (Civil) Nova Scotia Technical*
V. C. Randall, *Univ. of New Brunswick*
J. A. Sinclair, *Univ. of New Brunswick*
W. D. Wasson, *Univ. of New Brunswick*
D. E. Wright, *Univ. of Alberta*

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Members:

W. J. Ditto
A. S. Halldorsen
J. Tuskey

MANITOBA

Member:

S. H. Bonser

NEW BRUNSWICK

Junior to Member:

R. F. Weir

NOVA SCOTIA

Members:

E. C. Garrard
G. K. Penny

Junior to Member:

B. L. Bloomer
H. F. R. Hall

QUEBEC

Member:

M. M. Kozlowski

E.I.C. ANNUAL MEETING - 1954

MAY 12, 13, 14

CHATEAU FRONTENAC, QUEBEC, QUE.

Personals

News of the Personal Activities of Members of the Institute

Hon. Robert H. Winters, M.E.I.C., former Minister of Resources and Development, has been appointed Minister of Public Works.

Hon. R. H. Winters, M.E.I.C.

Cabinet Minister from Nova Scotia and a Canadian Privy Councillor since November, 1948, Mr. Winters first entered the political arena in 1945 when he successfully contested a seat in his home constituency of Lunenburg, N.S. In 1948 he was named Minister of Reconstruction and Supply, and in January, 1950 he was appointed Minister of the then newly-created Department of Resources and Development.

Mr. Winters was born in Lunenburg and was educated in the public schools there and at Mount Allison University where he received his B.A. degree in 1931. He then entered the Massachusetts Institute of Technology, graduating with a B.Sc. degree in electrical engineering in 1933 and a M.Sc. degree in 1934.

In 1934 he entered the Northern Electric Company Limited in Montreal as development engineer in the apparatus engineering department, and three years later was transferred to the manufacturing engineering department as methods engineer in charge of development of new manufacturing methods.

In June, 1942 he joined the technical directorate of the Royal Canadian Ordnance Corps, transferring later to the Royal Canadian Electrical and Mechanical Engineers when the Corps was formed. He was discharged in 1945 with the rank of lieutenant colonel.

Mr. Winters is a member of the Association of Professional Engineers of Ontario.

Dr. A. G. Christie, M.E.I.C., professor emeritus of mechanical engineering of The Johns Hopkins University, will be the first recipient of the George Westinghouse Gold Medal Award presented by the American Society of Mechanical Engineers "for eminent achievement or distinguished service in the power field of mechanical engineering."

The medal, to be awarded for the first time to Dr. Christie at the 1953 ASME annual meeting in New York, will be presented annually, if warranted, to a candidate of any age, whether engineer or not, who has contributed to the utilization, application, design, development, research, and the organization and administration of such activities in the power field.

Dr. Christie, who has been associated with The Johns Hopkins University since 1914, was born in Manchester, Ont., and graduated from the School of Practical Science of the University of Toronto in 1901. He was connected with the Westinghouse Machine Company in Pittsburgh; with Cornell University as instructor in mechanical engineering; and with the Allis Chalmers Company and the Western Canada Cement and Coal Company. From 1909 until 1914 he was on the staff of the University of Wisconsin, first as assistant and then as associate professor of steam and gas engineering. He received his M.E. degree from the University of Toronto in 1913.

Dr. Christie is the author of the Steam Turbine Section of Sterling Marine Engineers' Handbook and Kent's Mechanical Engineers' Handbook, and numerous scientific papers and articles. In June, 1953 he presented the paper, "Future Supplies of Power", before the Mechanical Section of the Montreal Branch of the Engineering Institute.

O. W. Titus, M.E.I.C., vice-president and general manager of Canada Wire & Cable Company Limited in Toronto, has been elected president of the Canadian Electrical Manufacturers' Association.

Mr. Titus has been responsible for engineering some of the most difficult cable installation in Canada during his 34 years in the electrical manufacturing industry.

In 1942 he received wide acclaim as co-author of the technical paper, "Design, Manufacture and Installation of 120 kv. Oil-filled Cables" long considered a major step forward in the North American cable industry.

Mr. Titus is a member of the Canadian National Committee International Conference on Large Power Systems, and the Association of Professional Engineers. He also belongs to the National Executive Council of the Canadian Manufacturers' Association.

O. W. Titus, M.E.I.C.

T. W. Wilson, M.E.I.C., has been appointed vice-president and managing director of Canadian Bitumuls Company Limited.

A graduate of the University of Toronto in civil engineering, Mr. Wilson served overseas with the Royal Canadian Engineers and was discharged with the rank of major in 1946.

He joined the staff of Canadian Bitumuls Company Limited as sales engineer upon his return to Canada, and subsequently became assistant manager and then manager.

Mr. Wilson is a member of the Association of Professional Engineers of the Province of Ontario, and of the Military Engineers Association.

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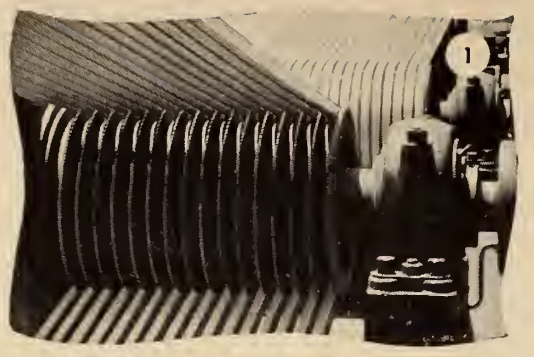

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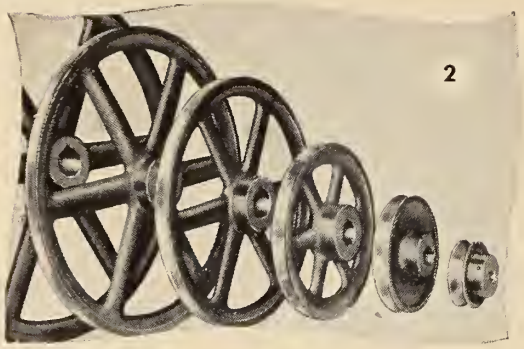

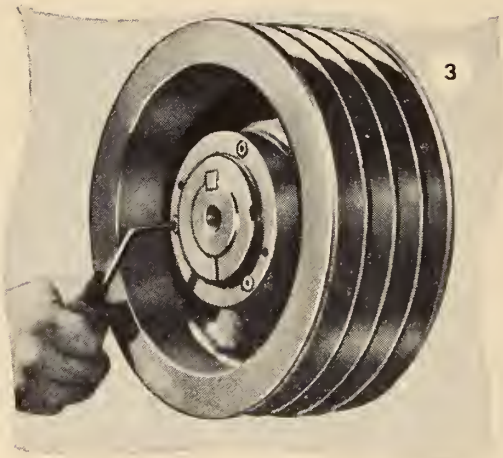

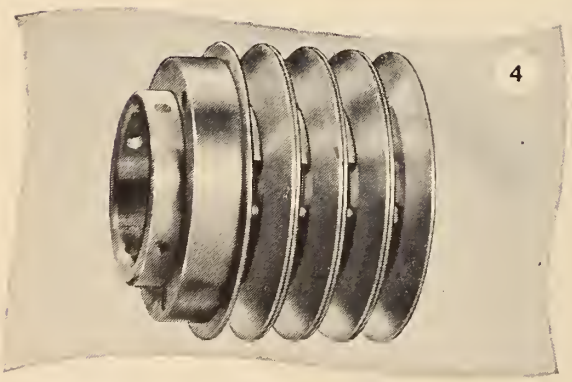

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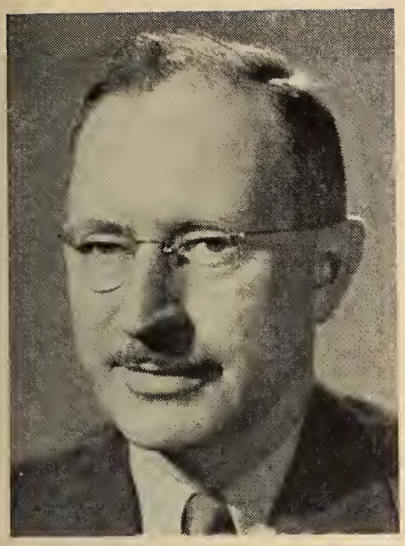

T. W. Wilson, M.E.I.C.

J. M. Jordan, M.E.I.C., councillor of the Institute representing the Port Hope Branch, has been appointed county engineer for Waterloo, Ont. Until his recent appointment, he was county engineer and road superintendent of the United Counties of Northumberland and Durham, Ont., and engineer and road superintendent for the Trenton Suburban Road Commission.

A civil engineering graduate of the University of Toronto, class of 1934, Mr. Jordan became associated with the Ontario Department of Highways for a year. After two years with Curran & Briggs Limited in Toronto, he was employed for a year on airport construction for the Department of National Defence; and for three years in mining with McLeod-Cockshutt Gold Mines Ltd.

He entered the position of county engineer for Northumberland and Durham after five years' service with the Royal Canadian Engineers.

J. A. Consay, M.E.I.C.

J. A. Consay, M.E.I.C., has been appointed general manager of the Robinson Machine & Supply Company Limited of Calgary and Regina.

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Mr. Consay received his B.Sc. degree in agricultural engineering from the University of Saskatchewan in 1945, after which he served as products engineer with Massey Harris Company Limited in both Canada and South America.

In 1947 he became a member of the teaching staff with the University of Saskatchewan, and served in this capacity until July, 1951, when he joined Robinson Machine & Supply Company Limited. Mr. Consay was named manager of the products engineering department in October, 1952, and has been serving as acting general manager of the Company since May of this year.

Lt.-Col. H. D. Berry, R.C.E., M.E.I.C., is commanding officer of the First Field Engineer Regiment at the Royal Canadian School of Military Engineering at Chilliwack, B.C.

The Field Engineer Regiment is just newly formed, and it is the first time that there has been such a regiment in peacetime in Canada.

Lieutenant Colonel Berry was, prior to his new appointment, GSO, Office of the Chief Engineer, Army Headquarters, Ottawa.

G. Percy Cole, M.E.I.C., has retired as chief engineer of Dominion Glass Company Limited in Montreal, completing almost forty years' service with the Company which he joined in 1914.

Mr. Cole's services will still be available as consultant in engineering matters to the general manager.

C. E. Morse, M.E.I.C., has been appointed chief engineer of Dominion Glass Company Limited in Montreal, replacing G. Percy Cole, M.E.I.C., who has retired.

Mr. Morse joined the Company in 1946 after service with the Royal Canadian Air Force.

Mr. Morse is a graduate of McGill University in electrical engineering, class of 1941.

W. B. Boggs, M.E.I.C., is manager of the Industrial Engineering Department of Canadair Limited in Montreal, Que.

Mr. Boggs graduated from McGill University in mechanical engineering in 1940. After service with the R.C.A.F., he joined Trans-Canada Air Lines at Dorval, Que., as supervisor of maintenance, and in 1951 entered the employ of Canadair Limited.

J. Gilchrist, M.E.I.C., has been appointed vice-president and managing director of Ex-Cell-O Corporation of Canada, Limited, of London, Ont. He was previously president of Henry Power Tools Limited in London, Ont.

Mr. Gilchrist is a graduate of the University of New Brunswick in electrical engineering, class of 1932.

R. L. Bigg, M.E.I.C., engineer with P.F.R.A., Dominion Department of Agriculture, in Kamloops, B.C., is chairman of the Central British Columbia Branch of The Engineering Institute.

Mr. Bigg was born in Davidson, Sask. He received the first year of his electrical engineering course at the University of Manitoba, completing it at the University of Saskatchewan where he graduated with a B.Sc. degree in 1933.

He entered P.F.R.A. in June, 1937, as rodman in Regina, Sask., and Swift Current, Sask., becoming acting instrumentman three months later. The following year he was transferred to Saskatoon, Sask., as instrumentman, and

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in 1939 was appointed acting district engineer in charge of work for the Regina district. Then in April of 1940 he became assistant engineer in charge of work in the Saskatoon district until 1942 when he joined the Royal Canadian Engineers as a lieutenant. He served overseas and was discharged with the rank of captain in 1946.

He returned to P.F.R.A. as hydraulic engineer in the water development branch of the Department of Agriculture in Kamloops. In 1949 he was appointed engineer in Regina, Sask., and was subsequently transferred to Kamlops as engineer.

I. D. Patterson, M.E.I.C., partner in the firm of M. M. Dillon Company in London, Ont., is chairman of the London Branch of The Engineering Institute.

Mr. Patterson was born in London and obtained his early education at the London Central Collegiate. He entered Queen's University in 1939 and graduated with a B.Sc. degree in mechanical engineering in 1943. During the summer months of his engineering study he was employed as machinist and draughtsman with the Webster Air Equipment Company and as tool designer with Waterous Limited.

From 1944 until 1946 he served as engineer officer with the Royal Canadian Navy, and then entered the Unifin Tube Company as chief engineer. Two years later he joined the M. M Dillon Company.

Mr. Patterson is a member of the Association of Professional Engineers of Ontario.

Dr. G. G. Meyerhof, M.E.I.C.

Dr. G. G. Meyerhof, M.E.I.C., has recently been appointed senior technical assistant at the Foundation Company of Canada Limited, Montreal.

Dr. Meyerhof graduated from University College, London University, England, in 1938 with first class honours B.Sc. degree in civil engineering, and received the Vernon-Harcourt Prize in civil engineering awarded annually to the first student on the graduation list.

After practical training with J. Mowlem & Company and Arup & Arup, Limited, London (reinforced concrete engineers and contractors), he joined the Expanded Metal Company, London, in 1939. He was responsible for designs of buildings, bridges, industrial structures and public works in connection with the prosecution of the war.

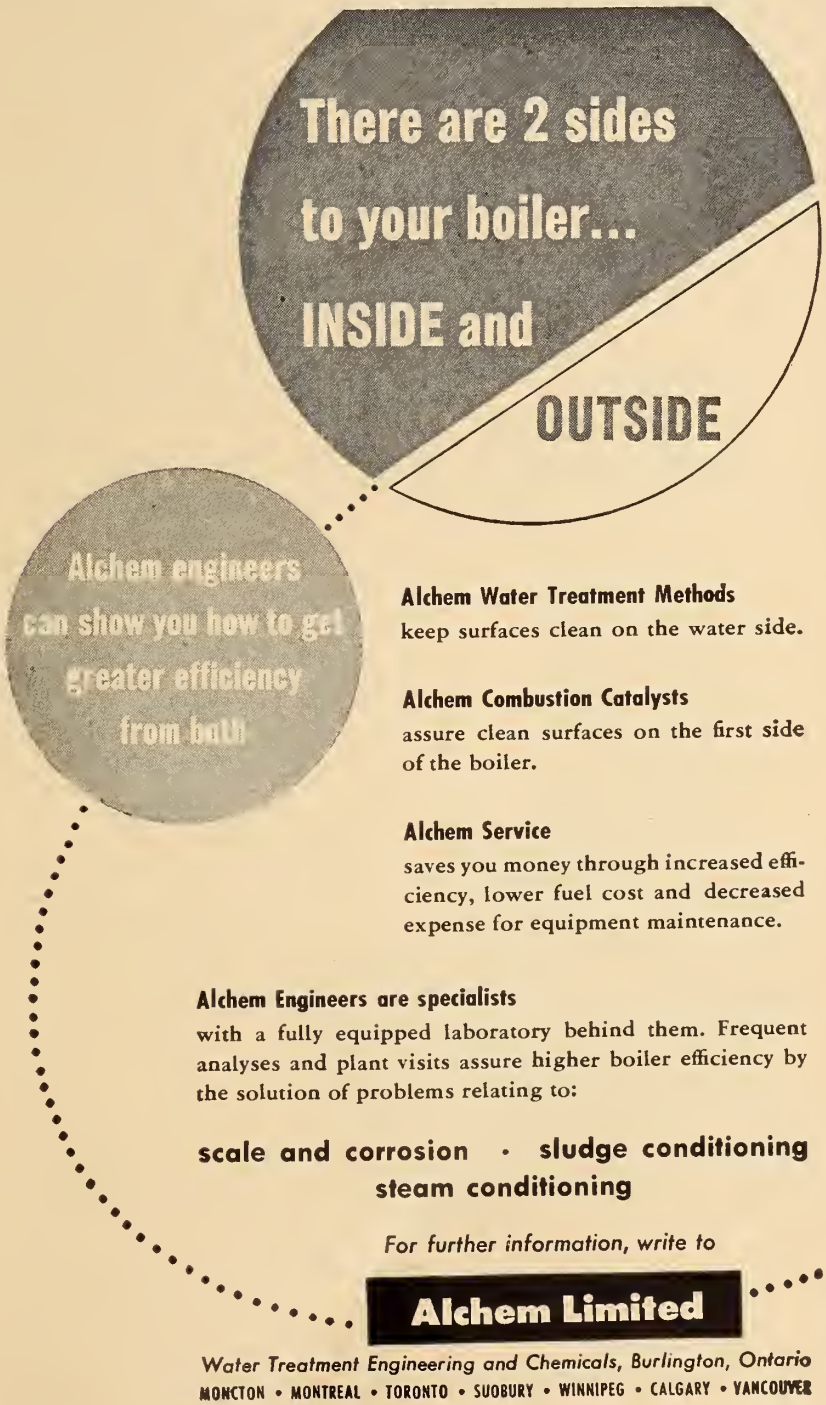
In 1943 Dr. Meyerhof received his M.Sc. degree from London University for research in soil mechanics and took charge of the soils department of R. H. H. Stanger, testing engineers, in London. He carried out site investigations, soil tests and engineering for aerodromes, earthworks, retaining walls and foundations.

From 1946 to 1953 Dr. Meyerhof was on the staff of the Building Research Station of the Department of Scientific and Industrial Research in England, latterly as principal scientific officer in the Soil Mechanics Division. He was in charge of soil investigations for public buildings, bridges and industrial structures and carried out extensive research on soil mechanics and foundation engineering problems for which he was awarded the Ph.D. degree in the Faculty of Engineering, London University, in 1950.

Dr. Meyerhof is a member of the Corporation of Professional Engineers of Quebec, the American Society of Civil Engineers, the Institution of Civil Engineers, the Institution of Structural Engineers and the Geological Society of London.

He has contributed a number of papers in the structural and soil mechanics fields, which have appeared in *Concrete and Constructional Engineering, The Structural Engineer* (London), the *Proceedings* of the Second and Third International Conferences on Soil Mechanics and Foundation Engineer, *Geotechnique*, and the *Magazine of Concrete Research*.

H. Forbes-Roberts, M.E.I.C., general manager of Newfoundland Light and Power Company, Limited in St. John's, has retired at his own request.



During his eleven years of administration, the Company has nearly quadrupled its output and now has an installation of seven hydro-electric generating stations. Its facilities have also been extended to the Corner Brook area of Western Newfoundland.

For the past forty years Mr. Forbes-Roberts has been connected with the power business in various parts of Canada, principally the Prairie Provinces, and has taken part in much of the expansion that took place in those areas in the middle and late 20's.

He has been succeeded by V. A. Ainsworth, M.E.I.C., former general manager of the Maritime Electric Company, Charlottetown, P.E.I.

C. Wachmann, M.E.I.C., is with the Division of Applied Biology of the National Research Council. Before entering the National Research Council, he was an instructor in the department of mechanical engineering of the Nova Scotia Technical College.

Mr. Wachmann received his B.A. and M.A. degrees from Cambridge University in 1942, and his B.Sc. degree in economics from London University.

R. A. Bradley, M.E.I.C., has been transferred by the Department of Transport from Gander Airport where he served as chief engineer, to Toronto, Ont., where he is now district airway engineer in a district extending through the whole of Ontario as far west as Fort William.

C. F. P. Faulkner, M.E.I.C., is district engineer for the B.C.-Yukon District of the Department of Public Works in New Westminster, B.C.

Born in St. Alban's, Herts, England, Mr. Faulkner received his engineering training at Heriot-Watt College, Edinburgh, and his apprenticeship with James Milne & Son, Edinburgh.

He came to Vancouver, B.C., in 1910 and the following year was articled to Alister Robertson, B.C.L.S. in Victoria. While there, he became one of the original officers of the 88th Regiment of the Victoria Fusiliers.

After service during the First World War in Canada, England and France, he joined the staff of the Canadian National Railway. He then became employed on road location and construction with the Provincial Government, and later assistant engineer with Peter Lyall & Son on the construction of the Esquimalt Dry Dock.

Mr. Faulkner joined the Nelson office of the Department of Public Works in 1925, and upon consolidation of the B.C. Districts, he was transferred to New Westminster. From 1934 until 1949 he was in charge of all works on the Northern Coast. A year later he was appointed assistant district engineer until 1952 when he was named acting district engineer.

Mr. Faulkner has been a member of the Association of Professional Engineers of British Columbia since its formation in 1921.

W. H. Craig, M.E.I.C.

W. H. Craig, M.E.I.C., has joined Dominion Viscose Products Limited as plant manager at Ajax, Ont.

He was formerly plant engineer at the Valleyfield, Que., plant of Merck & Co. Limited, having become associated with them in 1947. Previous to that time he was construction supervisor for Dow Chemical of Canada Limited at Sarnia, Ont.

Mr. Craig graduated in mechanical engineering from the University of Toronto in 1943.

Lloyd W. Geake, M.E.I.C., is now employed with Thompson Products Limited in St. Catharines, Ont. He was previously plant engineer with Dominion Tar & Chemical Co. Ltd. in Toronto.

Mr. Geake received his B.A. degree in 1939 and his B.Sc. degree in mechanical engineering in 1941 from the University of Saskatchewan.

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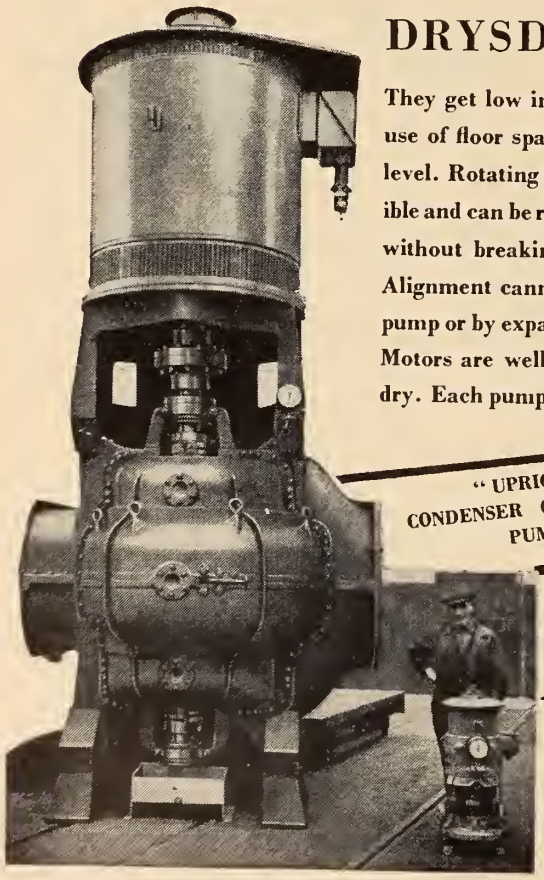

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Upon graduation in engineering, he joined the Civil Service Commission as government inspector on the quality and precision of material supplied to the R.C.A.F. In 1942 Mr. Geake entered the Canadian Army as lieutenant in charge of a R.C.E.M.E. Light Aid Detachment, and upon his discharge in 1946, served as mechanical project engineer with Price Brothers & Co. Ltd. in Kenogami, Que. He became associated five years later with Dominion Tar & Chemical Co. Ltd.

R. J. Cupit, M.E.I.C., is now chief engineer with Northwest Industries (Machine Division) Limited in Edmonton, Alta.

He was previously design engineer with Dominion Bridge Co. Ltd. in Montreal, Que.

Mr. Cupit is a graduate in mechanical engineering from Derby Technical College, class of 1946.

P. A. E. Hess, M.E.I.C., has been appointed construction project engineer with the Hydro-Electric Power Commission of Ontario in Toronto.

Mr. Hess was formerly project engineer with Central Mortgage and Housing Corporation at Camp Borden, Ont.

C. W. Taylor, M.E.I.C., assistant transitman for Canadian Pacific Railway in Montreal, has been appointed superintendent of traffic at Winnipeg.

L. J. MacKay, M.E.I.C.

Leonard J. MacKay, M.E.I.C., has joined the civilian staff attached to the United States Air Force.

A 1948 mechanical engineering graduate from Royal Technical College, Salford, Mr. MacKay was previously associated with Messrs. John Hall and Company Limited in Liverpool, England, with Fraser-Brace Terminal Constructors in Saint John, N.B., as assistant superintendent engineer, and with Darling Bros. Limited in Montreal, as sales engineer.

John F. Curran, M.E.I.C., is employed by the United States Air Force as chief civilian engineer, attached to the engineering section of the Air Installations Office on Pepperrell Base.

Previous to this appointment, Mr. Curran was field engineer with Central Mortgage and Housing Corporation and was mainly engaged in defence construction.

Mr. Curran graduated in civil engineering from the National University of Ireland in 1950.

C.P.R. Appointments

R. E. Farmer, M.E.I.C., has been appointed district engineer for the Canadian Pacific Railway's Quebec district. He was previously the assistant district engineer.

A. G. Hibbard, M.E.I.C., has been appointed assistant district engineer for the Canadian Pacific Railway's Quebec district. He was previously engineer for the Montreal Terminals Division.

Mr. Hibbard formerly held positions as assistant roadmaster of the Montreal Terminals Division and roadmaster of the Smiths Falls Division.

He graduated from McGill University in 1941 and joined the Canadian Pacific Railway that same year.

J. H. Reeder, M.E.I.C., district engineer for Canadian Pacific Railway's Quebec district, has retired. Mr. Reeder has held the position of district engineer since 1949.

R. S. Allison, JR.E.I.C., Canadian Pacific Railway division engineer from London, Ont., has been appointed engineer for the Montreal Terminals Division of the Canadian Pacific Railway Company.

Mr. Allison graduated in civil engineering from Queen's University in 1946 and entered the employ of the C.P.R. as a transitman in London at that time.

T. E. Chalmer, JR.E.I.C., is on the staff of Brown Corporation at LaTuque, Que.

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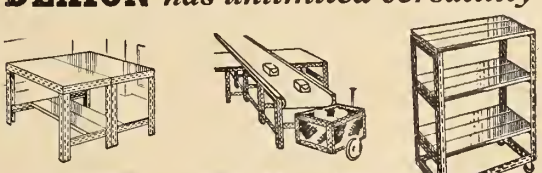

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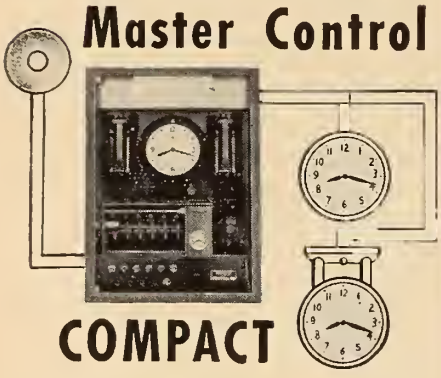

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He was formerly associated with Dominion Textile Co. Ltd. in Magog, Que.

Mr. Chalmer is a graduate in mechanical engineering from the University of Saskatchewan, class of 1946.

R. Haliburton, JR.E.I.C., is now on the staff of Atomic Energy of Canada Limited at Chalk River, Ont.

Mr. Haliburton graduated in chemical engineering from Queen's University, class of 1948.

S/L F. W. New, R.C.A.F., JR.E.I.C., has been transferred from The Institute of Aviation Medicine in Toronto to the position of officer in charge of maintenance at No. 3 Fighter Wing, Royal Canadian Air Force, Zweibrucken, Germany.

Squadron Leader New joined the R.C.A.F. as flight lieutenant in the Technical List in 1949 after graduating in mechanical engineering from Queen's University that same year.

Philip J. Harris, JR.E.I.C., is on the staff of C. D. Howe Company Limited in Montreal. He was previously structural design engineer with Dominion Bridge Co. Ltd., in Lachine, Que.

Mr. Harris received his B.Sc. degree in civil engineering from the University of Manitoba in 1948 and his M.Eng. degree from McGill University in 1949.

J. W. Robinson, JR.E.I.C.

J. William Robinson, JR.E.I.C., has been appointed manager of the new Canadian branch in Montreal of the F. J. Stokes Machine Company.

Mr. Robinson received his B.Sc. degree in chemical engineering from the University of Saskatchewan, and his master's degree in business administration from Harvard University.

In 1948 he joined the Engineering Division of Imperial Oil Limited in Sarnia, Ontario, and three years later, entered Courtaulds (Canada) Limited in Montreal, first as manager of the commercial intelligence unit, and later, in charge of sales developments of industrial applications for rayon.

Mr. Robinson is a member of the American Institute of Chemical Engineers, and the Corporation of Professional Engineers of the Province of Quebec.

Lieut. L. G. Cote, R.C.R., M.C., JR.E.I.C., while serving as signal officer with the Third Battalion of the R.C.R.'s in Korea, was awarded the Military Cross for gallantry in the May 2 battle.

Lieutenant Coté graduated in electrical engineering from the University of Manitoba in 1950.

J. L. Millen, JR.E.I.C., is with Williams & Wilson Limited, Montreal, Que.

Mr. Millen is a mechanical engineering graduate of McGill University, class of 1950.

J .T. Rogers, JR.E.I.C., has been named assistant professor of mechanical engineering at the Royal Military College in Kingston, Ont.

Mr. Rogers graduated from McGill University with a B.Eng. degree in mechanical engineering in 1948. He served on the university staff as a demonstrator during 1949 and obtained his M.Eng. degree in 1950.

L. M. Bluteau, JR.E.I.C., has been transferred by the Canadian Pacific Railway Company from Winnipeg, Man., to Montreal, Que., where he is now employed as assistant engineer of testing at the Angus Shop.

Mr. Bluteau joined the Canadian Pacific Railway engineering staff as a mechanical engineering assistant in Winnipeg in 1950 after receiving his B.Eng. degree from McGill University.

Paul LaPrairie, JR.E.I.C., is with the American Metal Company Limited in New York City.

Mr. LaPrairie graduated in mining engineering from the University of Toronto in 1950.

R. F. Allen, JR.E.I.C., is a works officer with the Royal Canadian Engineers, at Shilo, Man. He has returned from a tour of duty in Korea.

Mr. Allen received his B.Eng. degree in 1951 at the Nova Scotia Technical College.

Mrs. D. M. Stankiewicz, JR.E.I.C., has resigned her position with Canadian Inspection and Testing Company Limited in Toronto, Ont., to study toward her master of applied science degree in chemical engineering at the University of Toronto. Her major course is wood chemistry and research will be conducted on "Alkali Fusion of Aromatic Compounds".

Mrs. Stankiewicz is a chemical engineering graduate of the Polish University College, class of 1951.

R. H. Fletcher, JR.E.I.C., is a civil engineer with Fletcher Enterprises Limited general contractors, in Vancouver, B.C.

Mr. Fletcher graduated in 1951 with a B.A.Sc., degree in civil engineering from the University of British Columbia.

K. H. M. Robertson, JR.E.I.C., is project engineer with Canadian Arsenals Limited in Valleyfield, Que.

Mr. Robertson graduated in civil engineering from the Nova Scotia Technical College in 1951.

J. M. Squire, JR.E.I.C., is with the McGill Gas Dynamics Laboratory at Ste. Anne de Bellevue.

A graduate in mechanical engineering from McGill University in 1951, Mr. Squire was awarded the Athlone Fellowship that year. He spent one year with the Metropolitan Vickers Electrical Company in Manchester, and a year at the University of Birmingham in the study of thermodynamics.

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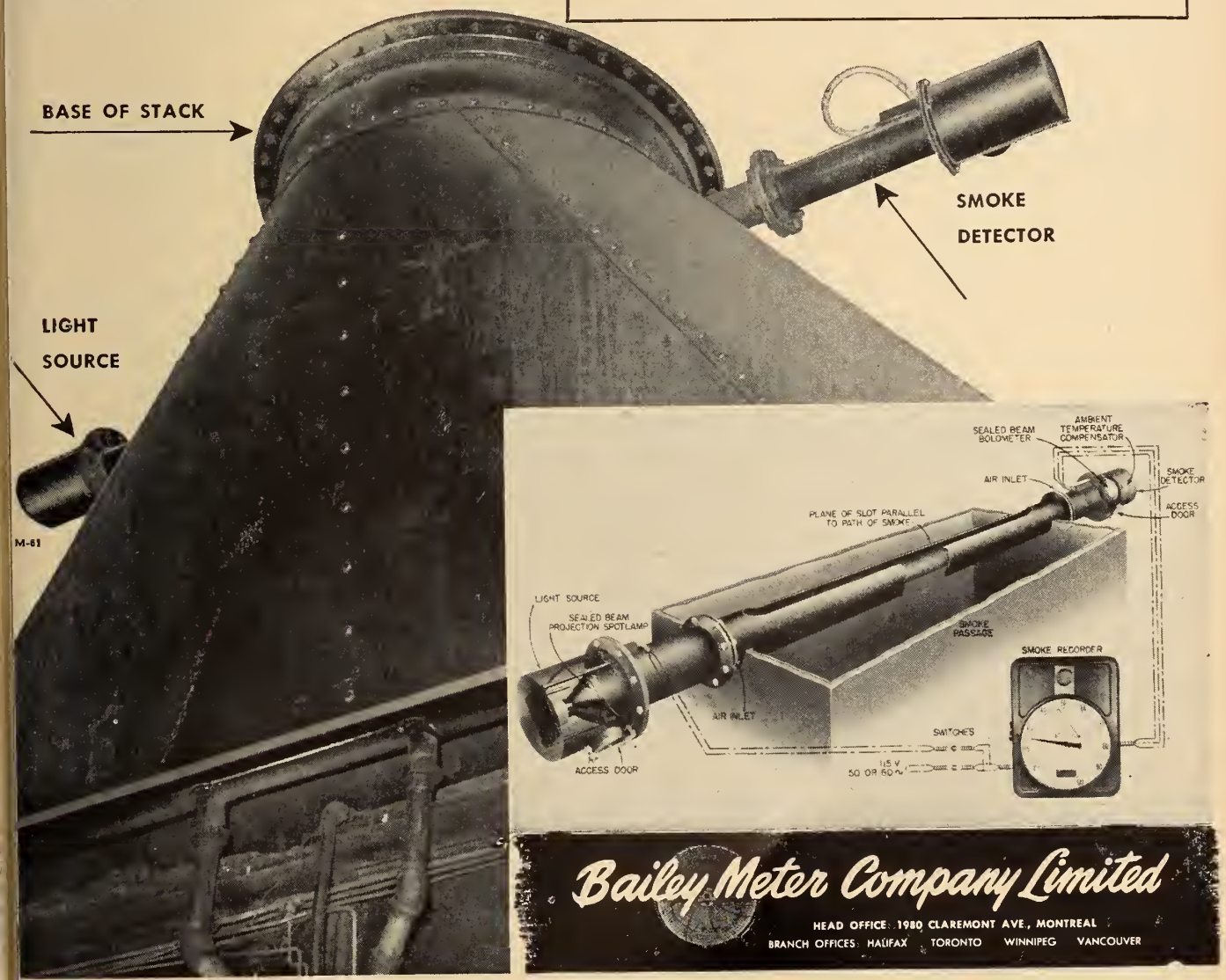

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Murray Gordon Colvin, JR.E.I.C., is job engineer with W. M. Barnes Company of Canada in Toronto.

A graduate in civil engineering from the University of Toronto in 1951, Mr. Colvin was formerly on the staff of Stone and Webster, Boston, as structural designer.

E. A. MacDonald, S.E.I.C., is now with the water resources branch of the Department of Resources and Development at Halifax, N.S.

He is a graduate engineer of the Nova Scotia Technical College, class of 1951.

A. J. Male, S.E.I.C., is on the staff of Canadian Standards Association as a testing engineer.

He was previously in the switchgear sales department of Canadian Westinghouse Co. Ltd., in Hamilton, Ont.

Mr. Male is a 1951 graduate in electrical engineering from the University of Toronto.

E. J. Macfarlane, S.E.I.C., is on the staff of The Shawinigan Water & Power Company in Three Rivers, Que.

Mr. Macfarlane graduated in electrical engineering from Queen's University in 1952.

Morley E. L. McPherson, S.E.I.C., is employed as an engineer in training with the firm of R. Lennox Mackenzie, consulting electrical engineers, in Vancouver, B.C.

Mr. McPherson graduated in electrical engineering from the University of Manitoba in 1952.

Eric W. Spurrell, S.E.I.C., is attached to the United States Corps of Engineers at Goose Bay, Labrador.

Mr. Spurrell graduated in electrical engineering from the Nova Scotia Technical College, class of 1952.

J. D. E. Cooke, S.E.I.C., is with H. G. Acres & Company Limited in Great Falls, Man.

Mr. Cooke graduated from Loughborough College in 1952.

G. H. Lachance, S.E.I.C., is a supervisor with the Aluminum Company of Canada Ltd., at the Isle Maligne plant, Lake St. John, Que. Previously, he was with the Quebec Iron & Titanium Corporation, Sorel, Que., as industrial engineer.

Mr. Lachance graduated in 1952 from Laval University with the degree of B.A.Sc. as chemical engineer.

J. E. Spring, S.E.I.C., is now with The California Standard Company in Calgary, Alta.

Mr. Spring graduated this year in civil engineering from the University of Manitoba.

Roy Harold Battersby, S.E.I.C., who led the graduating class in civil engineering at the University of New Brunswick this spring, has joined the staff of the Montreal Engineering Company in Montreal.

Jeremy T. Reid, S.E.I.C., who graduated from McGill University in mechanical engineering, was awarded an industrial scholarship in advanced aeronautical engineering in Great Britain, and is now with Rolls-Royce Limited in Derby, England.

R. F. White, S.E.I.C., is with A. J. Shama Geodetic Survey Party at Havre St. Pierre, Que.

Andre Dupre, S.E.I.C., is with the Canadian Westinghouse Company Limited, at Hamilton, Ont., and is engaged in the Company's two-year training course.

Mr. Dupre is a 1953 graduate in mechanical and electrical engineering from Ecole Polytechnique.

Visitors to Headquarters

J. F. Wiekenden, M.E.I.C., Three Rivers, Quebec, October 19, 1953.

George Stone, Montreal, Quebec, October 20, 1953.

R. M. Richardson, M.E.I.C., Saint John, New Brunswick, October 21, 1953.

J. Foster Petree, London, England, October 29, 1953.

H. W. Tate, M.E.I.C., Toronto, Ontario, October 30, 1953.

Paul E. Buss, M.E.I.C., Thorold, Ontario, October 30, 1953.

L. M. Hovey, M.E.I.C., Winnipeg, Manitoba, October 30, 1953.

E. P. Muntz, M.E.I.C., Toronto, Ontario, October 31, 1953.

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Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Godfrey Hugh Brunner, M.E.I.C., formerly with Imperial Chemical Industries Limited in Middlewich, England, died on June 27, 1953, after an illness lasting several months.

Mr. Brunner was born at Appleton, Lancashire, England, on February 3, 1884. He received his early education at Berkhampstead School, Herts, England, after which he entered McGill University in Montreal, graduating with a B.Sc. degree in 1906 and a M.Sc. degree in 1907.

A nephew of Sir John Brunner, co-founder of Brunner, Mond and Company, Mr. Brunner joined the family business at Winnington in 1908.

He entered the British Territorial Force in August, 1914, and served as staff captain with the 159th Infantry Brigade in the Mediterranean Expeditionary Force. He was invalided to England, but returned to the British Armies in France from June, 1918 until February, 1919. He was discharged with the rank of major.

Mr. Brunner returned to Winnington for a few years after the war before going to Wallerscote where he was construction and works engineer for the erection of the new works. Shortly after the completion of the Wallerscote Works, he was transferred to the Fleetwood Works in May, 1927 as chief engineer. Named works manager in June, 1931, he continued in this position until his transfer to Middlewich ten years later. Mr. Brunner retired in 1943.

He joined the Engineering Institute of Canada as a Student in 1904, transferring to Associate Member in 1911 and to Member in 1940. Mr. Brunner attained Life Membership on January 1, 1947.

Arthur Gourlay Riddell, M.E.I.C., director and vice-president of John E. Riddell and Son Limited in Hamilton, Ont., passed away in the Hamilton General Hospital on January 3, 1953.

Mr. Riddell was born in Hamilton, Ont., on November 29, 1884. After receiving his general education at the Hamilton public schools and the Hamilton Collegiate Institute, he attended McGill University, graduating in mechanical engineering in 1907.

During his first three years after graduation, Mr. Riddell was employed as mechanical superintendent in charge of operation and maintenance with Canadian Iron Corporation Limited in Midland, Ont. He then joined The Steel Company of Canada Limited in Hamilton as superintendent of construction, and in 1913, he worked with M. Beatty & Sons Limited in Welland, Ont.

Mr. Riddell served with the 2nd Battalion of the Canadian Engineers during the first World War. After service in France, he was awarded the Military Cross and was discharged in 1919 with the rank of major. The monument at Vimy Ridge was constructed by the Canadian Engineers under his direction.

Upon his return to Canada he was employed at the Welland Ship Canal Office in St. Catharines, Ont., and subsequently he entered into consulting engineering in the roofing contracting and manufacturing firm founded by his father in Hamilton 65 years ago. There he was in charge of the construction of Westdale Collegiate and other large buildings.

Mr. Riddell joined the Engineering Institute as a Student in 1907, transferring to Associate Member in 1913, and to Member in 1940. In 1948 he was granted Life Membership.

Samuel Ernest McGorman, M.E.I.C., mayor of Ojibway, Ont., and for 47 years a leader in industrial and community life in the Windsor area, died in his 73rd year on August 27, 1953, while vacationing at Hunter River, P.E.I.

A native of Perth County, Mr. McGorman went to Windsor, Ont., immediately after his graduation in 1905 from the School of Practical Science of the University of Toronto. He joined the Canadian Bridge Company there as a junior engineer and rose successively through the ranks of executive posts until he became chief engineer of the subsidiary company, Essex Terminal Railway, as well as one of the top consulting engineers of the firm. When he first joined the Canadian Bridge Company, its activities consisted mainly of bridge building, but as its field of industry became diversified, Mr. McGorman began to acquire supervision of many of its major projects, particularly that of tower-building. In this field he was regarded as a highly skilled specialist.

Mr. McGorman served for four years as the chairman of the board of the Sandwich, Windsor and Amherstburg Railway. When the Ontario Municipal Board took over the road in 1934, Mr. McGorman was named to the post of chairman. He served in this capacity until 1938.

He was many times elected as a member of the directorate of the Windsor Chamber of Commerce and headed committees handling important activities of that organization. He was also keenly interested in county affairs and sat for many years as representative of Ojibway on the county council.

Perhaps his greatest single contribution to the development of Windsor and the one which called forth his best efforts was acting on the Royal Commission on Amalgamation of the Border Cities, a provincially-sponsored project which resulted in the combining of the municipalities of Windsor, East Windsor, Walkerville and Sandwich. He was a keenly interested and fully active member of that commission and signed the report which is dated April, 1935. It was on the findings of this commission that the Amalgamation Act was based.

Mr. McGorman joined the Engineering Institute as a Member in 1921 and was granted Life Membership on January 1, 1951.

Charles Gunning Williams, M.E.I.C., an active director of Eldorado Mining & Refining Limited, and former head of the department of mining engineering at the University of Toronto, died on August 14, 1953, at Bracebridge, Ont.

Professor Williams was born at London, Ont., on March 16, 1882. He received his general education in that city and then entered the School of Practical Science, University of Toronto, graduating with honours in 1903. Two years later he received his B.A.Sc. degree with honours from the University of Toronto.

He learned the fundamentals of his profession working as a machine operator, prospector, mine surveyor and mine shift boss. When gold was found in the Porcupine area of Northern Ontario, Professor Williams joined the staff of Hollinger Consolidated Gold Mines at Timmins, Ont., where he subsequently became general superintendent, holding that position for twelve years.

In 1929 he set up a mining consulting practice in Toronto. This was interrupted in 1934 when he was appointed the first general secretary of the Canadian Metal Mining Association, a position he held for two years before resuming his consulting practice.

Professor Williams joined the staff of the department of mining engineering at the University of Toronto in 1938, and remained there until 1948.

A director of Eldorado Mining and Refining Limited, Professor Williams took an active part in the development of uranium mining at Beaver Lodge Lake, Sask. For the past few years he was a director of Teck-Hughes Gold Mines Limited, its subsidiary, Lamaque Gold Mines Limited, and Conagas Mines Limited.

Active in professional organizations, Professor Williams was president of the Association of Professional Engineers of Ontario and of the Toronto branch of the Canadian Institute of Mining and Metallurgy. He also served in 1943 on an eight-man government commission to examine Ontario mining.

Professor Williams joined the Engineering Institute as a Member in 1938.

Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER with experience in production, or allied engineering services is required as technical representative of manufacturer of centrifugal separators, heat exchangers, special process equipment and plants. Wide field of inquiry is afforded since such equipment finds application in virtually all types of industry. In reply please outline personal and technical history. File No. 4682-V.

CHEMICAL ENGINEER, recent graduate required by Montreal firm in the chemical construction and lining field. This opening includes designing, estimating and recommending for specific chemical problems, the handling of some technical correspondence as well as field supervision. Replies should include age, marital status, salary expected and if possible, a recent photograph. File No. 4688-V.

CIVIL

CIVIL ENGINEER, or architect for work in the building code section and to assist with technical work on the National Building Code. Location Ottawa. Age preferably below 35. Knowledge of French desirable. Good academic standing. Some building experience desirable. Work will involve some travel. A challenging opportunity in an expanding field, closely allied with research into problems of building design, maintenance and operation. Salary will depend on qualifications and experience. File No. 4670-V.

FOUR GRADUATE CIVIL engineers are required by the department of public work of Newfoundland for surveying, planning, estimating and supervising construction of highways and two others to assist in design and to supervise construction of reinforced concrete bridges. Salary range $3,400 to $6,000 per annum depending upon qualifications and experience. Apply by letter giving full information and salary expected. File No. 4685-V.

STEEL MAN experienced in structural detail design and estimating required for engineering and sales work with steel fabricator located in Niagara Peninsula. Apply stating age, experience and salary expected. File No. 4690-V.

ELECTRICAL

ELECTRICAL ENGINEER required by large paper company located in the Quebec City area. Graduate with two or three years experience preferred. In reply, please give complete details of experience and personal history. File No. 4686-V.

ELECTRICAL ENGINEER with one or two years experience in distribution planning, which eventually could lead to the position of Superintendent of distribution. The immediate work would consist of making up maps of our distribution system, planning and layout in the field, any new extensions or re-construction of present facilities, voltage and load studies, substation design and layout, with a gradual breaking-in to supervision of operating and maintenance personnel. Location Ontario. File No. 4695-V.

MECHANICAL

REQUIRED YOUNG MECHANICAL engineer, former experience in factory operations essential preferably in plant layout. Knowledge of wire and cable manufacturing processes an advantage. Position one of industrial engineering work, excellent opportunities. Please reply giving full details. Salary requirement etc. File No. 4674-V.

MECHANICAL ENGINEER with industrial engineering background to train in industrial department of large paper company with mills in the Province of Quebec. File No. 4675-V.

MECHANICAL ENGINEER bilingual single man with a desire to travel to conduct diesel service training sessions in distributor territories throughout Canada. This position is an ideal opportunity for an engineer desiring to advance in the diesel field. File No. 4676-V.

JUNIOR SALES ENGINEER, graduate with sales experience, technical knowledge of diesel engines and their application an asset. There is a definite future to this job with possibilities leading to executive levels. File No. 4676-V.

GRADUATE MECHANICAL ENGINEER wanted for large Canadian organization in Vancouver, B.C. Four to five years experience in medium or heavy machinery design preferably but creative mind with initiative to handle unusual design problems more important. Reply with full particulars including names for reference, in first letter. File No. 4677-V.

MECHANICAL ENGINEER with some experience in sales to contact industry as a representative for an old established nationally advertised line of lubricating equipment. This is a new opening and is a permanent position which carries an excellent opportunity for the future. File No. 4681-V.

MECHANICAL SALES ENGINEER with one or two years experience required by large rubber manufacturing company. Applicant should have one or two years experience and some business administration. Age 32 or under. File No. 4639-V.

MISCELLANEOUS

RECENT GRADUATES ('51, '52, '53) required for positions open in design, technical sales, technical service, process development, process supervision. Location Ontario. File No. 4672-V.

MECHANICAL ENGINEER required by a large oil company for its Montreal head office engineering division. Position involves pressure vessel and pipe design. Recent graduate with 2 or 3 years experience desired, preferably with experience in same or related field. Good possibilities for promotion. Attractive employee benefit plans. Salary commensurate with experience. File No. 4673-V.

SALES ENGINEER new Canadian subsidiary of established U.S. manufacturer of architectural metal products recognized as leader in its field requires experienced sales engineer to handle Montreal territory. Age 28-35. Must be familiar with architectural blueprints and the construction industry. University graduate in engineering or architecture will receive preference and premium salary consideration. Excellent opportunity to advance with new, young organization. Starting salary $5,000 to $6,000 plus car and expenses, insurance benefits, retirement plan. In reply state age, education, family status, work experience and present earnings. Replies absolutely confidential. File No. 4636-V.

A CO-ORDINATOR of basic material practices. $6,420-$7,200. Competition 53-583 and an assistant co-ordinator of basic material practices $5,640-$6,360. Competition 53-584 for the Department of National Defence at Ottawa. Full particulars on posters displayed at your nearest Civil Service Commission Office, National Employment Office and Post Office. Application forms obtainable thereat, should be filed immediately with the Civil Service Commission, Ottawa. File No. 4683-V.

TWO PRODUCT managers required by manufacturer of radio communications and electronic equipment. Graduate in engineering with experience in sales and marketing. Applicants will be expected to plan and organize a sales program, in a country wide basis. File No. 4684-V.

NATIONAL SERVICE MANAGER required by manufacturer in Ontario. Applicant should be graduate engineer, with communications option, from a recognized University. He should have administrative ability and experience in radio communications in the fre-

quency modulation field. File No. 4684-V.

THE PAKISTAN INDUSTRIAL Development Corporation invites applications for position of Works Manager for a paper mill to produce 100 tons per day of fine and superfine papers, utilizing bamboo as raw material. Also position of Works Manager for a high grade board mill and Works Manager for a straw board mill, utilizing cereal straws. Qualifications a degree in mechanical or chemical engineering or at least 10 years practical experience of management of a comparable mill and for board mill jobs a degree or at least 5 years practical experience of management of a comparable mill. Salary in accordance with qualifications and experience. File No. 4687-V.

ELECTRICAL OR MECHANICAL engineer required in Quebec City by large organization to do development work on Watthour meters. Applicant should be preferably bilingual. File No. 4691-V.

QUALIFIED MINING ENGINEER to take care of development in N. Saskatchewan. Applicant must be prepared to live on site and devote entire time to one project and be capable of handling the entire project. Excellent salary to applicant with ability and good record. File No. 4692-V.

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEER required, bilingual with experience in food canning, specially meat canning. Work will entail management of Montreal plant production of present manufactured goods and of future products. Salary will depend on experience and qualifications. All replies will be held confidential. File No. 4650-V.

CHEMICAL ENGINER for employment in the technical service department required for large pulp and paper organization in Newfoundland. File No. 4656-V.

QUALIFIED CHEMICAL ENGINEER with some chemical plant and or oil refinery processing experience. This person would be employed as technical sales representative covering the whole of Canada. Age range 35 years. Organization is a chemical plant and oil refinery construction company providing process engineering, design and construction services. Location Ontario. File No. 4659-V.

CIVIL

PROJECT ENGINEER REQUIRED, for large Newfoundland manufacturer of pulp and paper products. Man selected would be responsible for complete follow up of progress on all construction work including costs, etc. Work would cover general construction, hydro-electric development, railway and port projects. Excellent opportunity for right man, would possibly be considered for senior position in organization within three or four years. Previous pulp and paper mill experience valuable but not absolutely essential. File No. 4632-V.

EXPERIENCED ERECTION ENGINEER, required by a medium sized steel fabricator located in Toronto, supervisory ability and willingness to travel are important. Civil engineering degree preferred but not essential. Company offers pleasant working conditions, participating hospitalization insurance, pension plan, etc. Your resume should include a personality sketch, record of qualifications and past experience, and references. Salary open. Only experienced applicants will be considered. File No. 4641-V.

CIVIL ENGINEER, preferably college graduate and registered professional engineer with at least fifteen years practical experience in a supervisory capacity, specializing in design of structural steel and reinforced concrete buildings, to supervise group of engineers and draftsmen in consulting engineer's office in Windsor. Please write giving full details, including experience, age, salary requirements, references, et cetera. Interview will be arranged. File No. 4649-V.

JUNIOR CIVIL OR mechanical engineer for product sales development work. Graduate with two or three years experience. Experience in pulp and paper, chemical plant or general construction would be an advantage. Location Montreal. File No. 4658-V.

CIVIL ENGINEER required by municipality in Province of Quebec with a population of 5,000. Applicants must be thoroughly bilingual with not less than two years experience. Duties include budget survey, preparation of estimates and the keeping up to date of a large scale plan of all municipal services. In cooperation with a committee, to elaborate construction standards and a town planning program. Please give full particulars of age, education and experience in reply. File No. 4661-V.

YOUNG GRADUATE ENGINEER urgently needed for new expanding oil company in Quebec and Eastern Ontario, with headquarters in Montreal. Work will include field inspection and contract control of construction of all service stations, bulk plants and larger petroleum handling installations. Position will also involve some travel and responsibility. Applicant should have necessary qualifications for membership in the Corp. of Professional Engineers. Previous experience is an asset but not absolutely essential. Replies should state age, qualifications and salary expected. File No. 4694-V.

ELECTRICAL

ELECTRICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicants should have pulp and paper experience. Salary range $700 to $750. File No. 4653-V.

ELECTRICAL ENGINEER required for design of electrical installations in generating stations and substations. Will be responsible for layout, purchase specifications, scheduling and general supervision of installations and placing in service. Excellent fringe benefits including attractive pension plan. Apply stating salary required and giving full details of qualifications and experience. File No. 4655-V.

RESIDENT ELECTRONIC ENGINEERS required by company located in Montreal. Applicants should be Canadian with a degree in electrical engineering and 5 to 10 years experience on radar (ground radar) and communications work. File No. 4660-V.

ELECTRICAL ENGINEER required by army headquarters, Ottawa to assist and support an electrical engineer in connection with all electrical plant distribution and interior wiring systems—operation and maintenance. To carry out field work on a Canada wide basis in connection with all electrical facilities and appurtenances. Sixty per cent of the work will be field liaison visits, to provide a continuous check of all electrical consumption and use of equipment to ensure maximum conservation. File No. 4662-V.

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training program of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers, and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4663-V.

ASSISTANT PROFESSOR REQUIRED in the department of electrical engineering of University located in Maritime Provinces. Preferably Canadian, under 35, and with at least two years experience. The course involves D.C. machinery, A.C. circuits and introductory electronics. File No. 4667-V.

MECHANICAL

MECHANICAL ENGINEER, required as sales representative by machinery manufacturer. Recent graduate and preferably bilingual. Territory Montreal and Province of Quebec. File No. 4634-V.

MECHANICAL ENGINEER, required by long established manufacturing firm, graduate mechanical engineer, preferably between ages 25-32, should have some experience in plant engineering duties. Position offers better than average possibilities of working into responsible duties in production. Apply by letter giving full information. File No. 4640-V.

ASSISTANT MECHANICAL SUPERINTENDENT required by large paper company with headquarters in Montreal. Applicant should have pulp and paper experience. Position will eventually lead to mechanical superintendent. Salary range $700 to $750. File No. 4653-V.

MECHANICAL ENGINEER to engage in mill maintenance engineering including draughting and designing by large pulp and paper organization in Newfoundland. File No. 4656-V.

MECHANICAL ENGINEER required by Army Headquarters, Ottawa, to assist and support a mechanical engineer in connection with all types of heating plants operation and maintenance. To carry out detailed field work on a Canadian wide basis in connection with all heating plants and appurtenances. Sixty percent of the work will be field liaison work. File No. 4662-V.

MISCELLANEOUS

CHIEF ENGINEER HOME APPLIANCES. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design, styling, standardization, lab, etc. Canadian engineer with experience in home appliances design age 35 to 40 preferred. This is an excellent opportunity for creative engineering since this company is Canadian owned and wishes to produce Canadian designs for the Canadian market. Location Ontario. File No. 4616-V.

RECENT GRADUATE, preferably with experience in the pump or oil refinery fields to act as sales engineer in the Vancouver area for expanding Western manufacturing operations. Salary and bonus arrangement for successful applicant. File No. 4633-V.

DESIGN ENGINEERS, experienced in commercial vehicle design and production methods are required for general trailer design. In reply, state age, experience, references and salary expected to File No. 4636-V.

ENGINEERS, are required with previous experience in the design and construction of aluminum transport trailers. Replies stating personal history and salary required should be addressed to File No. 4636-V.

YOUNG CIVIL OR MECHANICAL ENGINEER, required by a pulp and paper company in Quebec. Applicant should have a minimum of three years experience in engineering and maintenance, preferably in the pulp and paper industry. Applicant should be fluent in either French or English and able to get along in the other. Replies should outline qualifications, experience, age and salary expected. File No. 4637-V.

OPENINGS ARE AVAILABLE, for mechanical and chemical engineers in a large Eastern Canadian paper mill. Single men preferred who have experience in the paper industry. Applicants please give complete detail of experience and personal history. File No. 4638-V.

Wanted Immediately

A Qualified

ELECTRICAL ENGINEER

Direct replies to

Town Clerk,
P.O. Box 147,
Summerside,
P.E. Island.

Junior Mechanical Engineer

To work under the direction of a senior engineer in a reseorch bronch to develop, test ond modify remote control equipment, instruments ond techniques.

Recent groduote in mechanicol engineering with some training in shop or instrument work. Should be fond of godgeteering.

Salory occording to quolificotions.

Stote porticulors including oge, morital stotus, educotion ond experience in first letter to file 10D, Atomic Energy of Conoda Limited, Cholk River, Ontorio.

GRADUATE CHEMICAL OR MECHANICAL ENGINEER, required. Preferably with some experience for Eastern Ontario food industry. Apply stating experience and salary expected. File No. 4642-V.

WELL KNOWN FIRM of Management Consultants is prepared to appoint additional engineers to their staff. Candidates should be Canadians, aged between 30 and 35, possessing engineering degree and several years executive experience with increasing responsibilities in manufacturing industry. Only those should apply who have a definite interest in management and who are well informed on present-day management techniques and general industrial trends. File No. 4643-V.

PROFESSIONAL ENGINEER, required to work on steam boilers and associated equipment. Applicants should have four to six years recent experience in this field and be capable of handling contract work, be conversant with heat transfer as it relates to steam power plant equipment. Location Toronto. File No. 4644-V.

THE DEFENCE RESEARCH BOARD, requires scientific information officers for employment in Ottawa, Canada. Bachelors degree in science with additional credits given for post-graduate study; preferably research experience; ability to work as an independent member of a scientific team; Canadian citizen or British subject. Vacancies: aeronautics and related subjects, physiology, biochemistry and bacteriology, electronics. Salary range $2,800.00 to $4,300.00 per annum. Competition No. 53-DRP-3. File No. 4645-V.

A GRADUATE ENGINEER, preferably civil or mechanical to develop, with assistance of economic research staff, industrial opportunity proposals for new industry and expansion of present industry. Must be able to meet the public. Post graduate experience required. Senior position with good opportunities for advancement. Location Regina, Saskatchewan. File No. 4646-V.

AGRICULTURAL ENGINEER, required by Eastern Canadian Agricultural College for teaching and field experimental work in farm power and machinery. Post graduate training preferred but not required. Salary commensurate with experience and training, good prospects for advancement. File No. 4647-V.

SALES REPRESENTATIVE, over five years experience in industrial manufacturing plants. Successful proven sales record and the following: over thirty, mechanical background essential, preferably metal shop experience; knowledge conveyors, or dust collection, or mixing, screening equipment preferred. Exclusive territory to acceptable representative opportunity American machine company with manufacturing facilities in Canada. File No. 4648-V.

ENGINEERING GRADUATE or equivalent, bilingual, with proven sales record to sell construction equipment, earthmoving machinery, diesel engines, electric sets and marine engines. Progressive company, good working conditions, salary, expenses and commission. Salary dependent on experience. Location Montreal. File No. 4651-V.

SALES ENGINEER bilingual for Quebec City area. Experience in water treatment beneficial but not essential. File No. 4652-V.

SALES ENGINEER for Eastern Ontario. Experience in water treatment beneficial but not essential. File No. 4652-V.

GENERAL SUPERINTENDENT required to take complete charge of paper mill for large organization with headquarters in Montreal. Salary $850 to $900. File No. 4653-V.

TWO SALES ENGINEERS required by manufacturer of code testers, convector radiators, unit heaters, fluorescent and incandescent fixtures, etc., to contact architects, engineers, contractors, plumbers, and electricians, to prepare plans and estimates. Must be bilingual. Good salary and commission. File No. 4654-V.

CITY OF MONTREAL architects office offers permanent employment opportunities to engineers. Age must not be over 55 years at date of employment. Education: preferably graduation in engineering from a recognized university must be a member in good standing of the corporation of professional engineers of Quebec at date of appointment. Post graduate studies; a compensation on the number of years of experience required will be alloted to candidates who have followed recognized post graduate courses. Experience at least 6 years practical professional experience or its equivalent, must have an extensive general formation in addition to proved administrative qualities, must be capable of taking the entire technical responsibility of a project. File No. 4657-V.

DIESEL ENGINEER (diesel electric) required in Montreal. Duties would involve the supervision of repair and maintenance on diesel power units. File No. 4660-V.

UTILITIES CONTRACT ENGINEER required by army headquarters, Ottawa, to continuously develop more economical procurement of utilities and services (furnished by contract), such as electricity, steam, gas, water, sewage disposal, boiler inspection, instrument repair, elevator maintenance, railroad siding maintenance, at Canadian Army installations. File No. 4662-V.

RECENT GRADUATES in metallurgical or chemical engineering for laboratory pilot plant and plant operations in the ore dressing and extractive metallurgical field. Location Ontario. Supply full particulars regarding qualifications to File No. 4664-V.

YOUNG ENGINEER to act as sales engineer. Age 25 to 35 years. Graduate with 6 months to 3 years experience. Manufacturers of finned tube and products manufactured from it. Although travelling is involved, it is not of a routinized nature. Periodic trips throughout Ontario and occasionally Quebec are required. The applicant should either have, or be interested in obtaining a knowledge of design and application of heat transfer treatment. The selected applicant will be expected to undergo a training period in London, Ontario, eventually locating in Toronto where he will operate independently. File No. 4665-V.

YOUNG GRADUATE ENGINEER preferably with manufacturing experience required by financial institution to make surveys of and write reports on industrial plants in Eastern Canada. Permanent position. Salary according to qualifications. File No. 4666-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate with Bachelor's or Master's degree, for research in the engineering and development section of the division of applied biology, National Research Council, Ottawa. Immediate duty to assist in small scale fermentation pilot plant investigation. Interest in food preservation and refrigeration research desirable. Starting salary up to $4,400 per annum depending on qualifications. Apply in writing giving all relevant details, including experience, academic standing, and if possible, references. File No. 4669-V.

Situations Wanted

CIVIL ENGINEER, B.A.Sc. U. of T., M.E.I.C., age 49, married. Three years experience in road and municipal survey work. Over twenty years experience in steel, concrete and timber design (municipal, industrial and office buildings, bridges, large sewers and tunnels, flat slab, rigid frames, equipment and conveyor supports, piles etc.). Considerable experience in inspection of construction, plant layout, and supervision of structural design and preparation of plans. Seeks responsible position with future possibilities — such as plant engineer. Preferably but not necessarily in South Ontario area. File No. 899-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. (McGill 1949), B.Sc. 1947, age 26, married, Four years experience as a structural engineer on bridges of all types in steel, reinforced concrete and timber. Desires position with future anywhere in Canada where design experience will be an asset. Available on approximately one month's notice. File No. 3097-W.

CIVIL ENGINEER, M.E.I.C., P.Eng. B.Sc. (Alberta) 1949, married, age 34, with administrative experience in handling contracts, contractors and purchasing of construction materials for government work. Experience in hydraulics and hydrologic investigations. Desires change with responsibility and a future. File No. 3223-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. McGill 1951, P.Eng. Quebec. Age 31 years, married, two children. Bilingual, Veteran 5½ years R.C.N. Familiar with West Indies, South America, South Africa, India, Egypt, Britain. Experienced one and one half years city engineering, six months railway maintenance of way; two years supervision of construction of biofilter sewage treatment plant, water filtration plant, sewage system, airport facilities, for consulting engineer. References and resume on request. Presently employed Montreal area. Seeks further opportunity in Canadian or foreign employment. File No. 3788-W.

CIVIL ENGINEER B.Sc. University of Manitoba 1939, M.E.I.C., P.Eng., age 36, married, 3 children, veteran R.C.A.F., 10 years experience in all phases of construction and management, mechanical superintendent. At present managing construction company. Desires position

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Civil Service

(Federal)

A Co-ordinator of Basic Material Practices

$6,420 - $7,200

Competition 53-583

and

An Assistant Co-ordinator of Basic Material Practices

$5,640 - $6,360

Competition 53 - 584

for the Department of National Defence at Ottawa

Full particulars on posters displayed at your nearest Civil Service Commission Office, National Employment Office and Post Office. Application forms, obtainable thereof, should be filed IMMEDIATELY with the Civil Service Commission, Ottawa.

with progressive company offering responsibility and sound future. File No. 3831-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

MECHANICAL ENGINEER, M.E.I.C., M.Sc. (University in Austria 1944), good Canadian experience, age 36, married, development and research minded, extremely good knowledge of theoretical and applied engineering sciences, well founded machine shop practice and 8 years of engineering practice in development, research and designing of machinery, equipment and tools, wants a responsible position with good opportunities, or independent work. File No. 3990-W.

PROFESSIONAL ENGINEER, age 35. Married, B.Sc. Civil Engineering 1941. A.M.I.C.E., A.M.I. Struct.E. Specialist in design and construction of reinforced concrete framed and factory buildings and industrial plant structures including foundations, sound knowledge of structural steelwork design and soil mechanics. Seeks responsible position with firm of engineers or architects. Preferably with view to eventual partnership. File No. 4041-W.

EXPERIENCED VIBRATION ENGINEER, seeks part-time consultation work for solving industrial problems on vibration isolation and noise attenuation. File No. 4091-W.

MECHANICAL ENGINEER offers services as part-time consultant for design of special purpose machines and preparation of shop detail drawings. File No. 4091-W.

GRADUATE CIVIL ENGINEER with B.A. (honours in mathematics) B.Sc. (civil eng.) degrees and post graduate work for Master's degree at McGill University seeks diversified work in connection with dam design and construction and other hydro works. Past experience for 1½ years includes work on dam design, dewatering of foundations and mass concrete for a big power house and bridge erection work. Presently working as a field engineer supervising earthen dyke construction. Location of job site and salary no consideration if job offers interesting technical experience in design office or in the field. Married, one child. Age 25. Highest references and outstanding academic record. File No. 4108-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. Sask 1949, age 25, single. Since graduation employed by large food processor as project engineer. Experienced in working under limited direction concerning investigations of feasibility of proposals, layouts drafting, design, technical field supervision, and purchasing for projects involving materials handling, steel structures, plant services, electrolytic gas production and compressing plant. Desire a junior position in design or production field and would consider training program. Location in Toronto, Alberta. File No. 4137-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in planning of major expansions and plant improvements for pulp and paper industry, including reports, costs, and design (civil and some mechanical). During 5 years in pulp and paper, reaching supervisory capacity, have obtained broad field and office experience in structural design, plant engineering, materials handling. Spent 1 year on design of power plants with hydro-electric consultants. Seek responsible position with industrial organizations anywhere in Canada. File No. 4171-W.

MECHANICAL - CHEMICAL ENGINEER, (M.Eng. Dresden Karlruhe) M.E.I.C., P.Eng. Former lecturer at McGill. 15 years experience as plant engineer and assistant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual. Single. Location anywhere. File No. 4183-W.

MECHANICAL ENGINEER, graduated, married, over 20 years experience in piping, heating, plumbing, ventilating, air conditioning, refrigeration, waterwork and sewer installations, experience in process industries, steam-power plant, boilers, pumps, valves and layouts related to steel and reinforced concrete structures, desires adequate position with possibilities for advancement. Experience includes, design, construction, maintenance, planning. Qualification for administration, organizing, sales, has been used too. Location with preference for Montreal. Available 1st December. File No. 4211-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.E. (mechanical) Nova Scotia technical college 1949. Several years experience in machine shop practice, some experience in the design and installation of mechanical drying systems, three summers experience on survey parties, desires an engineering position not necessarily in the mechanical field, in or in the vicinity of St. John's, Newfoundland. File No. 4255-W.

MECHANICAL ENGINEER, 25 H.N.C., G.I. Mech.E. Indentured apprenticeship; 4 years Junior Development Engineer, production and prototype machinery; 2 years design office on diesel and gas engines, arriving September in British Columbia. Presently employed in Ontario. Seeks position in B.C. File No. 4311-W.

STRUCTURAL ENGINEER P.ENG. 3 years experience in steel and concrete wants part time employment from Hamilton-Toronto area. File No. 4313-W.

CIVIL ENGINEER, B.Sc. Queen's University, Belfast, 1951. Age 23, recently arrived in Canada, seeks position with structural engineering firm, location unimportant. Keen to tackle difficult problems. Experience in structural steel and reinforced concrete design, estimating, preparation of bills of quantities, and model testing. Also some surveying experience and at present on building construction work in Toronto. File No. 4314-W.

MECHANICAL ENGINEERING DESIGNER, A.M.I., Mech.E., A.F.R., Ae.S., English immigrant, seeks position in Ontario, Montreal or West. Experience on gas turbines, axial flow compressors and reciprocating aero-engines. Will consider wide range of activity, including design, sales or testing. Presently employed in Maritimes. File No. 4315-W.

CIVIL ENGINEER, Jr.E.I.C. Nova Scotia Tech, 1951. Age 30 (married, two children). Experience includes field and office work with Maritime contractor on bitumin paving, water and sewer installation. Past two years as assistant engineer with public Works Department of Tanganyika, East Africa. Experienced in all phases of engineering concerned with the development and maintenance of roads, airports, buildings, water supply and sanitation. Desires position with consultant or contractor with opportunity of advancement. Location preferably Toronto or area. Available early February 1954. File No. 4316-W.

ELECTRONICS ENGINEER, Jr.E.I.C., B.A. Ottawa, 1943. B.A.Sc. Laval, 1949. Age 30, married with children, bilingual. Four years experience in radio physics, equipment design and basic research. Desires job offering good advancement possibilities. File No. 4317-W.

CIVIL ENGINEER, graduate Delft Technological University, Holland (specialization; hydraulics, dikebuilding), age 28, 1½ year experience in reinforced concrete structures and surveying; interested in prestressed concrete. Presently employed as instrumentman in Western Canada. Desires; position with possibilities for advancement. Available on about one week notice anywhere in Canada. File No. 4318-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. N.S.T.C. Age 28, single. Considerable experience in housing projects and timber construction. Some architectural experience, concrete form design on large hydro-project, pipe design and field supervision. Interested in isolation work in Northern Canada or South America. but will consider other foreign positions Minimum salary for isolation jobs $7,500. I would like experience and do not mind responsibility. Available on short notice. File No. 4319-W.

MECHANICAL ENGINEER, 52 graduate. Single. Desire position in research and development, automotive or allied fields. Presently employed in the pulp and paper industry. Bilingual. Preferred location Montreal or Ottawa area. File No. 4320-W.

YOUNG MAN, ENGINEERING PHYSICIST, S.E.I.C., B.C.S., Georgia, 1950 (Psychology with chemistry), B.Eng., North Carolina, 1953 (physics with Mathematics), English and French languages. Two years general practical electromis, three years university teaching experience. Canadian Army veteran. Desires permanent position with opportunity of furthering interests in research organization. Location anywhere in Canada. File No. 4321-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., N.S.T.C., 1951, age 24, single, experience includes 18 months pulp and paper industry. 8 months materials handling. Desire permanent position with opportunities for advancement. Location preferably Maritime Provinces. File No. 4322-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill, 1950, also graduate in management and business administration (McGill 1953). Age 28. Married, one child. Three years experience with large Canadian manufacturing concern. Duties have included product design, cost reduction work, product engineering and engineering liaison with all manufacturing department and suppliers. Requires responsible position with broad scope for an engineer with production and business administration ability. File No. 4323-W.

CIVIL ENGINEER, B.Sc., M.E.I.C., P.Eng., age 30 with five years engineering experience. Presently employed on the completion of a large expansion program in the paper industry. Desires position in the paper industry with greater responsibility and opportunity for advancement. File No. 4327-W.

MECHANICAL ENGINEER Jr.E.I.C., veteran, married, 28 years of age, graduated in 1950 from University of Saskatchewan. Have 3rd class stationary engineering papers. Have been doing plant engineering work for large mining company. Good knowledge of machine shop practice. Desire position with opportunity. Location not important. File No. 4328-W.

MECHANICAL ENGINEER, P.Eng. Jr.E.I.C., Jr.A.S.M.E., Canadian graduate of Toronto, married, desires position preferably in mechanical production or maintenance with opportunities for progression. Geographical location is of relatively minor importance but prefer one with access to sportsman's facilities (natural). Possess natural mechanical ability and seven years experience in automotive and aircraft maintenance; drainage equipment production; steel plant maintenance; motor vehicle parts manufacture; synthetic rubber plant pressure vessel, boiler and production equipment inspection, maintenance and senior development engineering. File No. 4329-W.

CIVIL ENGINEER Jr.E.I.C., P.Eng., B.Sc. (Queen's 1951) with one years experience in country engineering including O.L.S. surveying; two years in heavy building construction including precision surveying. Particularly interested in work in the west or in foreign assignments. File No. 4330-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc. Mt.A. 1946, B.E. (Civil) Nova Scotia technical college 1948. Age 30, married with two children. Five years experience in the construction field on harbour works, industrial plants and municipal works. Desires a permanent position with good prospects for the future. Will consider any offer and can furnish good references. File No. 4331-W.

CIVIL ENGINEER B.Sc. University of Manitoba 1933, age 42, married, one child. Has experience in various fields of construction. Past 15 years employed by large Rhodesian Copper mine holding positions such as mine engineer and assistant underground manager. Returned to Canada to seek permanent employment and have open mind regarding suitable positions available. File No. 4332-W.

CHEMICAL ENGINEER, B.Sc. 1948, M.Sc. 1952, P.Eng., M.E.I.C., age 26, married with 2 children, experience in production control engineering research, presently employed in fuel research but desires change to more progressive position in production development or

Town Engineer

and

Manager Required

for

The Town of La Tuque, Quebec

Applicant must be engineer in good standing.

Salary open, up to $10,000.00

control work preferably in Alberta. Available on reasonable notice to present employer. File No. 4336-W.

CIVIL ENGINEER, B.A.Sc. M.E.I.C., P.Eng. (Ont.) aged 39, married with one child. Experience comprises 8 years on railway location and construction, track design and layout, subway layout, supervision of construction, and finally in charge of engineering maintenance of a division of 600 miles of track. Military service for 4 years as officer. Last 4 years and at present employed on railway inspection and arbitrating problems between railways and municipalities and detailed reporting of same. Has travelled through Europe and very extensively throughout Canada. Now desires position with engineering or architectural company on administration or with firm of solicitors advising on engineering matters or any other position where above experience would be an asset. Preferable location — Southern Ontario. File No. 4337-W.

GRADUATE CHEMICAL ENGINEER, Jr.E.I.C., 27, married 1 child, requires employment. Two years laboratory supervision experience in large chemical factory. Desires a position with wider scope of responsibility in laboratory or production. Location anywhere in British Columbia. File No. 4338-W.

GRADUATE CIVIL ENGINEER, Delft University. Age 35. Married. Experience in steel and concrete structures. Arriving Canada October 1953. Seeks employment contacts. File No. 4339-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C., age 25, Queen's, 1951, experience includes 2 years of design and field work on construction and maintenance at Montreal Oil refinery and 6 months of control and layout field work at Alcan Power House construction in British Columbia. Desires design and field work in concrete, steel and piping with firm in Montreal area. Available December. File No. 4340-W.

GRADUATE COMMUNICATIONS and electronics engineer, diploma U.H.F. techniques Norway Institute of Technology, Trondheim, Norway. Experience: Europe, 2 years in communications work, transmitters, receivers, telephone equipment etc. Canada; 2 years on test set design telephone circuitry, industrial electronics. Desire new position prefrably in the U.H.F. or related field where possibilties are good for advancement. File No. 4341-W.

CIVIL ENGINEER, O.L.S., Jr.E.I.C., P.Eng. (Queen's 1951) desires to extend his experience in the municipal engineering field. Has worked since graduation with a consulting civil engineering and Ontario land surveying firm. Experience includes consulting for local improvements (field work, design and report writing), farm drainage, small concrete bridge design, filtration plant design, and all types of land surveys. Married, 1 child, has a car. Available on approximately 1 month's notice. File No. 4342-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng., power option, McGill 1950. Age 32, bilingual, single. Post graduate experience includes two year industrial training course and engineering sales-work with large electrical manufacturing company. Also possesses B.Sc. in physics and background of diversified experience. Presently following evening courses in business administration. Desires position with responsibility. File No. 4343-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., 31, married and presently employed by a consulting engineering firm. Experience consist of over 4 years in reinforced concrete design, structural design, and some field work. Desires a position with complete supervision of design and/or field work with a real opportunity for advancement. Locality is no barrier. File No. 4347-W.

CIVIL ENGINEER, P.Eng. (Ontario) D.L.C. Hons. (civil engineering) S.E.I.C. Age 22, single. Seeking a position entailing responsibility with a consulting or contracting firm dealing with hydro-electric power developments, oil fields or construction. Interests:— economic studies design, construction, sales and research. Fully familiar with office procedure. Past experience with highway and general construction in England. Party chief on location surveys with department of highways of Ontario, and at present with consulting engineers on a hydro-electric power project. Prefer position offering advancement to an ambitious engineer. Excellent references. File No. 4348-W.

ELECTRICAL ENGINEER, U. of Alberta 1951. Have 4 years communications and commercial radio experience prior to graduation, 2 years in heavy electrical manufacturing since. Graduate, Westinghouse Graduate Student Course. Have supervised assistants varying in number from one to three. At present manufacturing engineer in an industrial engineering department. Desire work of professional calibre in Edmonton district. Hard work and responsibilities taken for granted. Can speak and write well. Salary desired: $5,000 or equivalent. File No. 4349-W.

ENGINEERING EXECUTIVE, B.Sc. (Zurich, Switzerland) M.E.I.C., 35 years old, presently employed, having 12 years diversified industrial experience in Switzerland, Great Britain, United States and Canada which includes design of machinery, research work, development of domestic appliances, works management and general management including control of sales. Particularly interested in a position of chief engineer or works manager in machine, metal or appliance industry. Hard worker, energetic, accustomed to assuming responsibility. Location preferably Toronto area. File No. 4355-W.

Required

Graduate mechanical engineer preferably with sales experience, to handle complete line of mechanical power transmission and materials handling equipment. Location, Montreal. Age 35-45. Substantial income possible for qualified person. Reply directly to Paul M. Forana, c/o Forano Ltd., Plessisville, Quebec.

QUALIFIED MANAGER, M.E.I.C. A.M.I. Mech.E A.M.I.P.E., 16 years experience in U.K. Full apprenticeship tooling and production Planning and control, plant and design. Sales and service. Bilingual. Managerial appointment sought in Montreal area. Minimum salary required $7000 p.a. File No. 4356-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc. U. of A. 1951, married, age 29, experience in municipal engineering also highway construction and some reinforced concrete. Would like permanent position in municipal engineering anywhere in Western Canada. File No. 4357-W.

CIVIL ENGINEER McGill 1953, S.E.I.C., considerable construction experience seeks position in the construction field. Presently employed in non-construction work. Single, willing to work anywhere. File No. 4358-W.

CHEMICAL ENGINEER, 1945 graduate, M.E.I.C., P.Eng. (Ont.) with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical, beverage, textile industry. Has practical experience in managing, as well as laboratory work in the field of analizing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W.

CIVIL ENGINEER, M.E.I.C., with two years experience in Canadian structural design and detailing for industrial plants. 15 years broad and varied European experience as designer in structural, reinforced concrete and steel. Field and project engineer on foundations, bridges, harbour work, power and industrial plants, residential buildings, also cost estimating. Desire position where any past experience could be best utilized with contracting, consulting or operating company, preferably in Quebec, Ontario or Alberta. File No. 4360-W.

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Transite's* special factory-made Simplex Coupling was designed to minimize underground leakage . . . and to provide maximum protection from failures resulting from trouble at joints. Each joint is capable of a deflection up to five degrees, which helps to compensate for soil movement and effectively absorbs the vibration of heavy traffic when the line has to be laid under or near highways or railroads.

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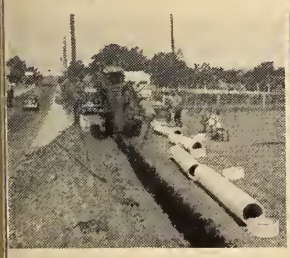

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PRESSURE PIPE

NEWS of the BRANCHES

Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings

Calgary

W. E. HAWKINS, M.E.I.C.,
Secretary-Treasurer

R. F. BAILEY, JR.E.I.C.,
Branch News Editor

September Meeting

The first fall meeting of the Calgary Branch was held on September 24 in the ball room of the Hotel Palliser with 180 members and guests present. Two colour films were shown, the first being *Prelude to Kitimat* and the second *Man With a Thousand Hands*. This was the premiere showing in Western Canada of these two latest films dealing with the Alcan project in British Columbia.

Man With a Thousand Hands was a feature production colour sound film, running for almost one hour. The commentator was the well known Canadian actor, Raymond Massey. The film explained the planning and construction at Kitimat, Kemano and the Kenny dam. It was produced by International Harvester of Canada Limited with the co-operation of Alcan and was a pictorial report of the Aluminum Company of Canada's mammoth British Columbia hydro-electric development program. It was indeed an outstanding film.

Central British Columbia

H. L. TOPHAM, JR.E.I.C.
Secretary-Treasurer

Joint Meeting Aboard S.S. Sicamaus

A joint dinner meeting of the Central B.C. Branch of the Institute and the B.C. Engineering Society was held on the *S.S. Sicamous* at Penticton on September 18, 1953. A total of 33 persons, including guests, were present. The meeting was sponsored by the Engineering Institute of Canada.

Refreshments were made available from 6.30 to 7.00 p.m., at which time dinner was served. Following dinner the regular business meetings of the two branches took place.

B.C. Engineering Society Business

Executive Member Paul Walker of Penticton held the chair in the absence of the regular president.

Mr. Walker announced that the president of the B.C. Engineering Society, J. C. Oliver, and the secretary, J. A. Merchant, would be making their annual Interior visit in early October. The date of October 9 has been set for a meeting in the Okanagan and he asked the meeting for a decision as to the desirability of such a meeting and the location. On a motion of Mr. McCallum, seconded by Mr. Joplin, it was voted to hold the meeting in Vernon, B.C.

Another decision of the meeting was that the Society executive appoint a nominating committee to draw up a slate of officers for the coming year.

E.I.C. Business

The chairman of the Branch, R. L. Bigg, took over the chair for this portion of the meeting.

The minutes of meetings held on July 10 and August 14 were read and adopted.

Mr. McCallum enquired who was responsible for presenting a summary of Mr. Wade's talk to the press throughout the Interior. He was advised that Mrs. Francis, public relations officer of the Society, had done so. It was then moved by Mr. McCallum, seconded by Mr. Smith, that the secretary forward her a letter of commendation for the resulting good publictiy in the Interior papers.

The secretary reviewed the correspondence dealing with a B.C. meeting of Branch councillors. It was suggested that this meeting be held in Vancouver at the time of the annual meeting of the B.C. Professional Engineers. After further discussion this suggestion was put forward as a motion by Mr. Hatfield, seconded by Mr. McCallum.

With reference to the correspondence regarding names to be considered by the nominating committee for the office of president of the Institute in 1954, it was moved by Mr. Smith and seconded by Mr. Joplin that this topic be referred to the executive for their further consideration.

G. L. Mill Guest Speaker

The meeting was addressed by G. L. Mill, mining engineer from Hedley, B.C., who was introduced by Mr. Johnston of Hedley. Mr. Mill gave a most interesting talk, illustrated by slides, of mining operations in Ecuador and Peru The talk was very well received and a vote of thanks was tendered the speaker by E. Smith on behalf of both bodies

Cornwall

L. H. SNELGRAVE, JR.E.I.C.,
Secretary-Treasurer

J. E. PESCOD, JR.E.I.C.,
Branch News Editor

R. Foster-Pegg Guest Speaker

The first general meeting of the autumn season of the Cornwall Branch was held on the evening of September 15 in the assembly room of Howard Smith Paper Mills. Members of the local branch of the Institute of Power Engineers were guests.

The guest speaker was Richard Foster-Pegg of McGill University. Mr. Foster-Pegg started his professional career as an apprentice with the Rolls-Royce Company of England in 1935 In 1951 he qualified as a mechanical engineer by passing the examination set by the Institute of Mechanical Engineers in England.

Since 1951 when he came to Canada, Mr. Foster-Pegg has been engaged in the research and development of the coal burning gas turbine at McGill University. This project which is under the direction of Professor D. L. Mordell, M.E.I.C., is sponsored by the Federal Department of Mines and Technical Surveys.

The speaker illustrated the possibilities of coal used as fuel in gas turbine engines when he pointed out that although it requires twice the weight of coal as oil to generate the same power, the coal cost is but one-quarter the cost of the same weight of oil, or a net gain of one-half. He dealt in some detail with the main problems which have arisen in the tests at McGill. In brief these problems were: (1) The removal of ash before passing gas through the turbine blades, to prevent the rapid erosion that would result. (2) Feeding the pulverized fuel into the combustor at a constant and controlled rate. (3) Failure of combustor lining. In overcoming these problems the aim of the research team is to produce an inexpensive, serviceable, rugged engine adaptable for use either as a stationary or mobile power plant.

A new engine, which is almost completed and scheduled to commence test runs in a few weeks, is constructed on what is called the exhaust heated cycle principle. This engine, when it is operated, will be the fifth of its kind in the world, and the first to use coal as fuel.

At the conclusion of his address Mr. Foster-Pegg led an interesting discussion period.

The speaker was introduced by D. Ross-Ross and thanked by Harold Nickerson. John Hawkes was chairman of the meeting.

Kingston

H. D. FORBES, M.E.I.C.,
Secretary-Treasurer

Heat Barrier Problem

With the sound barrier just about mastered by aircraft designers another barrier — heat — is another major problem which now must be overcome,

M. D. Willer, of Toronto, assistant sales and service manager of A. V. Roe Canada, Ltd., said recently.

Addressing the monthly meeting of the Kingston Branch on October 13, attended by about 200 persons in R.C.E.M.E. officers' mess, the speaker said that at present most of the aircraft industries' efforts are concentrated on trans-sonic and supersonic flight. It can reasonably be expected, he said, that twice the speed of sound will be reached in the not-too-distant future.

However, Mr. Willer said, that is where the next major problem — the heat barrier — comes into prominence. Jet engines are very sensitive to high temperatures and lack of cooling is liable to impose a new speed limitation.

Ultimately, he states, most aircraft companies will probably turn to rocket propulsion for the highest speeds.

The speaker said it is probable that the materials at present used for aircraft construction will be unsuitable since their mechanical properties decrease alarmingly as the temperature rises.

There is no doubt as to the aircraft designers' ability to solve the problems but the speed with which these problems are solved will be directly proportional to the efficiency, brains and energy of our engineers, not just aeronautical engineers, but in every branch of industry, he said. It will also be directly proportional to the amount of money the industry can spend on development.

New metals, new techniques, new power plants and new shapes are all around the corner and the corner is not too far away, the speaker said.

Mr. Willer devoted the major portion of his talk to the design and make-up of Canada's all-weather jet fighter, the CF-100.

An idea of the complexity of the aircraft may be found in the electrical system which is made up of 500 cables totalling about 12 miles of wire, 50 junction boxes and 12,000 electrical connections. All this does not include the plane's radio and radar installations.

Mr. Willer was introduced by F/L. J. Moran and thanked by Prof. J. Campbell. A report on the recent council meeting in Montreal was given by D. L. Rigsby, branch councillor. C. H. R. Campling, vice-chairman of the Kingston Branch, presided.

Kootenay

N. H. Booth, Jr.E.I.C.,
Secretary-Treasurer

Sir Patrick Hamilton Guest Speaker

The Kootenay Branch opened its activities of the fall season on September 30 with a dinner meeting attended by 90 persons. This event marked the first time that wives of members have attended one of the regular meetings. The evening proved so successful that it is hoped "Ladies Night" will become an annual event.

Head table guests included Sir Patrick Hamilton, Lady Hamilton and Major Beamish. Sir Patrick is an eminent British industrialist, being chairman of that well-known group of engineering firms, Henry Simon Holdings Ltd. He is also a director of Lloyds Bank, Renolds-Coventry Ltd. and other leading firms. Major Beamish, who is making a tour of Canada with Sir Patrick and Lady Hamilton, is also a director of Henry Simon Holdings Ltd. and is a member of the British Parliament as well.

In his address to the meeting, Sir Patrick answered three questions that have been asked of him daily since his arrival in Canada. Sir Patrick said that to the first question usually asked of him, "What is the purpose of this visit to Canada?", he answers that he is getting acquainted with the country and its people, for the purpose of being better equipped to watch and possibly take part in the rapid development which is occurring and which is bound to accelerate in the future.

He replied also to a second question which is frequently asked, "Why has England not attempted to compete to a greater extent for North American markets?" Sir Patrick was doubtful that

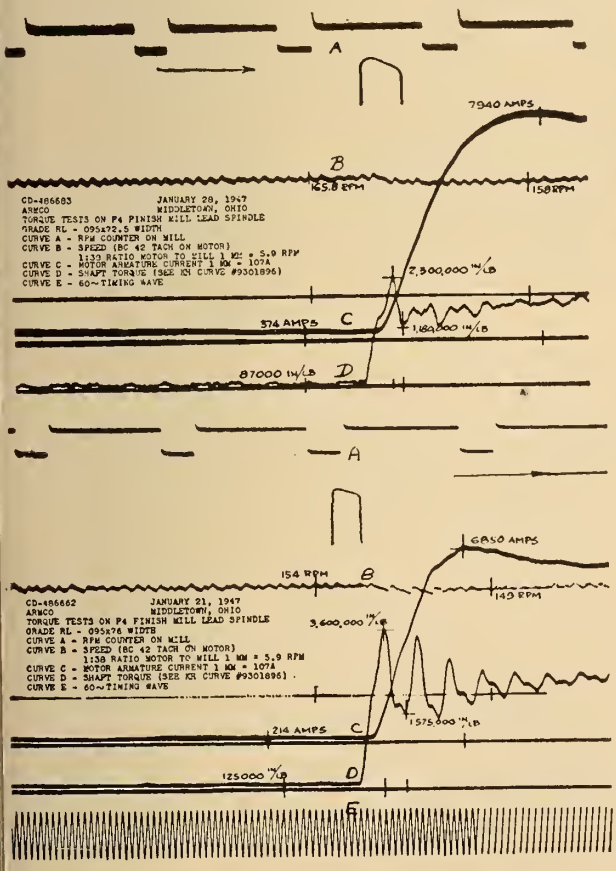

Figure 19 — Upper curve gives field test data for resilient type coupling and lower curve gives similar data for gear type coupling.

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PLACE

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REASON

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they would ever be able to compete with North American industry in the marketing of mass-produced products for domestic use. Instead, he felt that Britain's best chance in foreign markets was in selling engineering services and custom-made products. However, since the war Great Britain has had to neglect these markets because until recently it has been fully occupied with the rebuilding of England and Europe. Also, the Korean War created material and manpower shortages which cut into the amount of trade being carried on. Sir Patrick felt that this backlog of work had been caught up and the time has now come for a great resurgence of trade abroad.

Sir Patrick stated that he is frequently asked a third question, "How is Britain's economic recovery program progressing?" He replies that Britain is now doing very well. She is still troubled by a dollar shortage and without dollars cannot import such badly needly things as Canadian agricultural products. Sir Patrick felt that a general reduction of trade barriers throughout the world was the solution to this problem. Thanks to Marshall Aid and Canadian help, Britain is now in a position where she can progress.

E. Mason, Branch councillor, introduced Sir Patrick and W. K. Gwyer, Branch vice-chairman, expressed the thanks of the meeting.

The meeting was then turned over to A. H. W. Busby for the first public showing of the new Cominco film "Spanning Kootenay Lakes with a Transmission Line". This 40-minute film in sound and colour described the erection of this famous two-mile span across Kootenay Lake.

The Branch chairman, E. B. Broadhurst, congratulated Mr. Busby for his part in producing this remarkably fine film.

The meeting then adjourned.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.,
Branch News Editor

Annual Ball

Reported a most successful occasion by 350 engineers and their ladies, the Hamilton Branch's fourth annual engineers' ball took place on October 9 at the Bergundy Room of Fischer's Hotel, Hamilton.

N. A. Parry, heading a competent committee, had provided for a pleasant evening of dancing to the music of Ted Hader and his orchestra, and a buffet dinner.

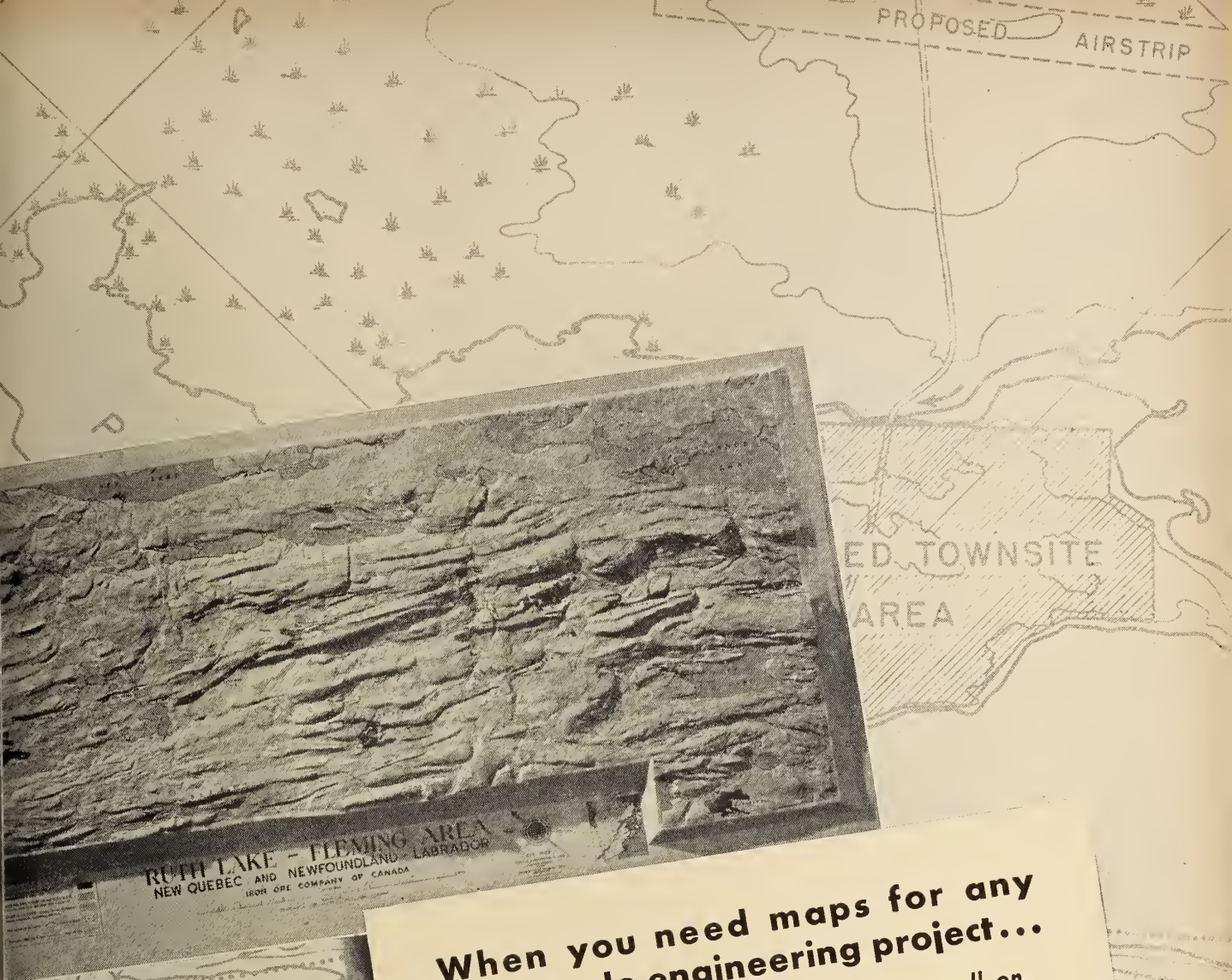
Patrons on this occasion were Mr. and Mrs. F. J. Veale and Mr. and Mrs. W. A. T. Gilmour, and attending as honoured guests were Mr. and Mrs. W. A. Dawson, Mr. and Mrs. J. A. Reid, Mr. and Mrs. J. A. Vance, Mr. and Mrs. J. A. Ogilvy, and Prof. and Mrs. W. L. Sagar.

Hamilton Ball Photographs

Left to right: Mrs. J. A. Vance, Mr. and Mrs. Fred Veale, and J. A. Vance.

Mr. and Mrs. J. A. Ogilvy (left) chat with Mr. and Mrs. N. Metcalf. Mr. Ogilvy is assistant to the field secretary of the Institute. Mr. Metcalf is the Hamilton Branch councillor.

The dance committee. Front row, left to right: W. A. Wheten, N. A. Parry, C. A. Kain, and R. G. Northrup. Back row, J. A. Reid, S. P. Lockhart, I. M. MacDonald. F. S. Gue, and ex-officio member of the committee is not in the photograph.



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Lakehead

G. E. Cook, Jr.E.I.C.,
Secretary-Treasurer

H. Penner, Jr.E.I.C.,
Branch News Editor

Riverlake Oils Refinery Tour

On September 26, members and guests of the Lakehead Branch of the Institute visited the Lakehead's newest industry, the independently-owned Riverlake Oils Refinery. Construction of the plant was started approximately a year ago, and it has only been in operation for several months. Equipment includes a crude unit and a catalytic unit and storage facilities for approximately one million gallons at present. Installed capacity is 4,000 barrels per day with the plant operating at present at well over half its capacity. Products include two grades of gasoline, two grades of diesel fuel and furnace fuel.

An interesting phase of the work was the fact that the equipment for the plant was purchased at Bay City, Texas, and travelled the 2,000 odd miles to the Lakehead, via the inland water route. The trip was made by barge up the Mississippi River system to Chicago, and from there by lake freighter up the Great Lakes to Fort William.

Approximately 50 attended the meeting, and despite the cold and wet weather it proved a very interesting afternoon to those who ventured forth.

Montreal

R. J. Harvey, M.E.I.C.,
Secretary-Treasurer

S. T. Rudkin, M.E.I.C.,
Publicity Vice-Chairman

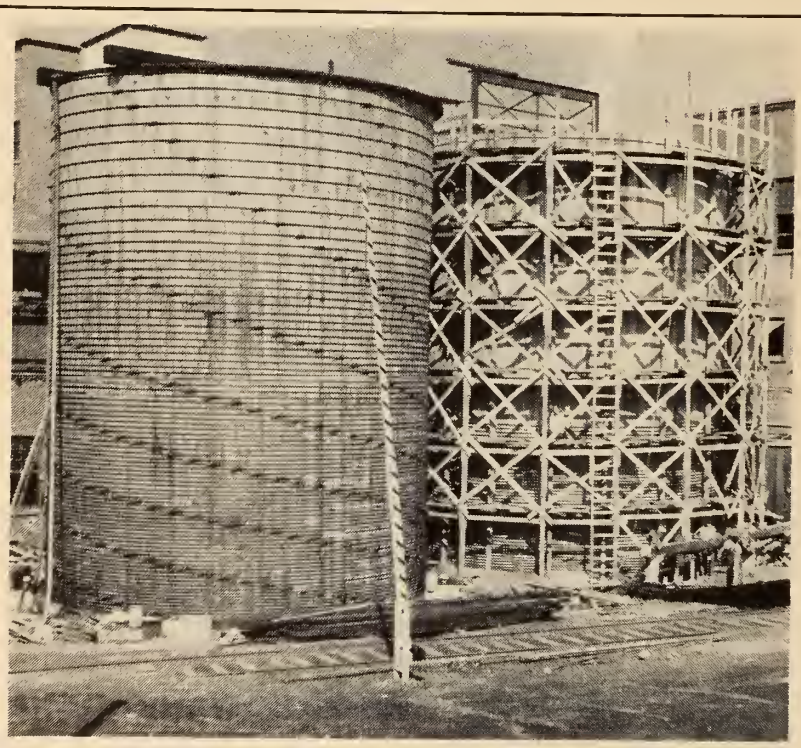
C. Jodoin Speaks on Lobour Movement

The 1953-54 season of the Montreal Branch got under way on October 1 with a general meeting, called for the election of one member of the Branch Nominating Committee, followed by a regular meeting sponsored by the Management Section. Approximately 65 members were present. Jack Hahn was proposed, seconded and elected unanimously to the Nominating Committee vacancy.

R. L. Dunsmore chaired the regular meeting, and introduced Claude Jodoin, who spoke on "The Labour Movement in our Society". With a background of five years as vice-president of the Trades and Labour Council of Canada, 17 years as an officer of the International Ladies Garment Workers Union, manager of the Montreal Joint Board of Dressmakers Unions, and Deputy Member of the Governing Body of the I.L.C., the speaker was well qualified to discuss various phases of the labour movement. Generally speaking his main theme was the increasing acceptance of the labour movement as a fundamental part of our society as a whole. The lively question and answer period following the talk pointed up the interest taken by the audience, with such controversial points as check-off, the desirability of making unions legal entities, and the effect of American headquarters on Canadian branches with respect to policy making, being discussed. Meeting arrangements were by R. K. Robertson.

C.G.E. Plant Tour

On October 5, the first industrial plant visit of the season, sponsored by the Electrical Section, saw some 125 to 130 members go through the C.G.E. Major Appliance Plant on Notre Dame East, where those labour-saving boons to the harried housewife, refrigerators, washing machines and electric ranges are mass produced. The most modern equipment and machinery for press forming parts, bending sheets into the top and sides of refrigerator cabinets, cleaning and plating metal parts, continuous porcelain enamelling and spray painting, and many other features too numerous to mention, display the ingenuity of the design engineer in such a highly competitive field. Following the tour, refreshments were served in the plant cafeteria, and W. J. Riley of the C.G.E.



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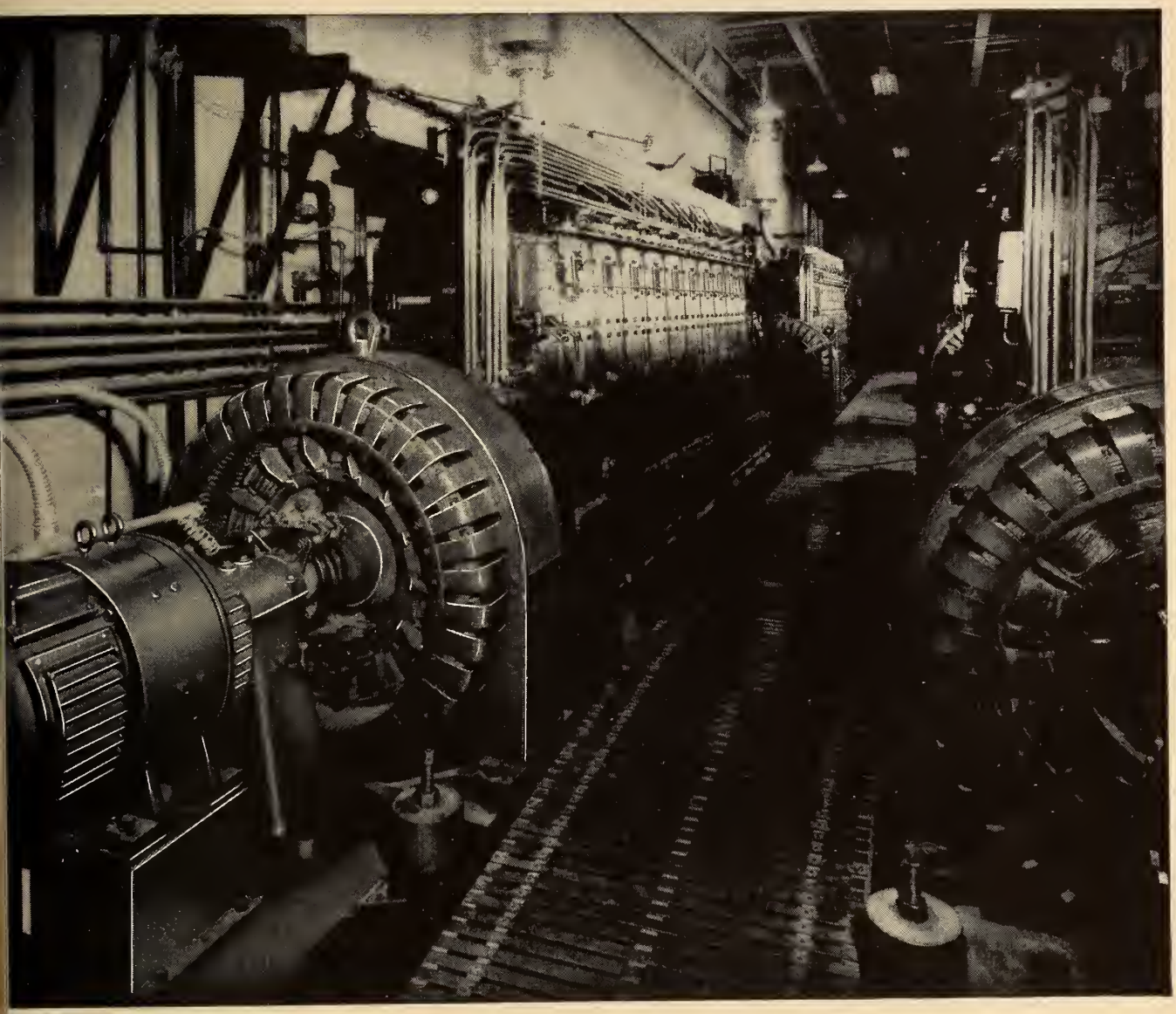

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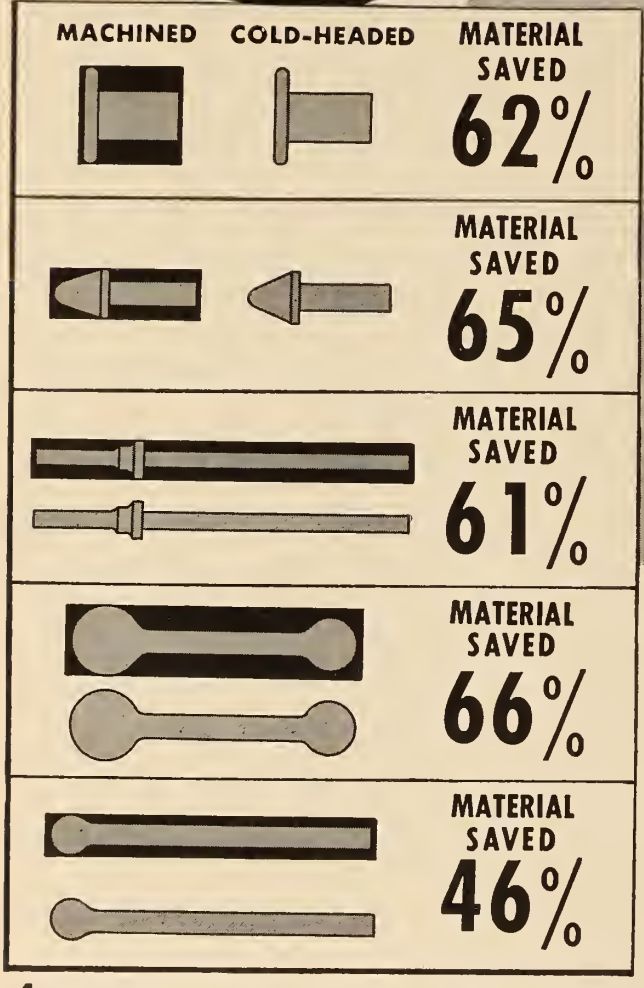

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gave a short talk on the plant, in the course of which he stated that peak production was 1,500 refrigerators, 1,000 washing machines, and 700 electric ranges per week! Meeting arrangements were by R. D. Merritt, and Leo Roy thanked Mr. Riley and the C.G.E. for a most instructive and entertaining evening.

Canadian Vickers Ltd. Tour

Some 125 Montreal Branch members took advantage of the meeting sponsored by the Mechanical Section on October 6 to spend a very interesting evening at the plant of Canadian Vickers Ltd. In addition to several cargo boats, a fairly extensive list of highly specialized naval vessels including frigates and minesweepers, and a car ferry for the Newfoundland service, were under construction. These provided ample scope for demonstrating the problems encountered, and techniques developed for surmounting them, in a major ship building yard. After a carefully conducted tour, the groups assembled for refreshments, short talks by Messrs. Sankoff and Fox of Canadian Vickers, and a question and answer period. P. J. Kunstler arranged the meeting.

D. J. Belcher Guest Speaker

Donald J. Belcher, of Ithica, N.Y., spoke on the subject of "Determination of Engineering Properties of Soil through Aerial Photography" at a meeting on Thursday, October 8. The Civil Section sponsored the meeting jointly with the Institute of Photogrammetry.

As stated by meeting chairman, R. F. Ogilvy, in his introduction, Mr. Belcher is a world-renowned authority in the field of aerial photography, and has carried out extensive projects where he has had to determine formation, distribution and engineering properties of the soil from air photos, especially in connection with islands in the hands of Japanese troops, prior to allied invasions.

According to the speaker, his initial interest in the subject originated from a comparison of aerial photographs and agricultural soil maps used to determine highway soil conditions. The aerial photographs showed that similar types of soil conditions were characterized by similar shadings in the pictures. A change in moisture content induces a change in colour, with well drained soils indicated by a light shade, poorly drained by dark. After years of careful study and analysis of thousands of aerial photographs, the expert is even able to differentiate between different types of rock. Many interesting slides were used to illustrate the talk. Mr. Belcher did not pretend that this type of work could do away with ground investigations, but stated that it could indicate potential trouble spots accurately, and simplify ground work, especially in perma-frost regions.

Sixty or more members were present, and their many interesting questions were ably answered by the speaker. D. F. Osler of the Institute of Photogrammetry and Surveying thanked Mr. Belcher. Meeting arrangements were by R. H. Quintal.

Niagara Peninsula

H. C. L. Joe, Jr.E.I.C.,
Secretary-Treasurer
J. H. Saldat, Jr.E.I.C.,
Branch News Editor

Power Development Tour

The Niagara Branch of the Institute held its first fall meeting on September 24. The highlight of the meeting consisted of a bus tour of the Sir Adam Beck Power Development, by some 330 engineers.

The first stop was at the surface canal. This canal is 2¼ miles in length, with an average width of 200 feet and an average depth through rock and earth of 70 feet. Approximately 15 million tons of earth will be excavated. The canal will be capable of handling 40,000 cubic feet per second of water.

The tour then proceeded to the generating station. In order to build the powerhouse on the side of the steep cliff, it had been necessary to blast and remove more than 1½ million tons of earth and rock. With the installation of 12 units the powerhouse will be 931 feet long, 63 feet wide and 50 feet high.

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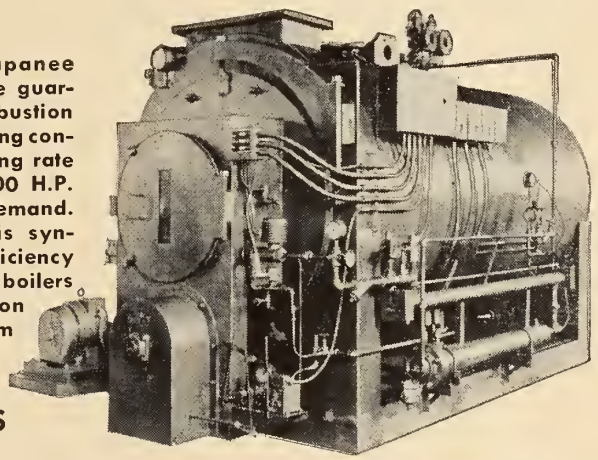

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ture at the village of Chippawa. Situated two miles above the falls the two intakes will each divert 20,000 cubic feet of water a second from the Niagara River. The intake for each tunnel will consist of a 500-foot long gathering tube, located along the present shoreline to take advantage of the main current in the river.

The touring group ended the trip with a hearty meal at the Hydro's upper camp. G. Mitchell welcomed the group.

The chairman, A. J. Bennett, called on Mr. Moody to introduce the speaker of the evening, W. Hogg of the Hydro. With the aid of coloured slides, Mr. Hogg reviewed the progress of the construction and gave a most enjoyable narration.

P. Pasquet expressed the thanks of the branch to W. Hogg for his excellent address.

Saguenay

C. C. Louttit, Jr.E.I.C.,
Secretary-Treasurer

H. T. O'Neill Addresses Mixed Dinner

The Saguenay Branch of the Engineering Institute held a very successful dinner meeting for members and their ladies on Tuesday, October 6, 1953, at the Saguenay Inn in Arvida, under the chairmanship of G. E. Clement. One hundred and one persons were in attendance.

Mr. Clement introduced the guest speaker, H. T. O'Neill, vice-president and treasurer of the British American Oil Company, whose topic was "The Development of the Oil Industry in Western Canada". Mr. O'Neill showed how man's progress can be measured by his utilization of the energy available to him, then discussed the known supplies of the common sources of energy, pointing out that Canada stood on the threshold of great development with large untouched reserves of energy. Progressing to the oil and gas industry, in particular, the speaker outlined the vast exploratory programs engaged in by all companies, and compared their cost to some of the large developments being undertaken in Canada. In closing, Mr. O'Neill discussed the economics of exploiting oil and gas fields and the construction of pipe lines to bring their products to the refinery and to the customer. There followed an informal period where the speaker answered questions from the floor.

D. F. Nasmith expressed thanks to the speaker on behalf of the Institute for a very interesting and informative talk, with all members joining in a hearty round of applause.

Saint John

J. A. B. Brenan, Jr.E.I.C.,
Secretary-Treasurer

H. McCleave,
Branch News Editor

Winter Season Starts

At the first meeting of the season held September 28 at the Admiral Beatty Hotel, R. L. Dobbin, the president of the Institute was the honoured guest.

A. G. Watt, chairman of the Branch, presided at the dinner meeting and introduced the head table guests.

First speaker of the evening was L. Austin Wright who, besides giving a report on the Institute's activities, amusingly described his trip across Canada with Mr. Dobbin.

Mr. Watt then introduced Mr. Dobbin who spoke of his recent trip to England where he represented the Institute at the Coronation.

His account of the trip, his various activities, and the impressions he had obtained of British industry proved highly interesting to all who attended.

D. O. Turnbull thanked Mr. Dobbin on behalf of the members.

Mr. A. Lee-White presented to the meeting a film produced by the firm of Ransomes and Rapier Ltd. of England. This film featured the design and construction of a 1670-ton walking dragline which has recently been produced by this company.

Head table guests included John A. B. Brenan, secretary-treasurer of the Branch, Murray Lamb, president of the Association of Professional Engineers of the Province of N.B., John Stirling, past president of the E.I.C., Mrs. A. G. Watt, Dr. L. Austin Wright, Mr. Dobbin, A. G. Watt, Mrs. R. M. Richardson, A. R. Bonnell, vice-chairman, R. D. C. Clarke, secretary registrar of the Association of Professional Engi-

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Sudbury

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Secretary-Treasurer

T. C. ROBERTSON, M.E.I.C.,
Branch News Editor

Norman D. Lee Speaks on Soil Engineering

The Sudbury Branch of the Institute resumed its meetings after a summer recess on October 8, 1953. This first meeting took the form of a dinner at the Sudbury Granite Club with Norman D. Lea, of the Foundation Company of Canada, as guest speaker.

The speaker was introduced by Grant Benjafield as a graduate of Toronto University in civil engineering who had furthered his studies by taking a master's degree in soil engineering at Harvard. His informative and unusually interesting address was on a comparatively new subject, "Soil Engineering".

Dirt had been studied for productivity, minerals, ceramics, etc. but it remained for Dr. Carl Terzaghi in 1928 to begin the study of soil relating to the magnitude and distribution of pressures, with the result that earth has been recognized as an engineering material, and during the past fifteen years soil engineering has been added to the curricula of universities.

All structures, be it factory, aeroplane runway, or transmission tower, must transmit their loads to the ground. Soil having such a huge variation in physical properties, there is need of trained men to determine site selection, foundation requirements or necessary underpinning. As an actual construction material, Mr. Lea pointed out, concrete had increased in price several times while the cost of earth moving, due to modern machinery had decreased in cost. This fact, coupled with the new knowledge, made the construction of dams and fills from earth not only satisfactory but economical and under certain circumstances, such as bombings and earthquakes, more permanent due to the amazing displacement that can occur without materially affecting the function of the structure. The determination of slope stability is also a function of the soil engineer and Mr. Lea cited an example where a sewer discharging into a small river had caused two and one-half million yards of material to float down the river in one week with great property damage and loss of life.

The soil engineer has first to obtain a soil sample by one or more methods, the most recent development being a steel-foil sampler which will give a continuous core of soil in excellent condition up to 130 feet in length. This eliminates the possibility of missing thin, but none the less important, layers in the analysis. In situ tests are also required in many cases. Various methods are in use, but one modern and informative test is the vane test in which a four bladed vane is inserted through the bore hole and into the earth. The torque required to turn the vane gives an accurate determination of the shear strength of the soil and also the nature of the failure, brittle or plastic.

Having completed the analysis, the information is compiled and proper constants obtained for application in formulae. This determination is, however, no simple matter as the constants may vary with such variables as time and loading. In closing, Mr. Lea stated that the work of the soil engineer does not end with the completion of construction but is valuable in determining soil changes which may allow additional use of existing structure. An example was cited in which the cost of a new wharf was saved by using the improved physical properties that had developed in the ground as a result of the additional soil loading caused by the structure itself.

A lively question period followed, after which Allistaire Finlayson thanked the speaker.

Jim Smith announced that the next meeting early in November would be addressed by Fred McQueen of the Algoma Steel Company.

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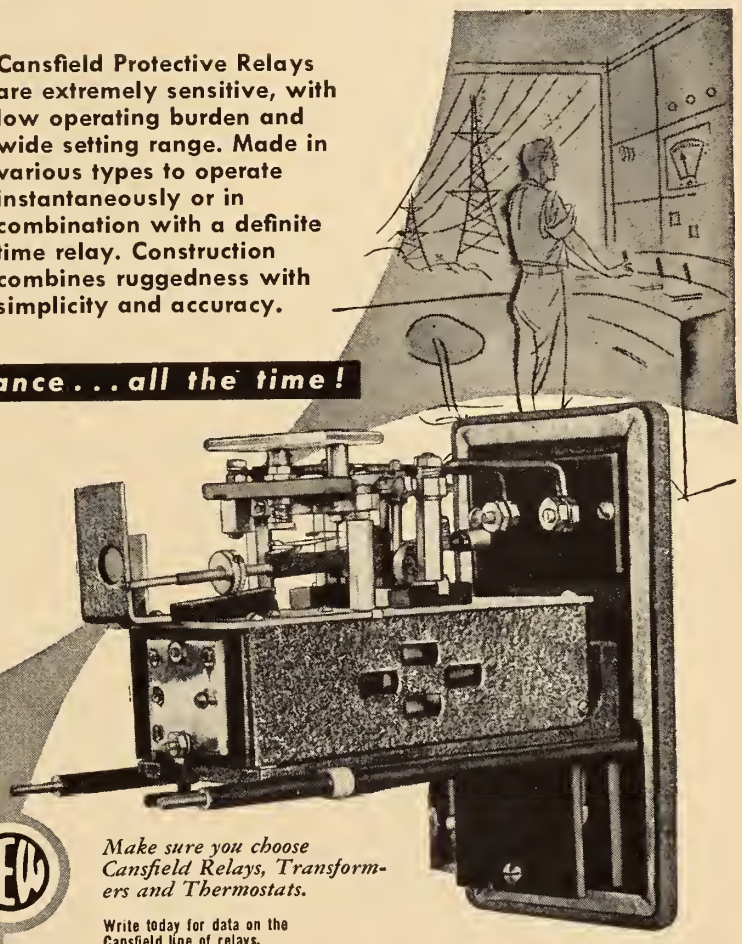

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Engineers as writers; growth of a literature, W. J. Miller and L. E. A. Saidla. Toronto, Van Nostrand Co., 1953. 340 pp.

In the forty-odd years during which the writer of this review has, among other things, tried to persuade engineering students that the ability to write literate English is not only a prime necessity for them but also something of a pleasure, he has seen student attitude change from "us engineers don't need no English" to something approaching general interest.

Forty years ago the literature of English for engineers was fairly limited; it may be argued that there is really no need for any, for good writing is good writing whether produced by engineer or by milkman. But the writing of reports, contracts, technical papers and the like is a somewhat specialized business, and thus a considerable number of books on the subject have appeared, most of them of the "how to" variety.

The authors of this book, both of them teachers of English at the Polytechnic Institute of Brooklyn, adopt a different approach, believing that the student will benefit at least as much from the study of examples of good engineering English as he will from rules laid down for his guidance. Really, the two are complementary; one cannot write without a sound knowledge of the basic rules; and the study of good examples will help.

The fifteen extracts chosen range from translation of Vitruvius' "De Architectura" and of Frontinus' "Aqueducts of Rome", through Smeaton, Rankine, Parsons, Taylor and others to A. E. Raymond's "The Well-tempered Aircraft", the nineteen hundred fifty-one Wright Memorial Lecture before the Royal Aeronautical Society. Most of them are easy reading for anybody; a few are too technical for anyone but the specialist, but all are excellent examples of the best engineering writing.

Each selection is followed by a page or so of comment by the authors, to point out to the student the notable features of that selection and with suggestions for future study; seldom is there much criticism. There are also some suggestions for the review of the book as a whole and a table to enable one to find handily various literary forms exemplified in the selections. There is an adequate index.

Probably the authors themselves would be the last to recommend that the engineering student should confine his reading to their book. He should, of course, read as widely as taste and opportunity permit. Here he has served up to him material of a kind he might never see elsewhere, or would have difficulty in finding were he to search for it.

Quite aside from their text-book value, this reviewer found Messrs. Miller and Saidla's extracts absorbing enough to keep him reading continuously until he had finished them all and so, he thinks, will most engineers, particularly those who have an interest in the history of their profession.

R.de L.F.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

CABMA Register of British products and Canadian distributors, 1953. London, Iliffe, 1953. 820 pp., $7.50.

Established two years ago with the object of stimulating trade between Britain and Canada, the Canadian Association of British Manufacturers and Agencies has now published the first edition of its Register, which it intends to make an annual publication.

The volume provides a comprehensive listing of British manufacturers interested in exporting to Canada, their products, and Canadian distributors or representatives. All types of manufacturers are included—the list of their products covering literally everything from soup to nuts, both of which headings can be found in the Buyers' Guide.

There are 6 sections in the book. The first lists alphabetically over 3,750 British products, and under each the names of British firms engaged in their manufacture. Section 2 is devoted to advertisements, whilst the fourth and fifth list respectively proprietary names and trade marks. The third section is an alphabetical directory of British manufacturers, and their Canadian agents. Under each firm is listed the products it manufactures, its address in the United Kingdom, and, where known, its Canadian agents or distributors.

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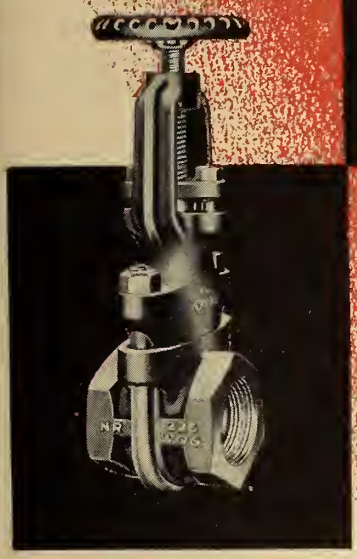

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It is, of course, impossible to tell how complete the listings in the Register are, but they seem to be quite comprehensive, giving as they do over 4,500 British manufacturers, together with over 2,750 Canadian agents. The register should prove a valuable guide to all those engaged in trade between the two countries.

Color in business science and industry. D. B. Judd. N.Y., Wiley, 1952. 401 pp., $7.15.

"Colour perception is what we see apart from variations in time and space. It does not refer to size, shape, texture, gloss, transparency, or flicker . . . it is the one aspect of the light entering our eyes."

The pre-requisite for a proper understanding of colour is a knowledge of the physiology and working aspects of the human eye, about varying kinds of eyes, and the reliability of their recordings or perceptions. But the confusing element about colour is that it is neither purely physical, nor purely psychological, as the chemistry of pigment and dye must be taken into account.

Basic facts dealing with the above mentioned statements constitute the first quarter of the book.

Tools and technics is the title of the next section of the volume, which deals with the photoelectric spectrophotometers, fundamental standards in colorimetry, sampling of colour solids, one dimensional colour, and uniform chromaticness, scales, and chemical terms relating to absorption of radiant energy.

Physics and psychophysics of colorant layers concludes the text of the book, which is followed by an appendix of fifteen pages of tables, and fifteen pages of valuable bibliographic references.

The book is adequately indexed, and should be of incalculable use to the thousands of our members concerned in one way or another with the use of colour during office and plant hours.

Diesel vehicles operation, maintenance and repair. F. J. Camm, ed. London, Newnes. Toronto, British book service, 1953. 107 pp., illus., $1.50.

We have a feeling these handy practical little inexpensive Newnes books are going to be very popular. Watch for them in your own field.

In one hundred and seven pages, this one presents concisely and factually, the practical information you want on the operation, maintenance and repair of diesel vehicles.

Engineering drawing. J. V. Lombardo, L. O. Johnson, and W. I. Short. New York, Barnes & Noble, c1953. 432 pp., illus., (pa.) $2.00 (U.S.) (College outline series).

Another in the College Outline Series, the aim of this particular volume is to provide a comprehensive practical guide for the student taking a course in engineering drawing. The outline is linked to the standard books on the subject by a table giving the chapters in this book with the corresponding pages in 8 text books.

The text covers all phases of a course in engineering drawing, from the first chapter which deals with linework, the instruments used, and the correct way to use them, through sections on lettering, orthographic projection, pictorial views, dimensioning, etc. There is a large number of problems based on the text, and also a section giving the American Standards Association drawing and drafting room practice.

There are many diagrams and illustrations, and the outline should prove useful not only to the student, but also to the engineer wishing to refresh his memory on a particular point.

La machine-outil. A. R. Métral. Paris, Dunod, 1953. Tome I, 4,400 fr. Tome IV, 4,600 fr.

In 1947 the Conservatoire National des Arts et Métiers founded the centre d'études de l'usinage des métaux, to promote better methods of production in the arts and crafts.

The result of this was organized gatherings of industrial leaders having to do with filing, chipping and milling machines, and machine production of articles in the fields of metal, wood and plastic.

Volume one deals with machine tools and uses in general, their history in various countries, design, casting, cutting fluids, and the maintenance of machine tools.

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Volume four treats machines in the

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2-3

field of planning, shaping and slotting.

This also is composed of five separate papers, each one done by a specialist in the field.

The illustrations throughout both volumes are excellent. Only one paper includes a bibliography, but this could be because all the information is from practical experience. There are no indexes.

The measurement of particle size in very fine powders. H. E. Rose. Toronto, Longmans, Green, 1953. 127 pp., illus., $2.00.

The four lectures of which this book is composed were delivered with the objects of analysing the current trends of thought on the subject of the measurement of particle size; of reporting recent developments, and of discussing the research in progress. The author points out that there is a widespread use in industry of powdered materials of all types, ranging from rare drugs to Portland cement. Many techniques have been developed for the measurement of size characteristics, and this book attempts to systematize these methods, analyse the factors on which the choice of technique depends, and describe the principles on which the design of some of the apparatus is based. The author has kept the practical aspects of the subject in mind, and so does not devote too much attention to elaborate techniques and apparatus. The book should be useful in industries where the size characteristics of fine powders are important.

Pratique du percement des tunnels. H. W. Richardson and R. S. Mayo; C. Magne tr. Paris, Dunod, 1953. 494 pp., illus., $18.00.

Originally published by McGraw-Hill in 1941, under the title PRACTICAL TUNNEL DRIVING, this volume is now available in French.

Opening with a history of tunnels and the technique of siting and planning them, the authors then proceed to a detailed analysis of their construction and use, including soil analysis and treatment.

The very practical presentation of tunneling which this book provides will be its essential value to engineers.

As far as possible, American terms have been translated into technical French equivalents. Also, official regulations and standards referred to are not necessarily those in use in France or other European countries, and this fact should be born in mind.

As well as the detailed French Table des Matières, the book has an alphabetical index.

Presswork and presses: a treatise on the problems of light presswork, press-tool design, and press operation (with over 300 illustrations). J. A. Grainger. London, Machinery publishing company, 1952. 259 pp., illus., $15.00.

Light and medium presswork and sheet metal working, including tools and equipment, machines and materials, are treated in this volume.

A new method of deep drawing circular shells is explained; a discussion on standardization and its obvious advantages is presented; and the all too often ignored subject of metal spinning, curling, trimming and beading is also considered.

Altogether, many of our readers will find this book both informative and of immense practical value.

Prestressed concrete. Y. Guyon. W. M. Johns, ed. London, Contractors record and municipal engineering, 1953. 543 pp. $14.00.

In 1951 we published a note on the French edition of Mr. Guyon's book, put out by Editions Eyrolles, in Paris.

The English edition of this has now been produced by Contractors Record and Municipal Engineering, in a translation by Messrs. A. J. Harris, J. D. Harris and T. O. Lazarides.

The translation is a free one which includes minor revisions and additions to the original. Worked examples have been recast using British dimensions, and test results have been similarly treated except where actual quantities are not a vital part of the procedure.

However, comparison of the two volumes shows that where additions may have been added, deletions have also obviously taken place.

The text itself occupies one hundred and fifty pages, carries no index whatever, and only the briefest of table of contents. In contrast to this, the French edition has the typical French detailed table des matières at the end of the volume, which easily and quickly directs the reader to the appropriate section. Also, running chapter headings, which could well have been incorporated into the English edition, are not used.

We much regret that this British publication proves a poor second to its French counterpart. However, if you do not read French, or for purposes of conversion,

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Saudi Arabia: with an account of the development of its natural resources: 2nd ed. K. S. Twitchell. Princeton, University press, Toronto, Saunders, 1953. 231 pp., illus., $6.75.

Now in the third printing of its second edition, the content of this volume has proved its worth and interest many times over. The revisions have been occasioned by the momentous changes in East/West relations from 1946 to mid 1952.

It seems a trite statement to exclaim that this book "contains so much information", but that is exactly the idea we wish to infer. It simply tells the reader, in most readable language, all he wants to know about Saudi Arabia, and also a great deal he did not know enough about to want to know.

Natural and developed features and resources are first dealt with, followed by social and political development, and the position of Saudi Arabia in world economy.

Would you be interested in knowing that the main dish of a typical meal is a platter of sheep, cooked whole? That after coffee, a delectable beverage is sometimes introduced, consisting of heavily sweetened green or black tea, with mint added? Or that Saudi Arabia has long been closed from travel to westerners because it is the heart of Islam, and not because of inhospitality? Or that newly irrigated districts are now suitable for raising either wheat or rice? And to come to the currently obvious subject of oil, the author states that Saudi Arabia is "presumably the only country in the world whose development of oil and mining resulted from purely philanthropic sentiment." And he proceeds to tell the story.

Saudi Arabia well merits the attention and interest of a large number of our readers.

The Scandinavian year book for 1953. London, Dawson, 1953. 696 pp., illus., fold. map, $5.00.

In this Year-book the three Scandinavian countries have been treated together as there is a similarity of language, culture, economic structure, and general outlook. The editors have not, however, resorted to sweeping generalities, and numerous statistics and special information are given for each country. Some of the topics covered are: history, public finance, social welfare, the arts, commerce and banking, agriculture, and industry. There is a large section of information for the tourist, and this includes: distances from points in Europe and America to Scandinavia; hotel accommodation; etiquette and manners; distances; and travel conditions. It is interesting to read in connection with the latter that Scandinavian trains travel on schedule.

The last section of the Year-book contains an alphabetical list of Scandinavian towns selected on the following bases: commercial and industrial importance; size; tourist interest. For each town is given information as to location, size, distances from other towns, and means of transportation, hotels, restaurants, industry, history, and points of interest.

Altogether this revised edition of the Scandinavian year book should interest all those engaged in trade with Norway, Sweden and Denmark, those who are considering visiting there, or those who merely like gathering miscellaneous information.

Surveying and field work, 3rd rev. and enl. ed. James Williamson. London, Constable, Toronto, Longmans, 1952. 551 pp., figs., $8.00.

Originally published in 1915, and revised in 1938, only to have its plates bombed to bits a few years later, this third edition is a photographic reprint of basic material from the 1938 edition with a new chapter on Hydrographic and Hydroelectric surveying. This describes methods of sounding of underwater ground surfaces, measuring and recording of water flow and spillway capacities, and guidance in the preparation of curves for the analysis of stream flow problems.

The rest of the volume covers the basic surveying and field work principles and practices, and is a valuable text both in the study and on the job.

Techniques of plant maintenance and engineering, 1953. New York, Clapp and Poliak, 1953. 288 pp., $6.00.

The papers reprinted in this volume are those which constituted the proceedings of technical sessions (sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management) held concurrently with the Fourth Plant Maintenance Show, Cleveland, 1953.

The conference opened with a general session taking the form of a panel discussion on maintenance essentials.

The papers from the sixteen sectional conferences are then presented with the accompanying discussions.

The second general session was also a panel discussion, treating "the growing pains of an engineering maintenance organization". Twenty-one round table discussions on all types of plants conclude this invaluable volume, for which we already have reserves in the library.

Theory of functions of real variables. H. P. Thielman, N.Y., Prentice, 1953. 209 pp., $6.65 (U.S.).

In presenting this book to the public, the author pre-supposes a course in advance calculus, and the topics considered are those generally included in standard mathematics courses for first year graduate students and advanced undergraduates.

Problems included in the text are based on preceding information and theory. The book is well indexed.

Waves and tides. R. C. H. Russell and D. H. Macmillan. New York, Philosophical Library, 1953. 348 pp., illus., $6.25.

Although a vital concern to mariners, harbour authorities, fishermen, and holiday makers, the subjects of both waves and tides, have never before both been considered in one volume.

These two factors are related to the design of ships, the siting of docks, harbours, and tactics, and strategy in war, in addition to the fascinating subject of the connection between weather forecasting and ocean phenomena.

The problem of necessary technical terms is solved with an index glossary, which becomes both an index and a key to terminology.

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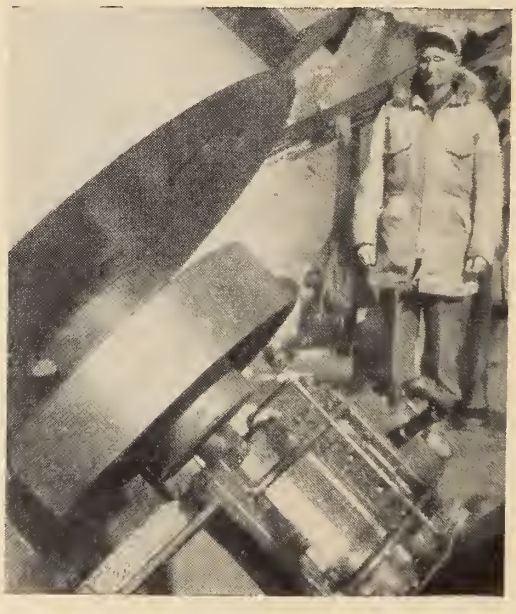

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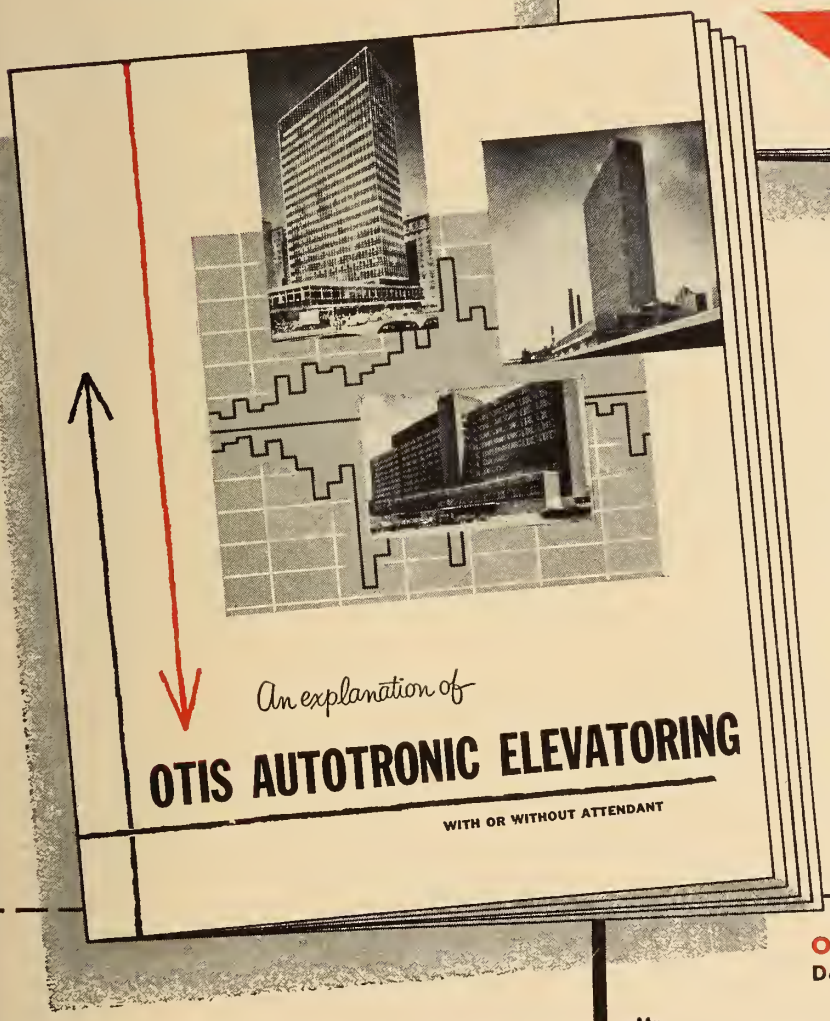

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The book is well illustrated, both with figures, and plates, carries bibliographies with each chapter, and is well indexed.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Aircraft propulsion—theory and performance. A. W. Morley, Toronto, Longmans Green, 1953. 221 pp., $5.00.

All the important systems of aircraft propulsion are surveyed in this introductory textbook for engineering and science students. The outlook is specifically theory and performance rather than design. It presents the basic principles governing the output and efficiency of the turbo jet, propeller turbine, piston engine, ram jet, and rocket motor as applied to modern aircraft. Such subjects as the thrust required for flight, compressor and turbine characteristics, axial flow theory, supercharger matching, and ram jet intake performance are considered.

Circuit theory of electron devices. E. M. Boone. New York, Wiley, 1953. 483 pp., illus., $9.35.

This text covers linear circuit theory of tubes and transistors with emphasis on the analysis of the circuit properties of the devices, properties that can be determined by measurements at available terminals. A feature of the book is the utilization of the concepts of four-terminal networks in sufficiently general form to apply to any electron device over any frequency range in which the device operates within the linear region of its characteristic.

Concrete mix design, L. B. Mercer. Melbourne, Melbourne technical college press, 1953. 59 pp., 5/-.

Emphasis in this publication is on the production of quality concrete from readily available materials and with modifications of mix design methods. The aim is to demonstrate the best use of "badly graded" materials. Quality of cement, type and grading of aggregates, influence of water-cement ratio, and a number of other variable factors such as quality of water, temperature, and mixing are treated from the standpoint of practical application.

Introduction to engineering economy, 2nd ed. B. M. Woods. Toronto, Macmillan, 1953. 519 pp., illus., $6.00.

A textbook for engineering students, in which the relation of such subjects as accounting, valuation, investment theory, statistical methods, and general economics to the management of engineering enterprises is explained. The subject matter remains substantially the same as in the previous edition but the material has been revised to conform with recent developments.

Measurement techniques in mechanical engineering, R. J. Sweeney New York, Wiley, 1953. 309 pp., diagrs., $6.05.

A practical, compact treatment of the principles and techniques of measurement for the performance testing of power equipment—enginers, pumps, compressors, and combustion and heat transfer apparatus. In addition to the descriptions of instrument types and their uses, the book discusses such topics as the factors underlying selection and function of instruments as signalling devices to automatic controllers.

Properties of metallic surfaces: a symposium, London, Institute of metals, 368 pp., illus., $5.50. (Institute of Metals monograph and report series No. 13).

This monograph contains thirteen papers by outstanding authorities presented at a symposium of the Institute of Metals, and covers a wide range: microscopical techniques in metallurgy; influence of machining on surface condition; effect of surface condition on strength and mechanical properties of metals; diffusion coatings; surface film properties and effects; character of abraded surfaces; etc. Both the papers and the extensive technical discussion are effectively illustrated.

Public Health Engineering, C. G. Isaac. London, Spon, Toronto, British book service, 1953. 277 pp., figs., $7.25.

The aspects of public health engineering discussed in this book are the provision of an adequate water supply, the treatment and disposal of solid and liquid wastes, and the causes and prevention of the harmful effects of air pollution. A chapter on district heating is also included because of its bearing on air pollution and problems of the water engineer. The emphasis is on general principles and their applications.

Radio engineering, Volume II. E. K. Sandeman. London, Chapman & Hall, Toronto, British book service, 1953. 613 pp., illus., $11.00.

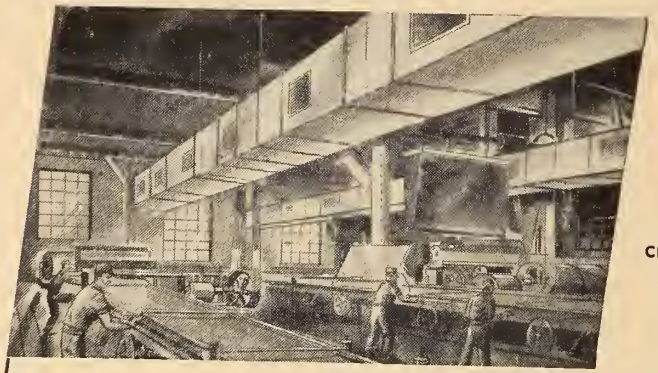
A detailed treatment of fundamentals primarily for beginners, but containing a sufficiently extensive amount of technical data to serve as a reference book for the practising engineer or designer. Important topics in this second volume are interference and noise, receivers, measuring equipment, feedback, network theory, filters, and standard calculations. There is a classified bibliography of some 1,200 references.

Railroad engineering, Volume I. W. Hay. New York, Wiley, 1953. 483 pp., illus., $8.25.

Part one of this book—devoted to principles of operation and location of modern railroads—considers such problems as distances, curvature, locomotive operating characteristics, and gradients, in relation to location of routes and choice among alternate routes and operating procedures. Part two discusses principles of maintenance and construction, with extended treatment of roadbed stabilization. Throughout, costs are stressed, as are recommendations of the A.E.R.A.

The writings of the Gilbreths. R. Spriegel and C. E. Myers, eds. Homewood, Ill., Irwin, 1953. 513 pp., $7.35 (U.S.).

This book assembles in a single volume the works of Frank B. and Lillian M. Gilbreth, edited to include evidences of lasting principles and problems, to exclude matter significant only at the time of writing, and to avoid duplication of the



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works of their contemporaries. The original wording has been retained except for minor changes in spelling and terminology, and changes made in the interest of continuity and readability. The volume includes a combined index to the writings.

STANDARDS REVIEWED

ASTM Specifications, American society for testing materials. 1916 Race Street, Philadelphia 3, Pa.

ASTM standards on bituminous materials for highway construction, waterproofing, and roofing (with related information) pa. $3.50.

The 1953 edition of this compilation, sponsored jointly by ASTM Committee D-4 on Road and Paving Materials, and Committee D-8 on Bituminous Waterproofing and Roofing Materials, brings together in a readily usable form the 105 standards and tentative specifications, test methods, recommended practices, and definitions of terms connected with bituminous materials for highway construction, waterproofing, and roofing. There are included 41 specifications and 58 methods of testing covering highway construction materials, waterproofing and roofing materials (asphalts, tar and coal-tar pitch, shingles, creosote, etc.) and viscosity by means of the Saybolt Viscosimeter, volume correction tables, etc. Tentative specifications and test methods are included for such items as concrete joint sealers, ASTM thermometers, and sieves for testing purposes. 17 of the specifications and tests included in the earlier edition have been revised, and there is also a Supplement bringing all standards up-to-date to September. The table of contents is arranged both by subject and by ASTM serial number.

British Standards, British standards institution, 24-28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 7 : 1953—Rubber insulated cables and flexible cords for electric power and lighting. 10/-.

This edition supersedes B.S.7 : 1946 as regards rubber insulated cables and flexible cords, and incorporates many of the requirements of Government Department Electrical Specifications Nos. 1, 8, 9 and 10, which it is understood are being withdrawn. The main change in this revision is the introduction of reduced thicknesses of insulation for 250-volt cables and flexible cords, and also for the higher voltage cables from 3,300 to 11,000 volts. The revision incorporates the quality clauses introduced by Amendment No. 3 to B.S.7, and the chemical and physical tests, based on B.S.903 "Methods of testing vulcanized rubber" have been extended to apply to rubber sheath. Other additions are the specification for the composition of various types of tough rubber sheath; requirements for aluminum sheath, and the adoption of 20°C. as the standard reference temperature.

B.S. 37: Part 3: 1953—Single-phase 2-wire prepayment meters. 4/-.

This part of the standard deals with single-rate (flat rate) multi-rate (load rate) and 2-part tariff prepayment meters for systems not exceeding 250 volts. Such types of meter combine a single-phase 2-wire element with a coin-freed mechanism wholly or partially controlled by the meter. The standard ratings are 10 amp. and 40 amp. corresponding to the maximum continuous rated current. Details are specified for the coin-register and the credit and debit indicators as well as the normal electrical requirements. Certain features recommended for incorporation in future designs of meter are included in the appendices. Part 1, "General clauses applicable to all types of motor meter", and Part 2, "Single-phase 2-wire whole current credit type meters" were published together as a single document some months ago.

Amendment No. 2, August 1953 to B.S. 883: 1949—Cables and flexible cords for electrical equipment of ships (including electrical propulsion) (PD.1665), 3/-.

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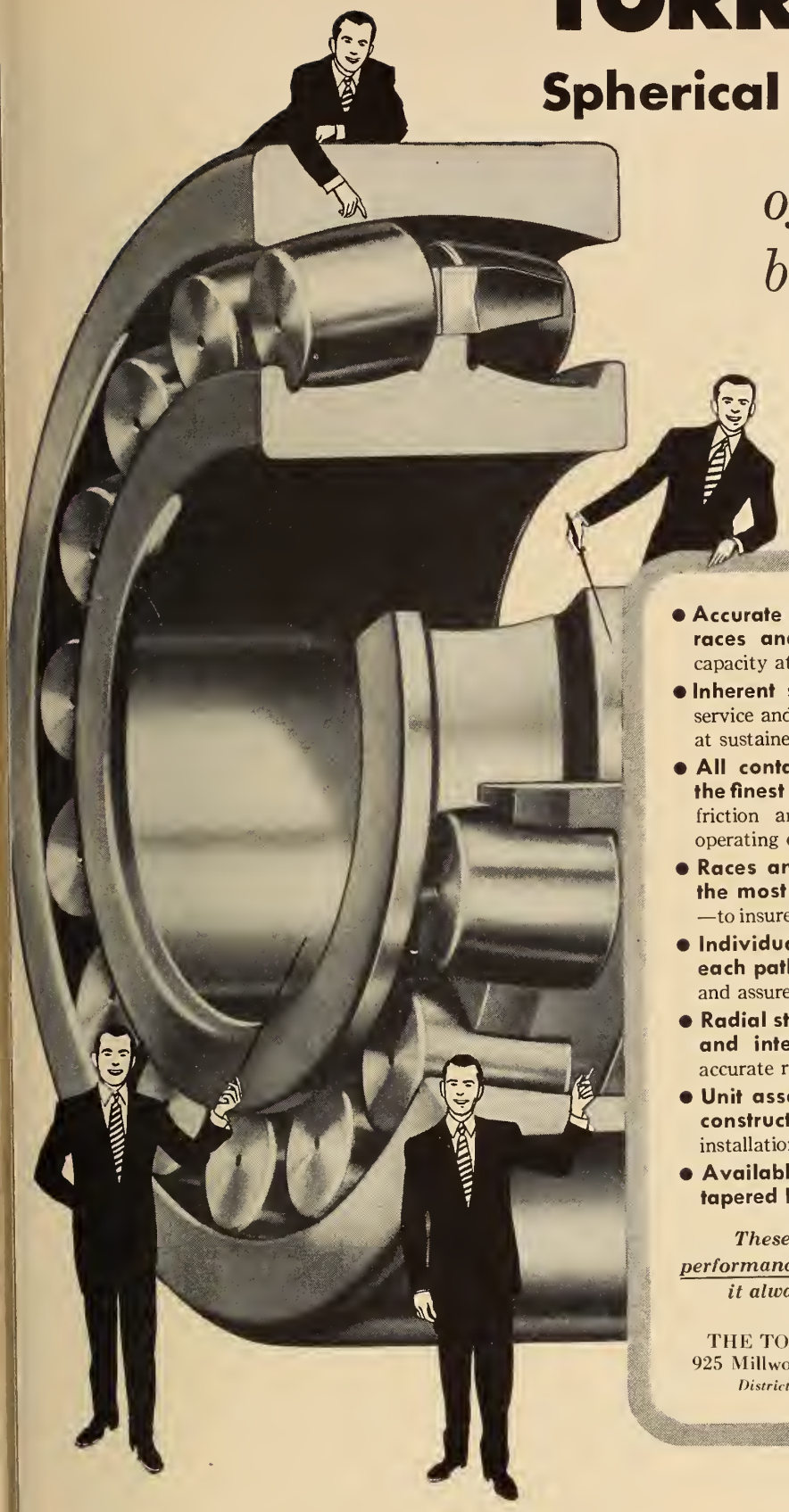

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B.S. 1435: 1953—Oil suction and discharge hose with built-in nipples for 100, 150 and 200 lb./sq. in. pressures. 2/6.

The 1948 edition of this standard has been revised to meet the changing requirements of the petroleum industry, and is intended primarily to cover heavy duty requirements, for example, tanker loading and discharge. The standard covers rough and smooth bore hose with smooth external finish, with a range of inside diameters from 2 to 12 in. and a range of standard lengths from 10 ft. to 30 ft., of five types, including ordinary and submarine uses. It specifies construction and materials other than rubber, and provides for performance and sample destruction tests and marking.

B.S. 1640: 1953—Steel butt-welding pipe fittings for the petroleum industry. 7/6.

The 1950 edition of this British Standard has been revised in the light of experience in its use and opportunity has been taken to bring certain dimensions into line with those in the latest edition of American Standards Association Specification B.16.9, "Steel butt-welding fittings". This British Standard specifies requirements for seamless and fabricated carbons and alloy steel 45° elbows, 90° elbows (long and short radius), return bends (long and short radius), 90° tangent elbows, equal tees, reducing tees, concentric and eccentric reducers, caps and lap-joint stub ends.

B.S. 1981: 1953—Unified machine screws and machine screw nuts. 6/-.

The publication of this standard marks a further step in the unification of screw threads. It is complementary to the standards for hexagon bolts and nuts which were issued two years ago and provides, as they did, for screws having unified threads and heads selected from a range already standardized in the United States. Whilst it is generally understood that unification of screw threads has been limited to sizes ¼ in. and upwards, provision is also made in this standard for a restricted selection of American number sizes, viz.: 4-40, 6-32, 8-32, 10-24, and 10-32, which are to be regarded as unified for purposes of attachment screws only. The standard covers slotted and recessed head screws of the following types: 80° countersunk and raised countersunk, pan, cheese and hexagon heads; dimensions of nuts and washers are also specified. Details are given in Appendices of the flushness gauge for checking countersunk heads, and information regarding the special penetration gauges used for checking recessed heads is also given.

B.S. 1986: 1953—Recommendations for the dimensional features of measuring and control instruments and panels for industrial processes. 3/-.

The use of automatic control and measuring instruments in the processes of the oil, steel, chemical and other industries is increasing rapidly. This equipment indicates, records and controls physical variables such as the pressure, temperature, level, and rate of flow, of many different fluids. These recommendations are intended to encourage the adoption of the principle of interchangeability of parts, and to ensure satisfactory operation in cases where items of equipment complying with the recommendations are connected together, even when they are made by different manufacturers. The recommendations specify the dimensions of circular and strip-type charts for recorders, and give dimensions for clocks for circular chart and drum type recorders, together with the appropriate drum sizes for the latter; they also indicate the sizes of screw threads for the measurement connections and pneumatic connections to instruments, and give guidance on the air pressure range for automatic control and remote indication or recording instruments. There is also information regarding the sizes and constructional features of panels and sub-panels, and for the aperture sizes for instruments.

B.S. 2002: 1953—Dimensions of diamond truing tools. 2/6.

This is another in the series of British Standards for diamond tools for use in general engineering. It has been prepared to assist in rationalizing the very large number of truing tool sizes now in use in industry. It specifies dimensions and tolerances for diamond truing tools for grinding wheels, of straight, headed, and taper shank types, and also weight

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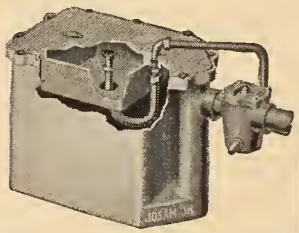

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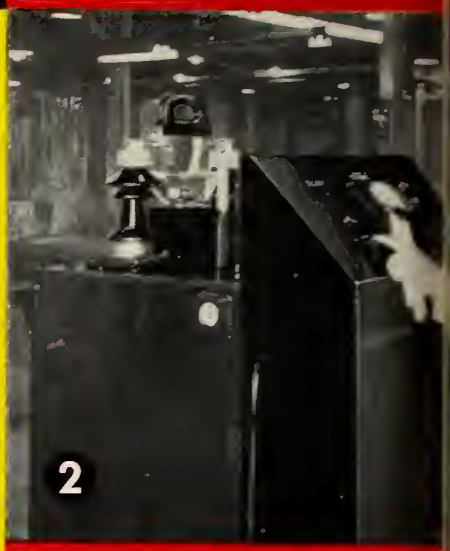
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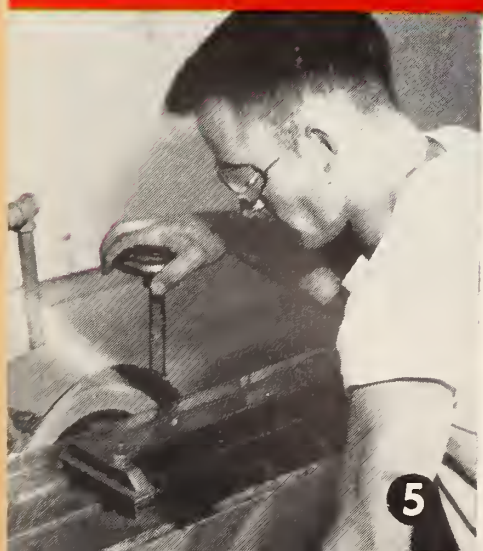
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ranges of single diamonds to be used with each type. The appendix lists recommendations for the selection, use and care of diamond truing tools.

B.S. 2004: 1953—Polyvinyl chloride insulated cables and flexible cords for electric power and lighting. 6/-.

This standard replaces the supplement to B.S. 7: 1946 which permitted the use of P.V.C. as an alternative to vulcanized rubber for insulation or sheath, or both, for flexible cords, and for 250-volt and 660-volt cables up to 0.06 sq. in. cross section. It deals only, however, with P.V.C. insulated cables and flexible cords for working voltages up to 250 volts. The insulation thicknesses are similar to those for corresponding rubber insulated cables and flexible cords specified in B.S. 7: 1953, and the physical tests for sheath and insulation are based on the methods included in that standard.

B.S.2007: 1953—Accuracy of circular gear shaving cutters. 2/-.

This standard forms part of a series which will deal with gear forming tools. It applies to serrated circular gear shaving cutters having single or double cutting flanks. It specifies limits of *accuracy only* for such cutters, new or completely reground, when intended for production of gears of an accuracy comparable with Class A1 of B.S. 1807: 1952, "Gears for turbines and similar drives. Part 1: accuracy' . The tolerances given are based on a specification prepared by the Mechanical Engineering Research Laboratory of the Department of Scientific and Industrial Research for "Accuracy of gear shaving cutters for marine and similar drives".

B.S. 2008: 1953—Wire armoured cables (vulcanized rubber insulated) for collieries. 5/-.

Prepared at the request of the Cable Makers' Association, this new standard deals with twin and three-core 250-volt colliery lighting cables (other than for coal face lighting) as well as 660-volt and 3,300-volt shaft and roadway cable. Dimensions are specified for each size of cable with single-wire or double-wire armouring, and served overall with hessian tape, or taped and braided. The physical and chemical test methods and requirements are again based on those in B.S. 7: 1953.

B.S. 2009: 1953—Acceptance tests for turbo-type compressors and exhausters. 10/-.

Together with B.S. 1571, B.S. 707, and B.S. 848, this new standard forms a series of codes for testing plant for the movement of air and other gases. Methods of test for uncooled and cooled axial flow and centrifugal compressors and exhausters are specified, both when the test and guarantee gases are the same and when they are different. Also specified are methods of measurement, and the instruments to be used. The methods of correcting the test results to allow for the difference between test and guarantee conditions are given. There is also a section on definitions and symbols.

B.S. 2012: 1953—Mould die sets for injection moulding machines. 2/6.

The purpose of this standard is to provide a range of mould die sets for use with existing designs of moulding machines, with a view to ensuring the maximum use of the platen area of machines and economical production of die sets. The relevant details of injection moulding machines which concern die sets have not yet been standardized; it is expected that this will receive attention at a later date, and this standard may then require review. This standard specifies dimensions, design and materials for use with injection moulding machines from 2 oz. to 10 oz. capacity.

B.S. 2017: 1953—Copper tubes for general purposes. 3/-.

There have previously been published a number of standards for copper tubes for specialized uses, which in most cases include fully dimensioned tables of sizes of tubes to which the standards apply. The need has been felt, however, for a standard for copper tubes which would meet the requirements of general users who find it difficult to select suitable sizes from the dimensional tables in existing standards and who may often prefer to specify copper tubes by the outside diameter required, normally expressed in inches and fractions of an inch, and by the required

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thickness, normally in imperial standard wire gauge numbers. It is believed that the standard in the form now presented should meet the needs indicated above, including, among others, those of users in the automobile, petroleum and refrigeration industries, from whom requests have previously been received for a new standard to meet their special requirements.

In many instances, tubes for general usage are required for connection by fittings involving a close fit between the outside of the tube and the socket of the fitting. It has been considered desirable, therefore, to include two ranges of tolerances on outside diameter. Table 2 providing for the usual plus and minus tolerances, and Table 3 providing for a limited minus tolerance only to meet the conditions required for connection by the types of fittings mentioned. It has been found necessary to confine the application of the closer range of tolerances on diameter to a preferred list of sizes from ⅛ in. to 2 in. outside diameter which is given in Appendix A. With a view to promoting a reduction in the number of sizes demanded, it is hoped that users will endeavour to select their tube sizes up to 2 in. outside diameter from the list of preferred sizes in Appendix A, irrespective of the range of tolerances on diameter which is required. The standard indicates a preferred method of designating tubes for general purposes which it is hoped will be followed by users wherever practicable. Appendix B gives tables of sizes of copper tubes for general purposes required for screwed connections, taken from B.S. 61, Part 1. Appendix C gives a table of sizes of copper tubes for the petroleum industry. These sizes have been selected from Tables 5 and 6, of B.S. 1306, Part 2, "Seamless copper tubes for steam services", with the exception of the 2½ in. size which is similar to the corresponding size in ASTM B.42. Additional provisions to meet the special conditions of the refrigeration industry are included separately in Section Two.

B.S. 2027: 1953—Copper plates for general purposes. 2/6.

This standard applies to rolled copper plate in the annealed condition in thicknesses over ⅜ in. and over 12 in. in width. It specifies quality of material, tolerances and mechanical properties and includes details of mechanical testing.

Canadian standards, Canadian standards association. National research building, Ottawa, Canada.

C.S.A. C22. 1-1953—Canadian electrical code, Part 1, 6th ed. $1.25.

The Canadian Electrical Code, Part I, covers essential requirements and minimum standards for electrical installations at all potentials in buildings, structures and premises. It has been universally adopted in Canada and has the force of provincial or municipal law throughout the nation.

The sixth edition supersedes the fifth issued in 1947 and presents the Code in a simpler form that is easier to read and understand. The arrangement and numbering system for the sections rules and tables has been completely revised to provide for more convenient use in the field. New subjects include requirements for wiring and equipment in storage and anesthetizing locations in hospitals, outdoor floodlighting installations, fixed electric space heating systems and induction and dielectric heating equipment. Requirements for the installation, protection and control of motors are now covered by a separate section. Type designations for equipment enclosures are provided, as are new appendices for vault construction, dust free rooms for housing electrical equipment, chain link fences, and graphical symbols for architectural plans. The section on high potential installations has been written in much greater detail. All tables are now grouped in one section for convenience in use and contain references to the applicable rule or rules.

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Elementary mathematics from an advanced standpoint, vol. I. Felix Klein. New York, Dover, 1953. 274 pp., pa. $1.50 (U.S.).

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Three-phase motors. T. F. Wall. London, Newnes, Toronto, British book service, 1952. 232 pp., figs., $6.00.

The works of Archimedes, with The method of Archimedes. T. L. Heath, ed. New York, Dover, 1953. 563 pp., pa., $1.95 (U.S.).

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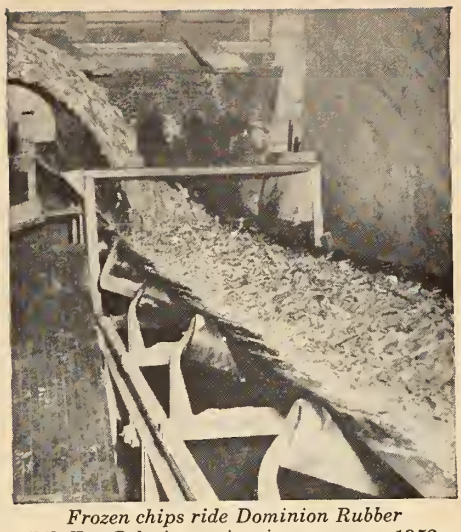

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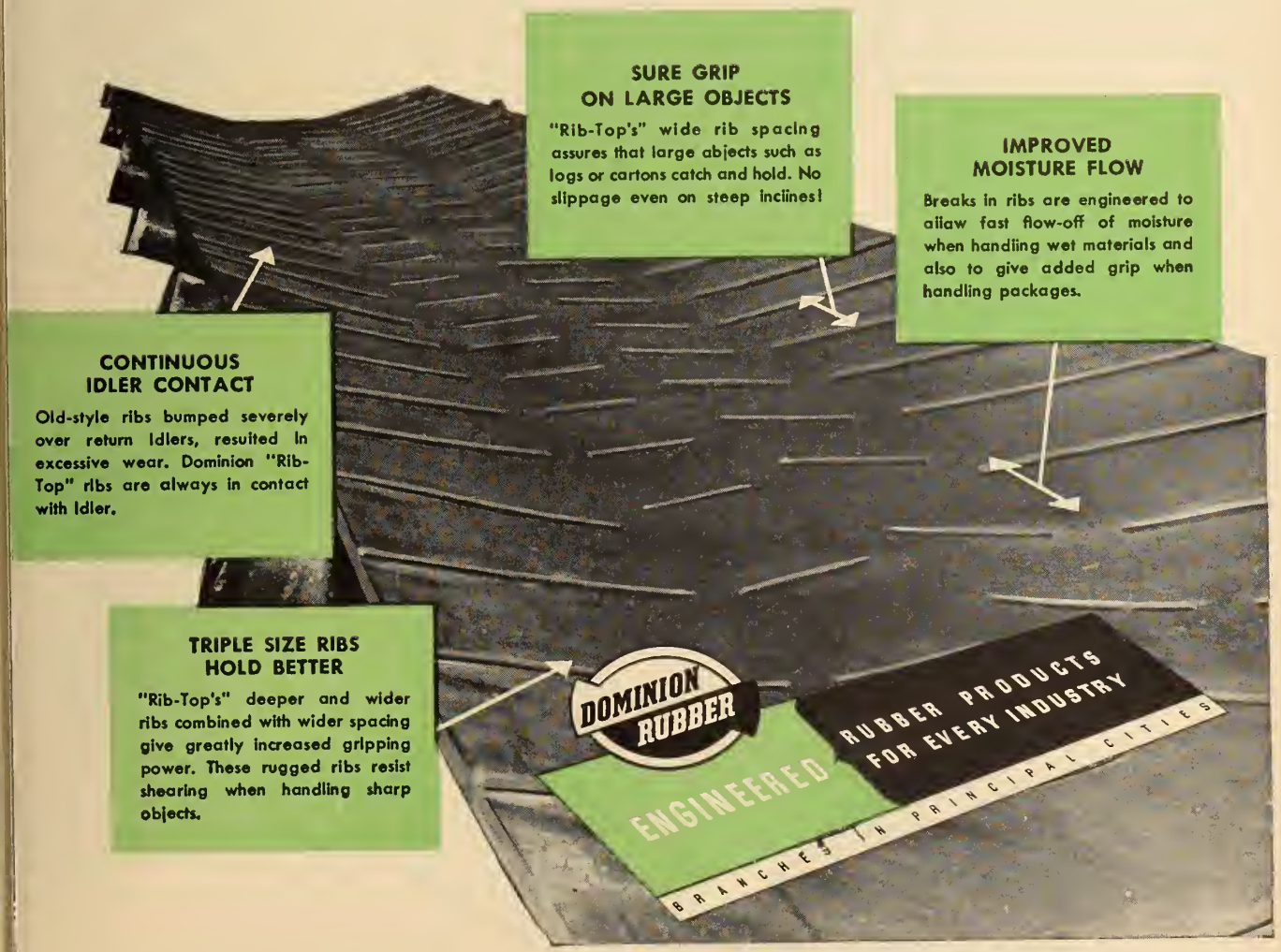

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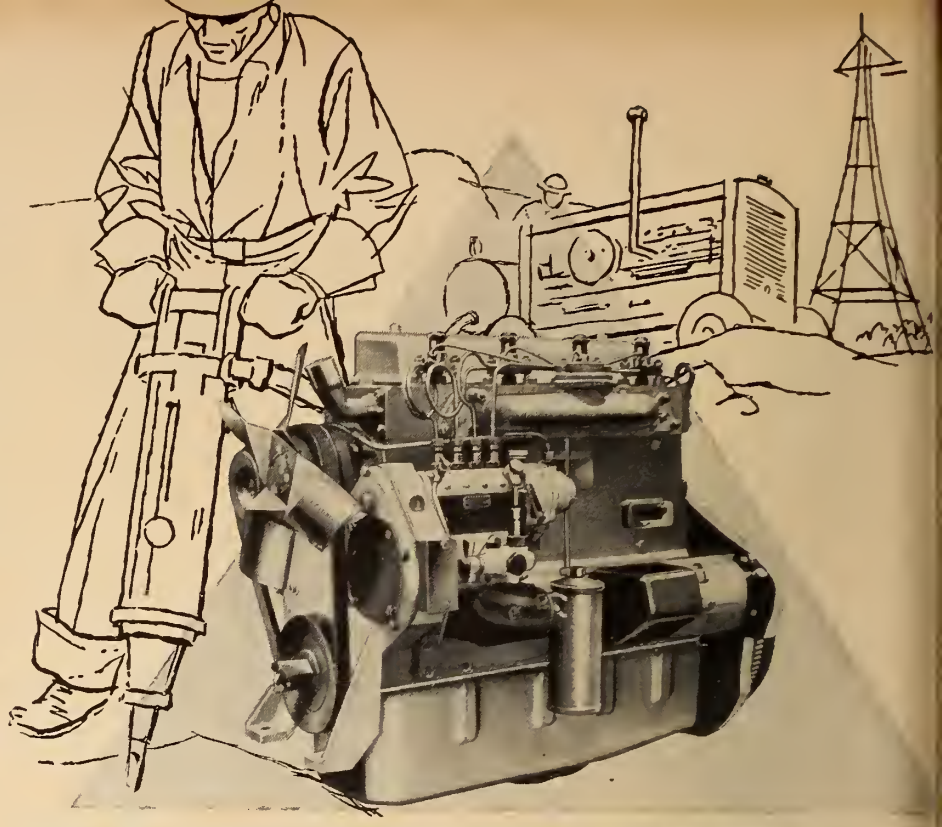

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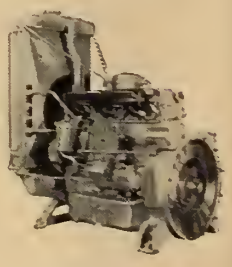

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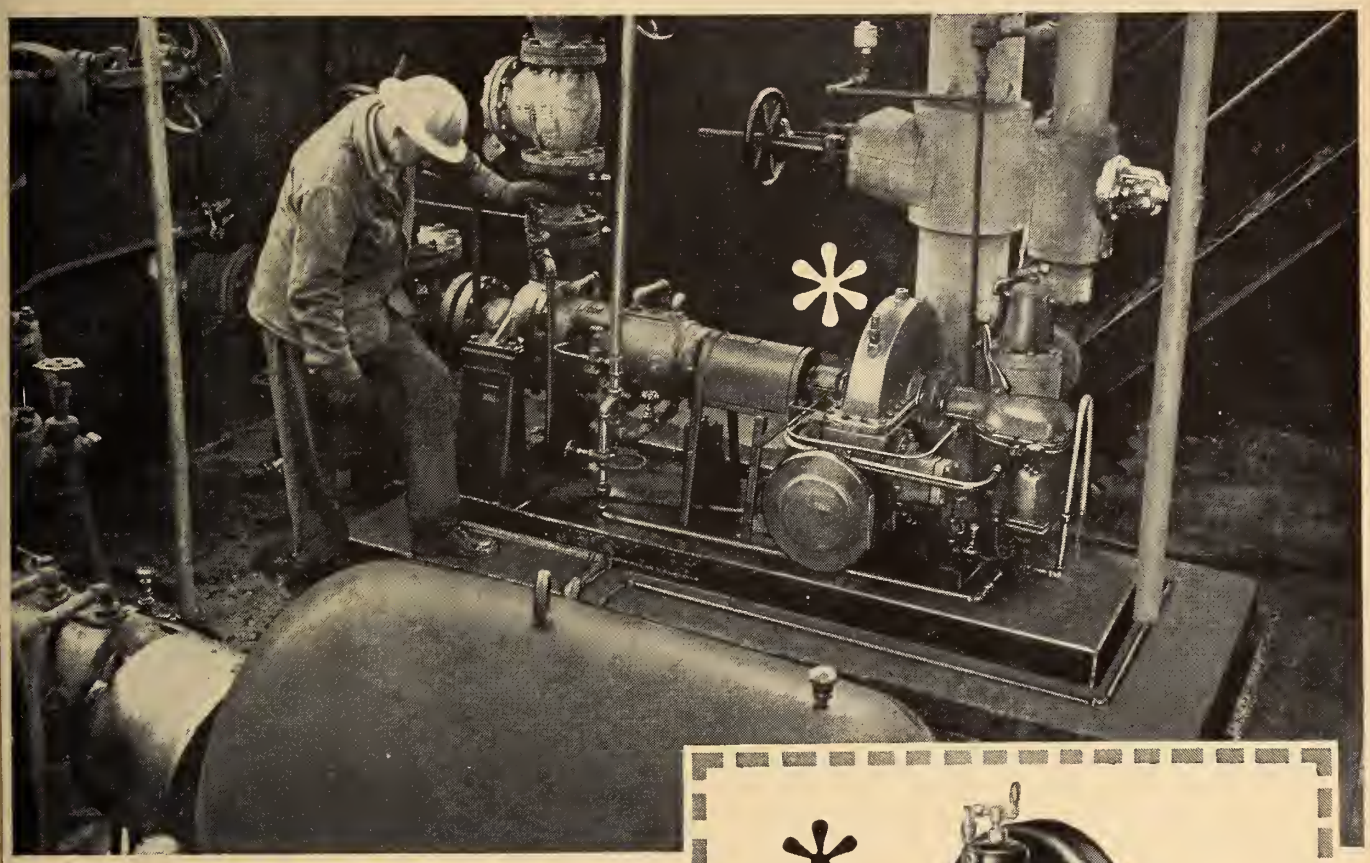
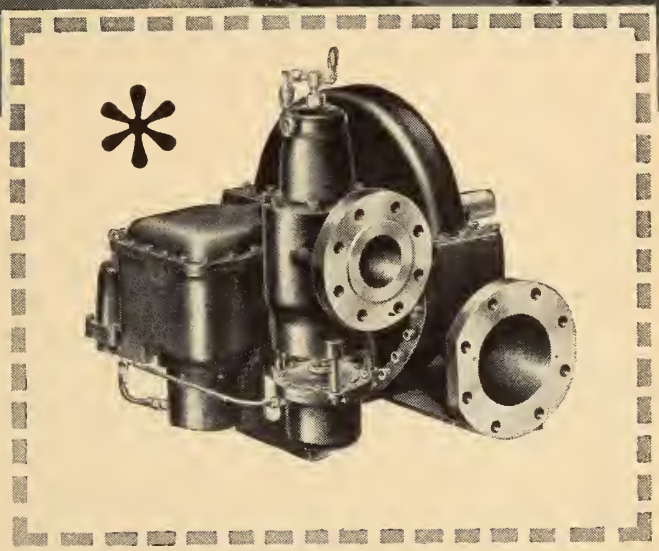


Refinery process foreman adjusts pump valve. This Type DP-20, 125 hp turbine increased by 75% the oil thru-put of this pump which supplies oil for the refinery's distillation unit. Total daily thru-put of pump equals former capacity af twa.



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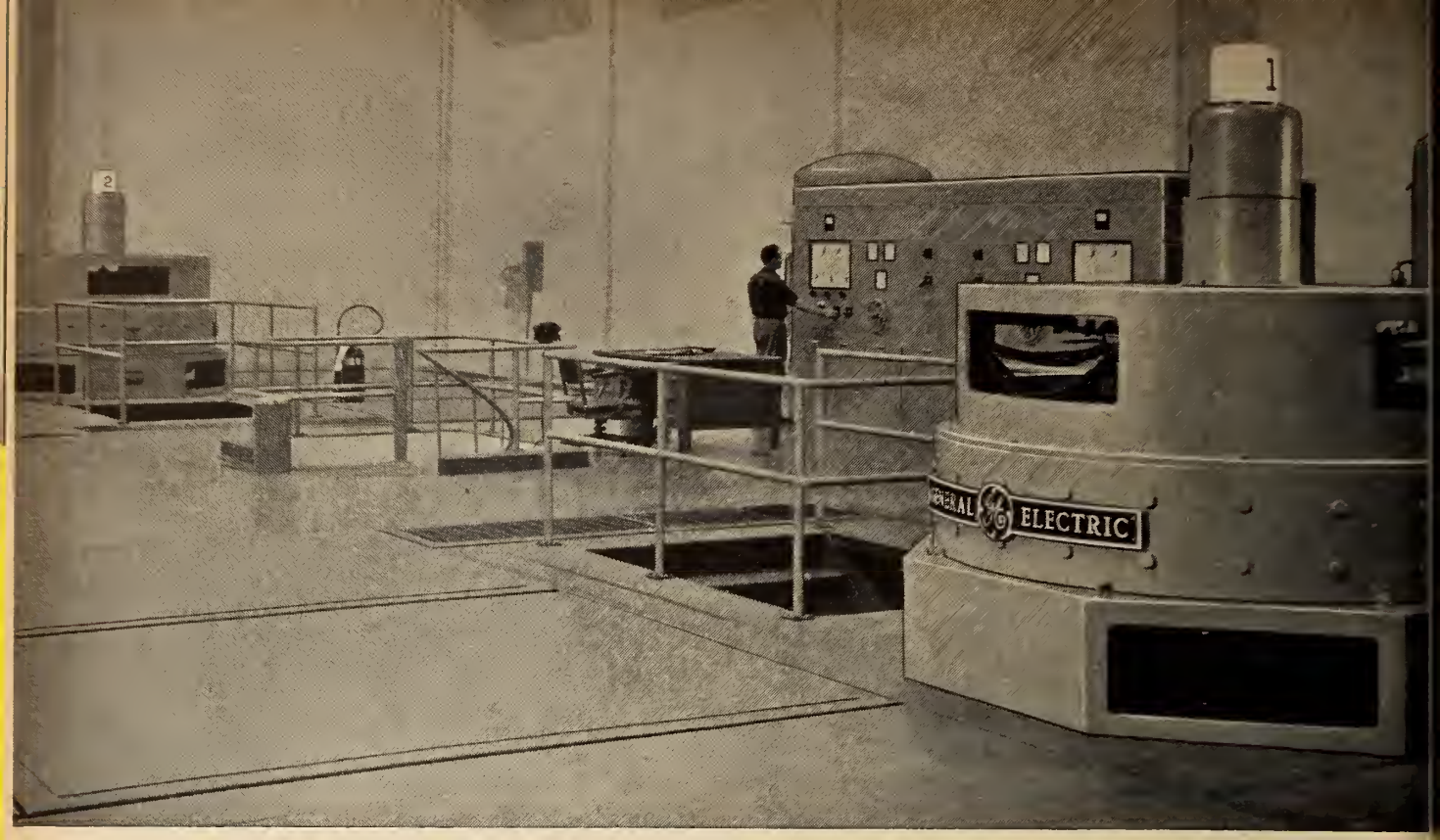
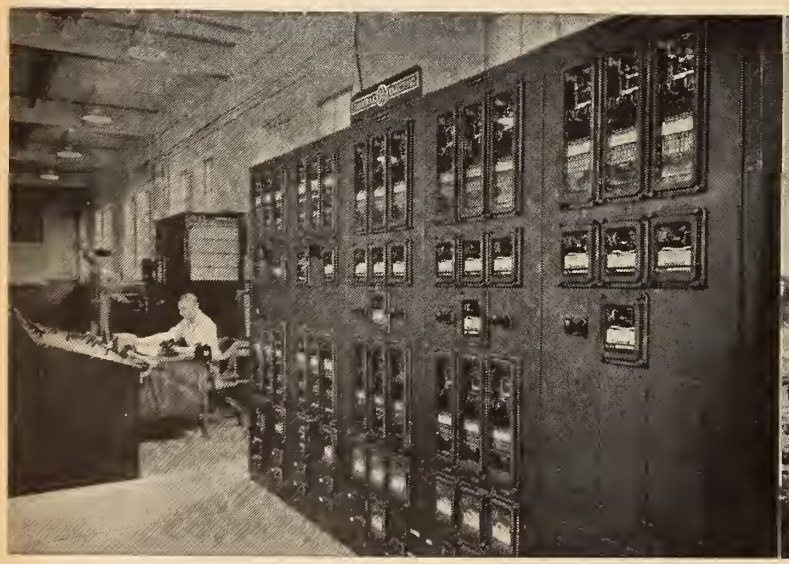
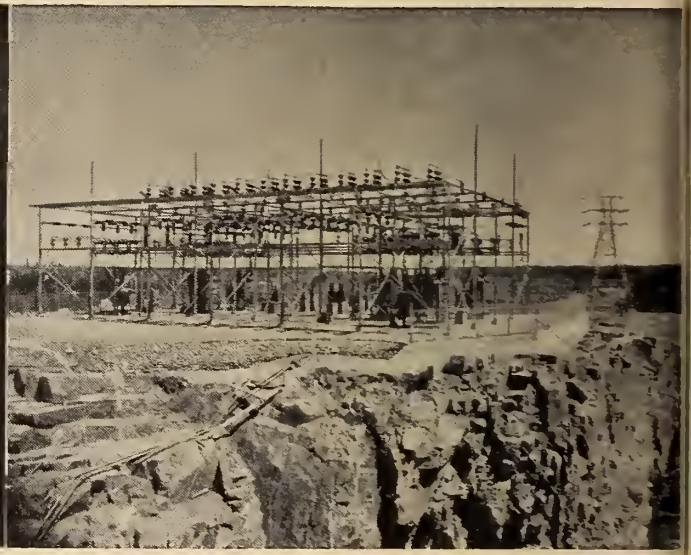


Two waterwheel driven G-E Generators, each 37,500 KVA, 13,800 volts, 3 phase, 60 cycle, 112½ RPM develop power at the new Manicouagan Power Company development of Ontario Paper Company. This new plant was built to supply an additional 75,000 KVA power load to the Quebec North Shore Paper Company mills at Baie Comeau.

Complete customer-satisfactio



Control bench and duplex relay boards at the Baie Comeau mill of Quebec North Shore Paper Co. This high-tension board serves four incoming lines and five transformer banks.



High-tension switching station at the Manicouagan genera station. This station handles four out-going power lines of 69 to Baie Comeau and two incoming lines of 69 KV from Outar

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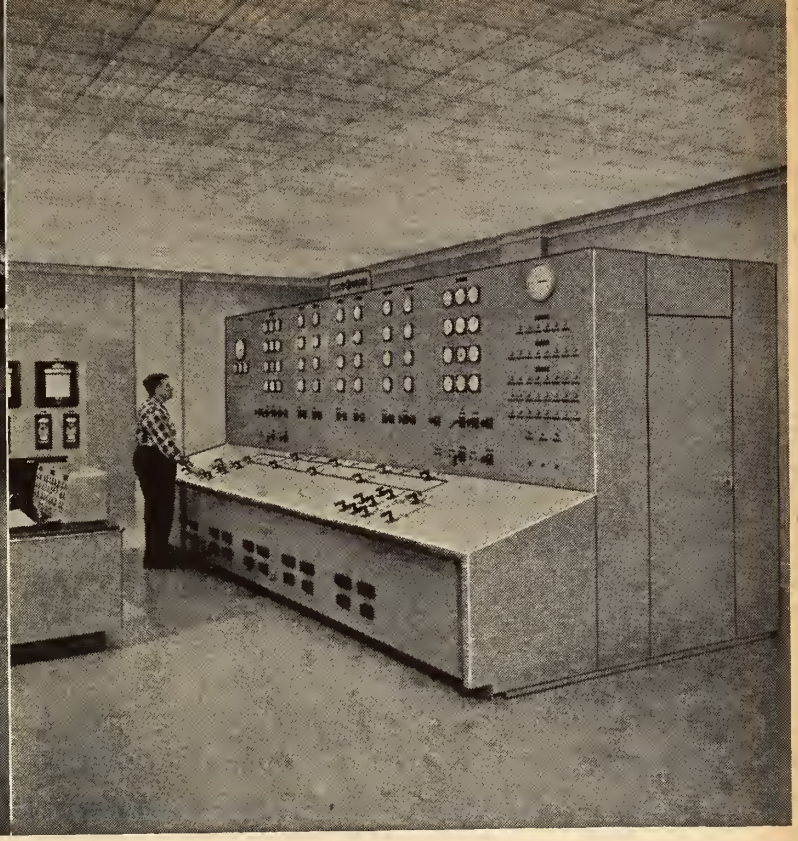
nain generating station service board at Manicouagan. ircuit-breaker distribution board handles power from two KVA—13,800/575 volt, 3 phase, 60 cycle transformers.



Control room view showing tunnel type duplex board and bench board. This installation controls waterwheel generators, transformers, power lines and station service transformers.

rings repeat G-E equipment order

Ontario Paper Company has again installed G-E generators, switchgear and control equipment. G-E equipment was specified for their Manicouagan Power Company project built to supply *Quebec North Shore Paper Company* mills at Baie Comeau, Quebec. Ontario Paper's Thorold and Outardes plants were both previously equipped by C.G.E.

Here is another of many repeat orders resulting from complete customer satisfaction . . . orders based on known qualities of G-E design efficiency, low-cost operation and dependability found in equipment already in operation.

The new power plant at Manicouagan, seven miles from Baie Comeau, will develop a 75,000 KVA power output with two G-E waterwheel driven generators. G-E Switchgear and control equipment are installed on the power site and high-tension switchgear is installed at the Baie Comeau mills.

Repeat orders such as this are significant evidence of the confidence our customers put in G-E Equipment. We like new business but take special pride in pleasing old customers . . . the proof of the pudding is in the eating. When your company plans a major expenditure in electrical equipment, talk to any C-G-E apparatus customer.

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G-E SWITCHER AT IMPERIAL OIL REFINERY
hauls 60% more . . . and cuts cost 40%

Here's what happened in the railyards of Imperial Oil's Sarnia Refinery when a new 35 ton G-E Diesel-Electric Switcher replaced their steam locomotive cranes:

- Average load hauled jumped from 120 to 200 tons
- Costs per operating hour dropped from $6.39 to $3.76
- Availability increased materially

Imperial Oil's remarkable efficiency report is echoed by many industrial railyards where G-E Diesel-Electric Switchers have replaced steam locomotives. Fuel savings plus lowered maintenance and labour costs mount to thousands of dollars yearly. The absence of open flame in the G-E Switcher is considered an additional safety factor in moving petroleum products at the Sarnia Refinery. And in any smoke-conscious community, smokeless G-E Diesel-Electrics contribute to excellent public relations.

These thrifty hard-working G-E Diesel-Electric Industrial Locomotives are ready to work for you at a moment's notice, hauling bigger loads — 24 hours a day. Your nearest C-G-E office will be happy to arrange a motive power survey, and predict the savings you can expect, with G-E Diesel-Electric.

GENERAL ELECTRIC
Industrial
LOCOMOTIVES

APPARATUS DIVISION

AAD-047

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

With an eye to the future . . . .

Ottawa Installs a Horton Radial-Cone Tank

This 750,000-gal. radial-cone tank installation shows foresight in selecting the location for the tank, as well as the design of the tank, so that the structure would blend into the surrounding landscape and present a pleasing, streamline appearance.

The City of Ottawa installed the 750,000-gal. radial-cone tank shown at the left in its water works system to provide gravity water pressure and improve water service in the Carling Avenue booster area in the southwest section of the city. Planned expansion to the City of Ottawa will increase the area served by the tank five or six times and eventually the elevated tank will serve an area with a population of over 50,000 persons.

Ottawa is another of the progressive cities that has answered immediate problems with a solution that has a future — modern elevated storage. This trend is continuing because elevated storage usually provides uniform water pressure during peak loads, adequate reserve supply during power failure, lower pumping costs, and lower insurance rates.

The radial-cone design of elevated tank reduces pumping costs because it provides a low range in head. The plates of the conical sections between the radial girders supporting the bottom are dished to a relatively long radius. This places them in tension and they carry the weight of the water on the tank without any other support. As a result radial-cone tanks can be built with a larger diameter and a shallower depth more economically than can tanks of other designs of the same capacity. Costs for power are less since the pumps operate against a lower average head.

Horton radial-cone tanks are available in capacities from 500,000 to 2,000,000 gallons. Horton ellipsoidal bottom tanks are built in standard sizes from 15,000 to 500,000 gallons. Write our nearest office for complete information or tenders.

ENGINEERING DATA FOR OTTAWA WATER WORKS SYSTEM

Number of domestic customers	34,092
Number of commercial customers	3,185
Miles of distribution mains	272
Size of distribution mains	3 to 51 in.
Number of fire hydrants	2,361
Maximum daily consumption	29,920,000 gpd.
Minimum daily consumption	18,231,000 gpd.
Average daily consumption	23,404,660 gpd.

HORTON STEEL WORKS LIMITED

Main Office and Plant: FORT ERIE, ONTARIO

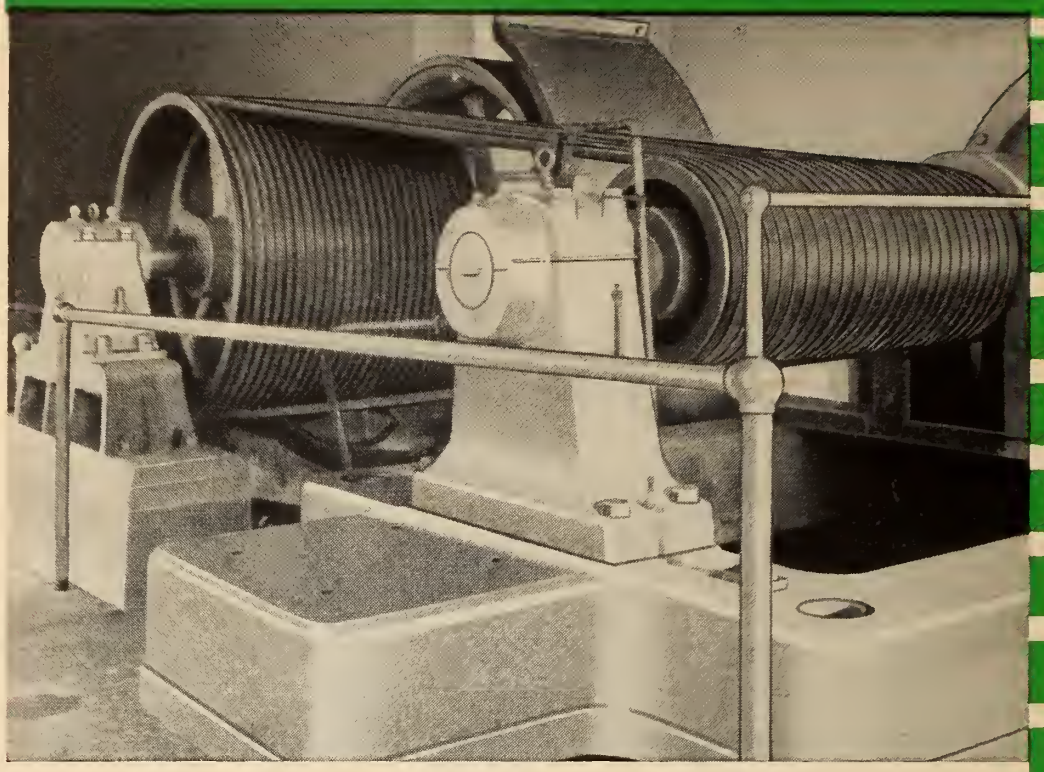
SALES OFFICES

gary, Alta. • Toronto, Ont. • Montreal, Que.

AGENTS

Gordon Russell Ltd., Vancouver, B.C. Mumford Medland Ltd., Winnipeg, Man.

Cut Plant Maintenance costs!



Giant 800 H.P. Drive depends on DUNLOP "Flexicord" V-BELTS for peak performance!

The illustration on the left shows a series of 26 "Flexicord" V-Belts driving a giant Fan in an Eastern Canadian Mine.

This same drive has been giving trouble-free, low-upkeep service for many years . . . supplying billions of cubic feet of air without need of repair.

It's one of many installations where Dunlop "Flexicord" V-Belting is providing dependable and economical power transmission to industry.

Built to really "take it" Dunlop "V" Belts are of single "continuous spiral" low-stretch cord construction. This ensures maximum flexing life and uniform distribution of load over large and small pulleys.

In addition, each cord is impregnated and surrounded with a cushion of live rubber to prevent chafing, separation and slipping.

Dunlop "Flexicord" V-Belts are not only matched for length within very close limits, but are "coded" so that matched sets are available from stock for any drive—whether 1/8 H.P. or 800 H.P.

Why not investigate the advantages of Dunlop V-Belting and the many other Industrial Rubber Products designed and manufactured by Dunlop? For details as to cost and ease of installation, just contact our Engineering Service.

SPECIFY DUNLOP INDUSTRIAL RUBBER PRODUCTS FOR HIGHEST QUALITY, LONGEST LIFE AND LOWEST COST

Strength to withstand the toughest of operating conditions . . . durability that assures dependable and economical performance over the longest period of time . . . these are the chief characteristics for which Dunlop Belting and Hose have long been famous.

A world-wide background of research, engineering "know-how" and field experience stands back of every Dunlop Industrial Rubber Product. Contact or write our Engineering Service for the low-cost answer to your equipment problem. There is no obligation!

. . . BASIC DUNLOP RUBBER PRODUCTS VITAL TO PLANT MAINTENANCE

"Powerplus" "Flexicord" "Gibraltar" and "Samson" Transmission Belting.

"Flexicord", "Flexibraid", "Gibraltar", and "Record" Air and Tool Hose.

"Flexibraid" and "Flexitwin" Welding Hose.

"H.P.R." Fibreglass, "H.P.R.", "Gibraltar" and "Record" Steam Hose.

"Flexicord", "Flexibraid", "Gibraltar", and "Reliance" Water Hose.

DUNLOP-CANADA

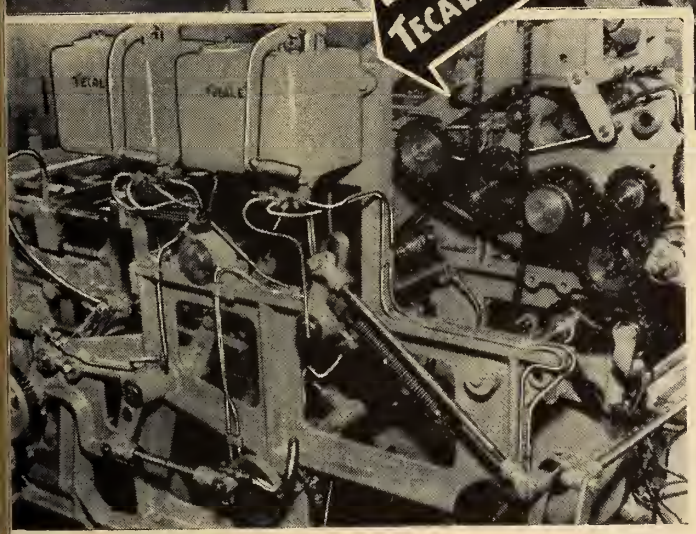
Branches in:

Saint John, Quebec City, Montreal, Toronto, London, Winnipeg, Regina, Edmonton, Calgary, Vancouver.

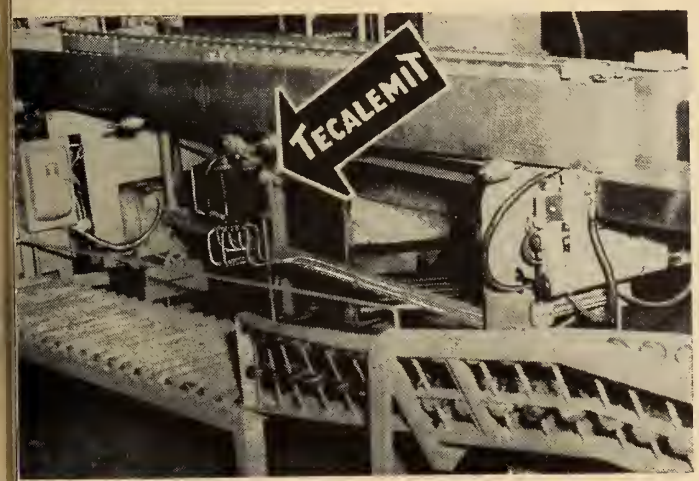
DUNLOP
INDUSTRIAL RUBBER PRODUCTS

"BEARS FOR PUNISHMENT"

TECALEMIT
SEMI AUTOMATIC LUBRICATORS *in Operation...*



Above — 2 "P.C." 6-unit pumps on main mochine section.



Above — 1 "P.C." 8-unit pump on stacker.

on Soap Wrapping Machines in Plant of
COLGATE PALMOLIVE PEET CO. LTD.
TORONTO

Wherever continuous machine operation is imperative, whether packaging, automatics, machine tools, presses, etc., Lubrication is a prime essential for satisfactory production.

Illustrated is the Tecalemit hand operated Central Lubrication system installed on a type S 3 Wrapping Machine and Stacker — throughput 150 cakes per minute. Continuous operation is assured by Tecalemit Lubrication — Life Insurance for all automatic Machinery — The 150 Lubrication points, 30 of which are moving and use flexible connections, are kept properly lubricated with time-saving Tecalemit Lubricating Equipment.

We offer a wide variety of equipment for every application. Why not let us help YOU.

Write us or contact your local agent to-day.

Thomson-Gordon Ltd., Hamilton, Ont.
Moore Bros. Machinery Co. Ltd., Montreal, P. Quebec.
The Federal Belting & Asbestos Co. Ltd., Toronto & Vancouver.

TECALEMIT
(CANADA) LIMITED

The Authority on Lubrication

431 KING ST. W., TORONTO, ONT.

Our Windows are Engineered...

Engineered to focilitote ca-ordinotian with other wall materials, Crittoll and Fenestra windaws are made in stondard units in o wide voriety of styles. This stondardization soves on-the-site expense. It olso means delivery from o big stock in the quantity you want, when you wont them. Distinctive in appearonce, rigid and strong without bulkiness, free forever from warping, twisting, swelling, Crittall and Fenestra windows ore designed and engineered for o life-time of serviceability. Their low initial cost, low installotion cost ond low mointenance cost hove eorned the approval of architects, builders and owners for holf a century. Whether you require a speciol job in o hurry, a number of single units, or entire walls of windows, they're as neor as your telephane. Call us an yaur next window jab.

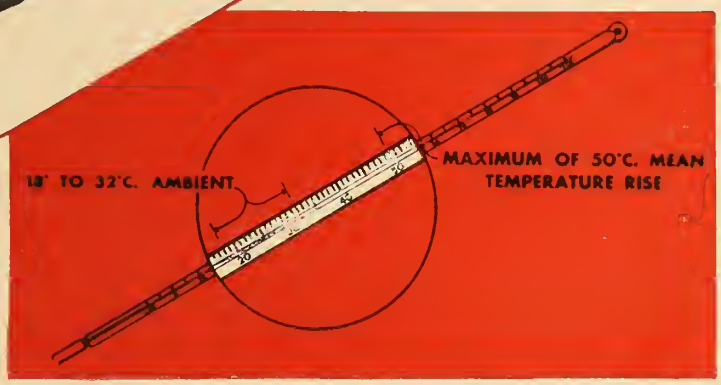
Hot Dip Galvanizing for Rust-Proof Windows available at extra cost

CANADIAN CRITTALL METAL WINDOW LTD.

139 STEPHENSON AVE., TORONTO 13 — 2165 CLIFTON AVE., MONTREAL 28

Fenestra Industrial Windows in Steel **CRITTALL** Universal and Residential Windows in Steel and Aluminum

HIGH RUPTURING CAPACITY
Non-Deteriorating FUSEGEAR



OUTSTANDING FEATURES

- HIGH RUPTURING CAPACITY
- NON-DETERIORATING
- CURRENT LIMITING
- HIGH SPEED OF OPERATION
- ACCURATE CALIBRATION
- ACCURATE DISCRIMINATION
- LOW OPERATING TEMPERATURES
- VOLTAGE SURGE LIMITATION

The complete range from 2 to 600 amperes of English Electric 600 volt A.C., H.R.C. fuse complies with C.S.A. specification C22.2 No. 106. The specification stipulates maximum temperature rises when the fuses are subjected to 110% of their rated current in Test surroundings free from external draught. Under the more severe conditions met in actual service English Electric H.R.C. fuses still meet this stipulation.

CSA Approval No. 12203

Write for publication A3344

'ENGLISH ELECTRIC'

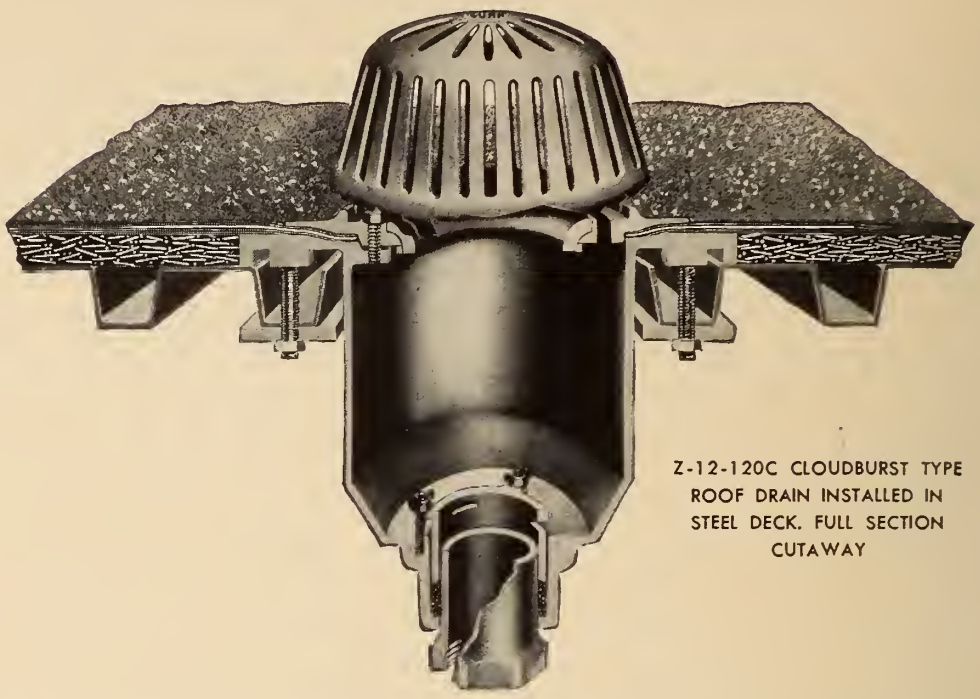
Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

nglish Electric Company of Canada Limited Head Office and Factory: St. Catharines, Ontario

PA5301-G

DRAINAGE PRODUCTS

AIR RELIEVED • CLOUDBURST
TYPE ROOF DRAIN



Z-12-120C CLOUDBURST TYPE ROOF DRAIN INSTALLED IN STEEL DECK. FULL SECTION CUTAWAY

Possibility of damage to roof areas by heavy loads of backed-up water which are a threat to roof safety is reduced by Zurn Air Relieved Cloudburst Type Roof Drains. A major improvement over conventional roof drains is the expecially large and deep sump area, which acts as a temporary reservoir, eliminating swirling and splashing and allowing entrained air to escape before water enters drain pipe.

Maintenance of such a hydraulic head on downspouts compensates for pipe entrance friction factor and assures continuous flow at full capacity. Extra large, non-clogging mushroom type dome strainer increases free open area of straining surfaces up to 9:1 — a unique feature of Zurn Roof Drains.

CP-5687

Damage ta roof areas fram backed-up and standing water due ta freezing af water in drain inlet is reduced by the Zurn Steam Jacketed Raaf Drain. The Steam chamber campletely encircles sump area, providing radiatian fram inner surfaces. The Zurn Steam Jacketed Raaf Drain is easily cannected ta building steam lines.

Z-200

Flaar ar shawer drain pravides pasitive seepage cantral and has nan-clagging seepage slats in flashing callar and in vertically adjustable strainer. Strainer adjustable ta plane af flaar assuring a smaath, even finish. Regularly furnished with dura-coated cast iran body and clamping callar, Cast Zurn Nickel branze adjustable strainer.

Z-506

The Zurn Easy Level flaar drains are designed far quick, simple flaar level adjustment at all times. These drains are suitable far either new ar ald construction and are particularly desirable for flaar installatians where resurfacing is required. Available far bath narmal traffic and extra heavy traffic laads.

Z-1326

Supremo Perfect Seal floor level cleanou far access thraugh floors ta drainage lines-used in industrial plants and othe buildings where cleanout apenings occu in heavy traffic apen areas. Lugs permit adjustment ta plane af finished floor to smooth even finish. Caver is non-slip scoriated Nickel Bronze and is adjustable

CANADIAN ZURN ENGINEERING LTD.

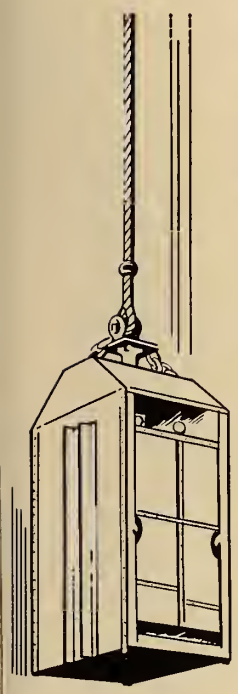
PLUMBING • MARINE • INDUSTRIAL • POWER TRANSMISSION

2052 ST. CATHERINE ST. W., MONTREAL, P. Q.

SALES OFFICES

MONTREAL, P. Q. • TORONTO, ONT. • VANCOUVER, B. C. • WINDSOR, ONT.

Put Your Trust in a **SAFE**



Wire Rope

SPECIFY

MARTIN BLACK

SHIPPING

POWER SHOVELS

POWER CRANES

WINCHES

Preformed and

BEST

irtin Black "Speedwell" e ropes are known the rld over for their perfor- nce and durability. The ecial process in the pro- tion of the wire ensures t the right wire for the goes into Martin-Black re Ropes—It's the right e and construction of r wire ropes that count!

Available in Canada Through:

ONTARIO	JOHN T. HEPBURN, LIMITED 914 Dupont St., Toronto
QUEBEC	WM. McKIBBIN & SONS, 216 Board of Trade Bldg., Montreal
ALBERTA	D. G. LATTA LIMITED 9510-105th Ave., Edmonton
MANITOBA	KANE EQUIPMENT LTD. 701 Henry Ave., Winnipeg
	C. J. BROWNE 486 Sprague St., Winnipeg
MARITIMES & NEWFOUNDLAND	LOGUE INDUSTRIAL EQUIPMENT LIMITED P.O. Box 400, Sydney, N.S.

FREE INSTRUCTION BULLETINS

Write for instructive bulletins and learn how to secure more uses and longer life from your wire ropes.

Business & Industrial Briefs

A Digest of Information

received by

The Editor

Appointments and Transfers

Department of Labour. — Dr. George V. Haythorne, director, economics and research branch, Department of Labour, has been promoted to an assistant deputy minister of the Department. M. M. Maclean, director, industrial relations branch, is the senior assistant deputy minister.

●

Dahl Bros. Appointments.—Dahl Brothers (Canada) Limited, Toronto, have appointed the following firms as distributors of their lines of brass valves, fittings, and pipe hangers: H. F. Clarke & Co., 1114-5th St. W., Calgary—General Supply Co., 2814 Dewdney Ave., Regina—G. W. Orton Limited 917 Memorial Ave., Port Arthur. The distributors will carry stock.

●

Otis Appointment. — The appointment of Jean Benzacar to the position of Montreal district manager, Otis Elevator Company Limited, is announced by W. J. W. Reid, president. Mr. Benzacar has been a member of the Otis organization for over thirty-three years and has had extensive experience in the service, construction and sales divisions of the Company. He has represented Otis in various countries of Central and South America as well as in the United States and Canada. He was in charge of operations in Santiago, Chile, for four years. Mr. Benzacar has been engaged in Company sales activities in the Montreal district for the past four years, latterly as assistant district manager. He succeeds Lt. Col. C. F. Ritchie, D.S.O., M.C., who retired October 31st after forty-seven years outstanding service with the Company.

●

C.I.T.F. Appointment.—H. N. Haken has been appointed publicity and advertising manager of the Canadian International Trade Fair. He will make his headquarters in Toronto.

●

Geo. M. Brydon.—Geo. M. Brydon has been named manager - manufacturing - Carboloy Works of Canadian General Electric Co. Ltd.

●

Frank M. Squires. — Ferranti Electric Limited has formed a sales promotion department and Frank M. Squires has been named sales and promotion manager of the Company.

●

Monsanto Appointments. — E. H Toombs has been appointed to the development department of Monsanto Canada Limited. Mr. Toombs will be resident in Vancouver and will pay particular attention to developments in western Canada.

Mr. Toombs was formerly chief chemist and technical manager in charge of research and production for the Company's western operations. The post of chief chemist will be handled in future by C. A. Moore and G. L. King will be superintendent in charge of production.

●

C.G.E. Changes.—According to A. M. Doyle, general manager of C.G.E. apparatus division, productions of Canada's electrical apparatus manufacturing industry will expand 2½ times its present volume in the next ten years. This forecast was made at a conference of business and technical paper editors at which Mr. Doyle announced a major reorganization in the structure of G.E. apparatus division.

Effective January 1st, 1954 the Company will reorganize as follows: six operating departments, each functioning as a separate business within the division, have been delegated product responsibility. The motor and generator division will be headed by J. E. Girven of Peterborough. It will produce waterwheel generators, synchronous condensers, large DC motors and generators, large induction motors, transportation equipment and power rectifiers.

The motor and control division will be under the guidance of J. D. Willis of Peterborough and will produce smaller induction motors, high-speed synchronous machines, welding sets and electrodes, motor starting switches, brakes, selenoids and push-buttons.

Switchgear and industry control also located at Peterborough will be headed by S. O. Shields and will continue to produce all the switchgear and custom-built controls manufactured by the company.

The Davenport apparatus products will be headed by V. B. Ross, whose responsibilities include the foundry, production of Cochrane and heating equipment, distribution transformers and instrument transformers. Power transformers will be produced at Guelph, and that plant will also manufacture reactors and voltage regulators. The head of the department is A. L. Graham. The meter plant is located in Quebec City and is headed by B. I. Burgess.

A seventh operating department is under S. E. Erskine, located at the Company's head office in Toronto, and it will coordinate the sales activities of the apparatus group.

Centralized services to the operating area of the division will be provided by four staff departments, engineering under J. L. McKeever; finance—under R. D. Richardson; relations—under D. R. Brown; marketing—under J. W. Milne. Messrs. J. L. McKeever, B. I. Burgess and S. O. Shields are members of the Institute.

●

John D. Mitchell.—John D. Mitchell has been appointed assistant manager of the Dominion Hoist and Shovel Company, Limited (a division of Dominion Engineering Works, Ltd.) Until his recent appointment he was a sales engineer with the Ontario and Industrial divisions.

●

Peter J. Vakomies.—Peter J. Vakomies has joined Sandwell and Company Limited in Vancouver as a project engineer. He has had extensive experience in the pulp and paper industry and graduated from the Finland Institute of Technology in wood chemistry engineering.

●

(*Continued on page 1551*)

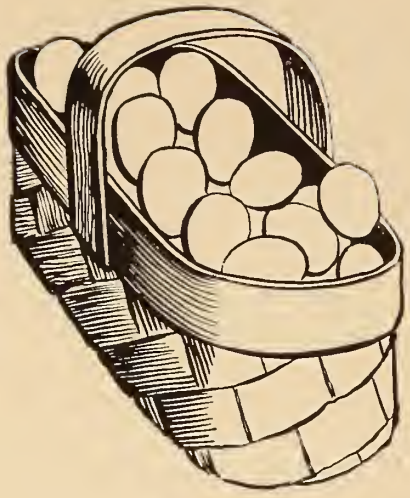
STEEL SHAPES...

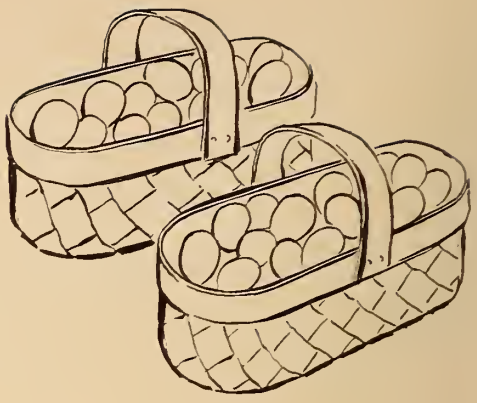
that shape the Future

In Canada's rapidly expanding economy, steel warehouses serve an essential function by supplying steel shapes of all kinds for a multitude of industries. We, in Dominion Bridge, are proud of the fact that we maintain the only *national* warehouse service, serving thousands of customers from steel stocks at nine strategic centres from coast to coast. Under present day conditions, this "on the spot" service means a great deal in meeting urgent requirements.

WAREHOUSE DIVISION
DOMINION BRIDGE
COMPANY LIMITED

Dominion Bridge Company warehouses at:
MONTREAL, OTTAWA, TORONTO, WINNIPEG, EDMONTON, CALGARY, VANCOUVER.
Assoc. Company Warehouses at: AMHERST, SAULT STE. MARIE.
*Other Divisions: Structural, Platework, Boiler, Mechanical.





How will you meet the next supply shortage?

"Sorry, during this shortage period we're only looking after our regular customers."

A regular alternate source of supply is your only insurance against that answer when you're forced to go "looking" because your usual supplier is unable to deliver. Trouble is, when your supplier is jammed with orders, chances are the whole industry is.

If you're shopping for an alternate source for die castings, sand castings, machined parts or forgings, the Wallaceburg people have some interesting facts for you.

Facts about a production-wise engineering department and modern automatic machines that combine to produce *quality products on time, at realistic prices.*

WALLACEBURG
BRASS LIMITED
Wallaceburg, Ont.

DOMINION
DIE CASTING LIMITED
Wallaceburg, Ont.

MONTREAL, TORONTO, LONDON, CALGARY, VANCOUVER

(*Continued from page 1548*)

Ontario Hydro Appointments. — The following appointments have been made by the H.E.P.C. of Ontario. G. D. Floyd, M.E.I.C., director of planning has been named deputy to Dr. Otto Holden, M.E.I.C., assistant general manager-engineering. J. M. Hambley, director of operations was named deputy to A. W. Manby, assistant general manager-administration. M. H. Mackenzie has succeeded Mr. Floyd as director of planning and C. B. Sharpe has taken over Mr. Hambley's former post as director of operations.

●

New Consulting Office. — T. O. Lazarides, Lount and Partners, consulting structural engineers and specialists in prestressed concrete in Toronto opened a branch office in Montreal at 2005 McGill College Avenue. G. M. Demarque, M.E.I.C., is in charge of the Montreal office.

●

Interesting Advertising Appointment. —For, it is believed, the first time in the annals of Canadian advertising an account executive, who has made his name exclusively in the field of industrial advertising has been elected by his Company to the board of directors. This appointment has just been announced by the Walsh Advertising Company Limited. The new Company director is thirty-nine year old Jack Stone who heads the Agency's industrial advertising division.

●

1954
ANNUAL
MEETING
QUEBEC CITY
May 12-13-14

Ruston Hornsby Move. — Ruston & Hornsby Ltd., formerly of 36 Lombard St., Toronto, the Canadian branch of Ruston & Hornsby of London, England, are now settled in their new premises at 2 Paxman Road, Islington, near Toronto.

To mark opening of the plant a reception was held on October 30th. It was attended by some 100 guests. The manager of the Canadian Branch, A. Newland, M.E.I.C., introduced the guest of honour, the U.K. senior Trade Commissioner from Ottawa, Mr. Gordon Bowen.

The new building which is of single storey construction, contains 5,000 sq. ft. It will house the office and warehouse facilities for sales for the Company's products which are sold in Canada and the U.S. The building is located on a five acre site and arrangements have been made for future expansion and for the construction of a factory.

This Company has been well known to Canadian Diesel users for twenty years or more. Engines sold twenty years ago are still running in many parts of Canada and services being maintained. The Canadian distributors are Vancouver Machinery Depot Ltd., Vancouver, B.C.—Electrical Industries Ltd., Edmonton and Calgary—Mumford Medland Ltd., Winnipeg and Regina, Laurie & Lamb, Montreal and Toronto, The Atlantic Bridge Co., Ltd., Lunenburg, N.S., Job Brothers & Co., Ltd., St. John's, Nfld.

●

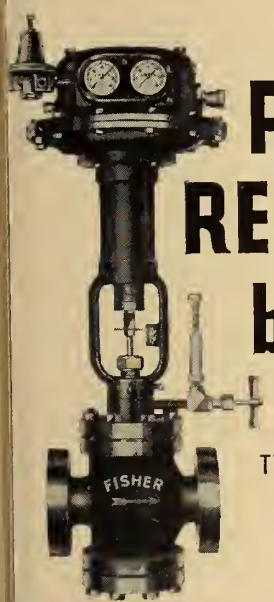
R.C.A. Victor.—R.C.A. Victor Company has announced the appointment of managers to head two new divisions in the products department. R. B. Lanskail has been appointed manager of the government contracts administration division, and B. J. Sibbold has been appointed manager of the engineering products commercial sales division.

●

Slough Estates.—Slough Estates (Canada) Limited, Royal Bank Building, Toronto 1, has undertaken the distribution in Canada of the castors and wheels manufactured by Flexello Castors and Wheels Ltd. and George H. Hughes, Ltd., both of England.

●

(*Continued on page 1554*)



PRESSURE REGULATORS by FISHER

TYPES AND SIZES FOR ALL REQUIREMENTS

MANNING, MAXWELL & MOORE INC.
DANIEL ORIFICE FITTING CO.

Barber ENGINEERING & SUPPLY CO. LTD.
CALGARY
EDMONTON

BOOTH STEELWORK

Designers and Fabricators of Structural Steelwork for Power Stations in Great Britain, Australia and the Yukon. (The illustration above is of Steelwork for Power Station for Public Works Department of New South Wales). Paper Works in Canada, and Works and Bridges in Chile, Africa, India and West Indies.

Illustrated Catalogue on Request

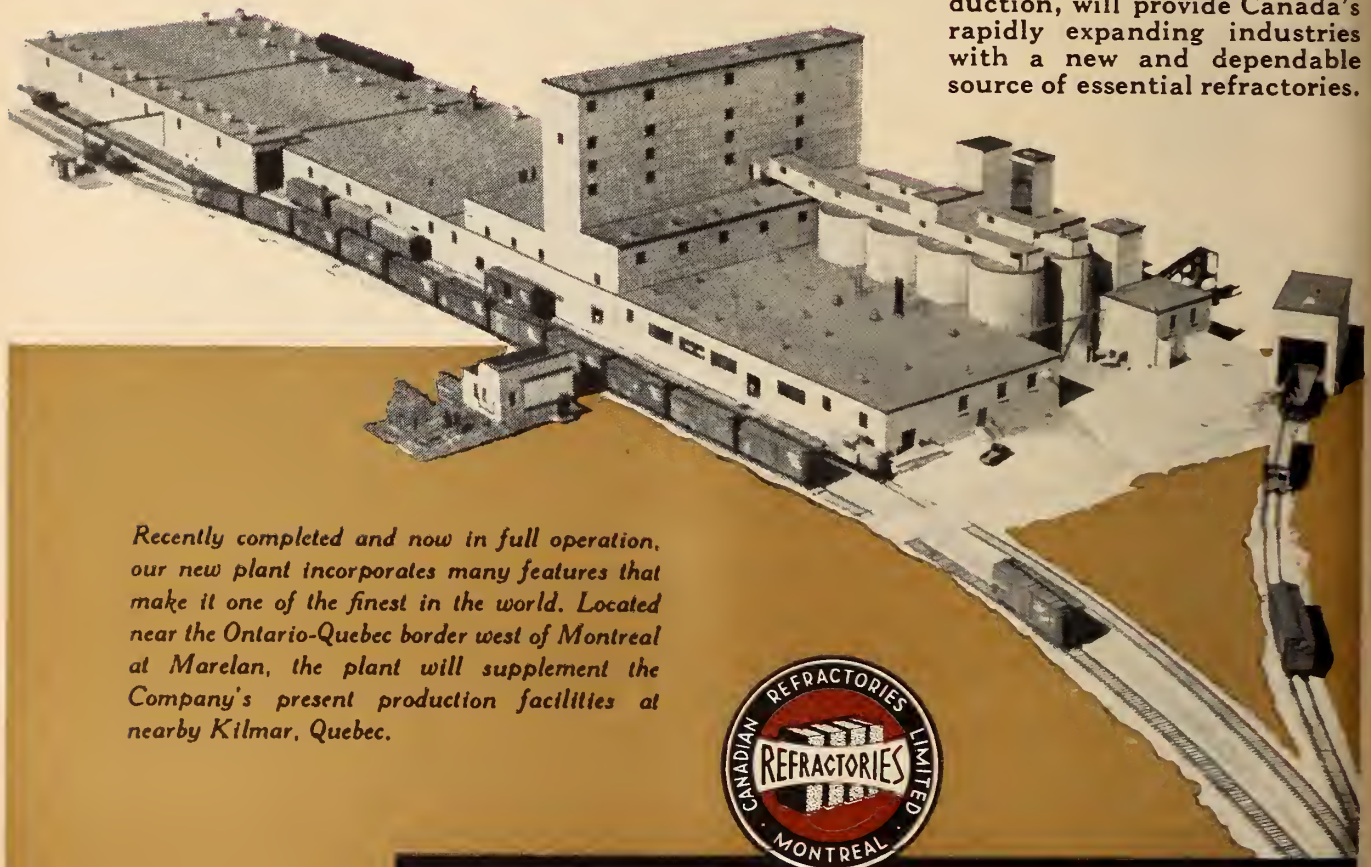
JOHN BOOTH & SONS (BOLTON) LTD.
HULTON STEELWORKS, BOLTON, ENGLAND

Canadian Distributors (Eastern & Maritime)
David McGill & Sons Ltd., 620 Lagauchetiere Street West, Montreal
Phone: UN. 6-3691

Announcing

The World's Most Modern Basic Refractory Brick Plant

Over the past few years the growth in Canadian demand for refractory products has created an urgent need for new manufacturing facilities. Our new plant, occupying an area of 110,000 square feet and equipped to meet the rigid standards established by CRL for high quality refractory production, will provide Canada's rapidly expanding industries with a new and dependable source of essential refractories.



Recently completed and now in full operation, our new plant incorporates many features that make it one of the finest in the world. Located near the Ontario-Quebec border west of Montreal at Marelan, the plant will supplement the Company's present production facilities at nearby Kilmar, Quebec.

CANADIAN REFRACTORIES LIMITED · MONTREAL · REFRACTORIES

CANADIAN REFRACTORIES LIMITED

1050 CANADA CEMENT BLDG., MONTREAL, QUEBEC · 105 WALNUT STREET SOUTH, HAMILTON, ONTARIO

Refractory clinker is brought from our Kilmar plant to Marelan by Company railway cars, mechanically unloaded, and after passing through the crushing and drying section is stored in silos. When required . . .

. . . ingredients from any of the eight 1000 ton silos are ground and sized using 2 dry pan crushers and 2 six foot cylindrical fine grinding mills in circuit with . . .

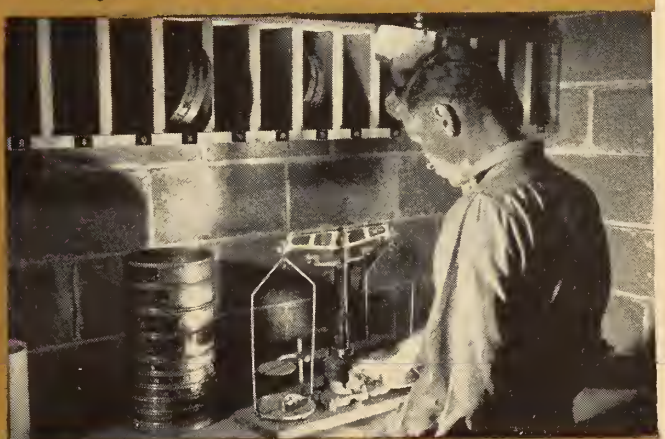
. . . electrically vibrated 3 deck screens. (Overhead duct work is part of a dust collection system which keeps the air clear and clean). The sized materials then go to . . .

. . . the storage bin section, and are stored in 48 giant bins. Sized materials are proportioned automatically in weigh larry, mixed in wetpans, and conveyed by monorail bucket and tram system to . . .

. . . mechanical presses (10,000 lbs/psi) which press the mixtures into bricks of two types (1) chemically bonded and (2) burned brick. Both run through driers. Bricks for burning go through . . .

. . . the 274 ft. Swindell-Dressler oil fired tunnel kiln firing at 2800° F. Optical pyrometer readings double-check automatic temperature controls regulating the kiln operations. Coming from the tunnel kilns . . .

. . . the brick on cars are inspected and loaded onto pallets for storage or shipment to our customers who can be confident. . .



. . . that each phase of the process is controlled at all times by the laboratory, insuring the finest basic refractory brick obtainable.

(Continued from page 1551)

New Equipment and Developments

New Fertilizer Plant.—Chemical fertilizer for Canadian crops holds the spotlight at Kimberley, B.C. The Consolidated Mining & Smelting Company of Canada Ltd., has announced the commencement of operation at the Kimberley fertilizer department. The plant is designed to produce about 190 tons of ammonium phosphate per day. The $9,000,000 project has taken two years to build and, it is claimed, it is one of the most up to date chemical plants in Canada.

●

Gradall Accessory. — The Warner & Swasey Company, Cleveland, Ohio, announced that a new snow removal bucket is available as a standard Gradall accessory.

The new bucket is 60" wide, 32¼" deep and weighs 585 lbs.

●

New Insurance Building.—A new head office building for the Confederation Life Association is the latest addition to Toronto, Canada's "Insurance Row". In this "Insurance Row" $50,000,000 is to be spent in the construction of offices for insurance companies.

The Confederation Life building will be 12 storeys, plus basements, sub-basement and lower boiler room. Overall dimensions are 153 by 173 feet. Part of the concrete foundation walls are 40 feet high from lowest level to grade. General contractor for the project is Angus Robertson, Ltd., Toronto.

●

Allis-Chalmers Motors.—Canadian Allis-Chalmers entered a new field in the Canadian market in October this year, when they announced that polyphase squirrel cage induction motors are now being manufactured in Canada at their St. Thomas Works.

The Company with its main plant at Lachine, Quebec, produces hydraulic turbines, grinding mills, jaw and gyratory crushers, rotary kilns, coolers and dryers, centrifugal pumps and *Texrope* V-Belt Drives. St. Thomas Works in addition to its new line of electric motors, manufactures control equipment for Diesel-electric locomotives.

Motors to be produced include drip-proof, spash proof, totally enclosed and explosion proof types. The larger sizes of totally enclosed and explosion proof are fan cooled. Motors of the same basic design in smaller sizes may be furnished without fan or fan housing as totally enclosed non-ventilated. Initially all types in frame sizes up to and including 326 will be carried in stock. This provides HP ratings up to 20 HP at 3600 RPM.

Motor production in the new facilities at St. Thomas Works is in line with the Company's policy of expanding the range of Allis-Chalmers' products manufactured in Canada.

"Plans are to expand manufacturing facilities to include the larger ratings of polyphase motors in all commercial types," Canadian Allis-Chalmers President M. C. Lowe said. "Our production can be stepped up and increased as the need arises."

Canadian Allis-Chalmers Ltd. became a wholly owned subsidiary of the Allis-Chalmers Manufacturing Co., Milwaukee, on February 1, 1951. The Canadian Head Office is located in Lachine, Quebec.

●

New Binks Plant.—Binks Manufacturing Co. of Canada Ltd., makers of spray painting equipment, opened their new Canadian plant October 5th. It is located at 14 Vansco Road, Toronto, Ont.

●

Unique Relief Maps. — Aero Service Corp., 236 East Courtland St., Philadelphia, have produced new relief maps of the Ruth Lake-Fleming area. They have been prepared to assist the Iron Ore Co. of Canada. The new maps, formed in light weight plastic, were produced in Philadelphia. Basic topographic information was taken from aerial maps of the area compiled by Canadian Aero Service, Ltd., of Ottawa.

These new relief maps show both the topographic situation and the geologic picture for the area. They have been lithographed in three colours to show geologic data provided by the Iron Ore Company's geologists. Following this work they were formed in plastic. Each map is 58 in. wide by 31 in. deep, and weighs only 1½ lbs. The scale is 1 inch equals 1000 ft. and vertical exaggeration emphasizing the relief character is 2 to 1. Cost of 30 copies of the maps, including the master mould, was less than $5,000. This, however, does not include the cost of the air photograph or topographic maps made by Canadian Aero Service, Ltd.

●

Automatic Oscillograph.—A new seven-element automatic oscillograph for recording power system disturbances and photographically recording pre-selected magnitude, wave shapes, and phase relations, is available from Canadian General Electric Company's apparatus division.

The new oscillograph is designated as G-E Type PM-13. It has seven permanent magnetic, fluid-damped galvanometers with a separate shunt and resistor unit for adapting them to current or voltage measurements. Relays and controls are provided for starting the instrument automatically by overcurrent in ¼ cycle, and stopping it after a predetermined interval or after the fault has cleared.

Complete information may be obtained from Canadian General Electric Co., 212 King St. W., Toronto.

●

Pipe Line.—The 24-inch pipeline running from near Edmonton to the big tank farm in suburban Burnaby, which has been constructed at a cost of $97,000,000 and stretches 711 miles across the Rockies, is open for business.

On October 15, $1,000,000 worth of oil gushed through to Burnaby where it will be distributed to tidewater refineries.

The line was not started until the spring of 1952 and 1,500 men have been engaged in its completion. The work is three months ahead of schedule and is Vancouver's first direct link with a major oil producing area.

It was built under the engineering management of Canadian Bechtel Limited and the principal contractors included Mannix Ltd. of Calgary and Comstock Midwestern Limited, of Toronto.

The line is designed to transport initially up to 120,000 barrels a day with more than 50,000 required daily to meet the B.C. demand. The ultimate goal is for a daily capacity of 200,000 barrels.

Coast refineries have spent millions of dollars modernizing and enlarging plants to handle the flow through the pipeline from Alberta. Imperial Oil, the largest refinery in the west has spent $13,500,000. It will handle 22,500 barrels daily.

One of the key pumping stations is at Kamloops, where the coming of the pipeline has brought a $3,000,000 refinery. The stations were built at a cost of $4,000,000 each.

●

U.S. Oil Imports.—According to information released by York-Gillespie Mnfg. Co., there will be strong agitation in the United States for limitation of foreign petroleum imports. In a release issued on behalf of the Company it is stated "The potential inflow of oil from abroad is the crux of the problem confronting the industry and it's a billion barrel a day headache. You'll see and hear demands for limitations on imports. You'll also see plenty of rebuttals. You'll get the feeling that the whole oil industry is split right down the middle—and well it may be. The issue will pop up when the important American Petroleum Institute meets in Chicago next month. It will be echoed when Congress reconvenes in January. The argument will get hotter than a well afire."

The report continues "There are answers, we believe, to this seemingly insoluble problem. We suggest: Intensify efforts to find new uses for petroleum products. Work the engineers and scientists harder. They can take it.

"Develop more export markets for oil products. It can be done by selling more autos and other things that *use* petroleum as well as by devising brand new products for markets overseas. Continue America's expansion so that industry and consumers will demand constantly more fuel and other petroleum products. Some conservationists may tilt eyebrows at proposals to increase total consumption of petroleum. It will, they may fear, hasten the day when oil supplies are ended.

"That's a calculable risk. And since oil that the free world does not use is likely to fall to the Soviets, the risk may be calculated in these terms: Is it better for our grandchildren to live in a world with scarce oil—or no freedom?"

The York Report, over the names of James MacGregor and Charles MacGregor, presidents of the York companies, is circulated privately among business leaders. The date of the release from which this information is taken is October 13, 1953.

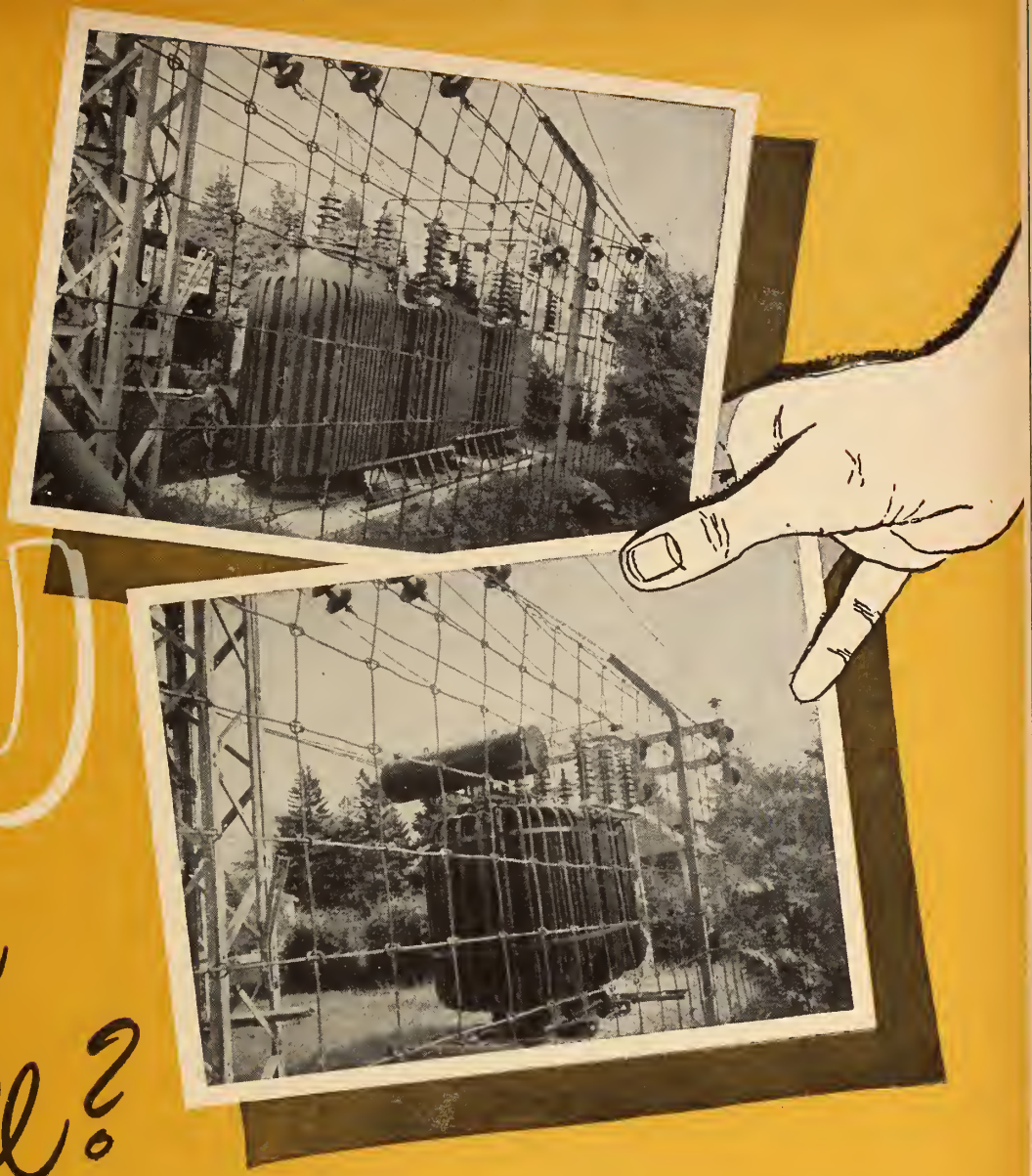
●

Westinghouse Lamp Warehouse.—The Canadian Westinghouse Co., Ltd., is erecting a Regional Lamp warehouse in Etobicoke, Ontario. It will be used to service all lamp customers in the Toronto area.

●

CTURE PUZZLE

Can YOU tell the ifference?



These pictures look alike. But look closely. You'll see *three* transformers in the first photograph and only *one* in the second. Yet these pictures were both taken from exactly the same location — outside the "live area" of the Gatineau Power Station at Hudson, Que. AND — they were taken only four hours apart!

Here's the story . . .

Recently our customers decided to increase the capacity of this important rural substation. The top picture shows three transformers (333 KVA, single-phase) which were replaced — in the lower picture — by our Canadian-built Brown Boveri three-phase 2500 KVA unit. This tripling of capacity, made necessary by increased power consumption in the district, was carried out by engineers of the Gatineau Power Company in co-operation with Brown Boveri experts, and involved a service interruption of only four hours.

This is only one small example of how Brown Boveri is working with our country's industries to help them meet their growing power requirements. Can we be as helpful to YOU?

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Representatives:
HALIFAX: General Equipment Ltd.
KIRKLAND LAKE, ONT.: Mine Equipment Ltd.
WINNIPEG: Power & Mine Supply Co. Ltd.
VANCOUVER: Gordon Russell Ltd.

British Crane Deliveries. — Canada Steamship Lines have placed orders for two major cranes with a British manufacturer. It is claimed that this purchase was influenced by the Company's record for prompt deliveries.

The firm to receive the contract is Wharton Crane and Hoist Co. Ltd. of Stockport, England. This Company commenced exporting to Canada only three years ago. When entering the Canadian market the Company decided to give top priority to Canadian orders, despite the fact that their order book was full and that they were already exporting to 17 countries. They now claim that they hold as much overhead crane business in Canada as all other British firms put together.

Their first order for the Nova Scotia Light and Power Co. Ltd. and delivery made in August, 1950, only 30 weeks after receipt of the order. Normal delivery at that time was 75 weeks. Since that time they have shipped a total of 20 overhead travelling cranes to this country, mostly for use in power stations, shipyards and steel yards.

R. H. Campbell, director and sales manager of the Company, who recently spent 12 weeks in Canada, stated "all things being equal Canadians are more than willing to place orders in Britain rather than in America. "But," he added, "you have to be truthful and realistic about deliveries. We have gone all-out for the Canadian market and we are happy to say that we have never let a customer down and we don't intend to."

●

Dominion Bridge and Engineering Visitors.—On the concluding day of our four day conference in Montreal some 150 members of the Technical Association of the Pulp and Paper Industry visits were made to the plants of Dominion Engineering Works Limited and Dominion Bridge Company Limited, Lachine. During the course of their visit, the visitors were entertained at lunch by the Dominion Bridge Company Limited.

The tours of plants were most comprehensive. The visitors were shown the operations of all the principal departments. Special interest was shown in the extensive platework and welding facilities at Dominion Bridge, including the largest stress relieving furnace in the Country and a fully equipped X-Ray laboratory.

At Dominion Engineering Works examinations were made of the transmission equipment, suction rolls, water turbines, power cranes and shovels, diesel engines, etc. and great interest was shown in the 52 ft. boring mill which is the largest in Canada and one of the largest on the continent.

●

New Chemical Plant.—Contracts valued at almost $3,000,000 have been placed to date with Canadian firms for supplies or services connected with construction of the $20,000,000 "Tervlene' polyester fibre plant of Imperial Chemical Industries of Canada Limited. This plant is being erected at Millhaven, Ont., near Kingston.

●

New Canadian Company. — The formation of Dow Corning Silicones Limited, a Canadian associate of the Dow Corning Corporation of Midland, Michigan, has been announced by Dr. W. R. Colling, vice-president and general manager of Dow Corning Corporation. Construction of a warehouse and office building was commenced on a four and one-half acre site immediately north of Toronto.

Formation of Dow Corning Silicones Limited, will offer greatly expanded services to the presently established silicone market, as well as making its services available to numerous new fields. The plant will commence operations in January, 1954.

●

Heated Highways. — Boston's new $25-million aerial highway now being constructed may serve as the model for the highway of the future.

While most of the United States' modern roads are built for speed and safety, designers of the aerial highway are going a step further by installing heating pipes to melt snow and ice from all access ramps of the new thoroughfare. When completed, the Boston expressway will be the largest snow melting installation in the U.S.

To assure dry road surfaces in the blustery cold months, wrought iron pipe grids are being embeded in each of the seven ramps serving the new highway. Although the individual ramps have their own snow melting system with pump, heat exchanger and pipe units, the total area served amounts to more than 161,000 sq. ft. of concrete pavement.

To operate the systems, steam supplied by Boston Edison Company, is fed to heat exchangers. Water mixed with ethylene-glycol anti-freeze, is circulated through the heat exchangers and pipe networks. The heated concrete pavement prevents ice from forming and melts snow as it falls.

Each snow melting system is designed for automatic or manual operation—or for a combination of both.

●

Welding Control.—A new synchronous-precision control for fast high-quality resistance welding of hard-to-weld metals, is available from Canadian General Electric's apparatus division.

It is adaptable for bench, spot, seam or combination welders. It accurately regulates the value of the current and length of time it flows, to help assure high quality welding especially where short durations of weld current are necessary for high speed applications.

The control was developed for use in welding stainless steel, aluminum, magnesium, and other non-ferrous alloys with a short plastic range and where good welds with few rejects are necessary to keep production at peak capacity, such as in chain welding, relay components, or electronic tube fabrication. It is also designed for use where varying welding quality is not acceptable such as in the manufacture of jet engines or airplanes. It can be used on motor, fluid, or air-operated welding machines.

For complete details communicate with the Canadian General Electric Company Limited, 212 King St. W., Toronto. A special bulletin No. GEA-5945 is available.

●

Ductile Iron Producers. — Under the auspices of The Mond Nickel Company, a subsidiary of The International Nickel Company of Canada, Limited, the Third International Meeting of licensed producers of magnesium-containing, spheroidal-graphite iron (Ductile Iron) was held in Paris, France, on September 22. The meeting was attended by 150 representatives of licensees in 18 countries and papers on all aspects of the production and application of spheroidal-graphite irons were read and discussed.

Subsequently, on September 28 and 29, a tour in which 100 persons participated, was made to the works of four of the licensed foundries in Eastern France, namely, J. Marichal Ketin & Cie, Berlaimont; Gailly Freres, Charleville; Societe des Acieries de Longwy, Sedan; and Societe des Fonderies de Pont-a-Mousson, at the kind invitation of these firms.

●

New C.G.E. Plant. — Canadian General Electric Company has purchased a ten-acre site in the Rexdale subdivision of Etobicoke Township, Ont., for a proposed new Carboloy cemented carbides plant. Announcement was made by J. S. Keenan, general manager of the Company's industrial products division.

Plans call for construction of a single story building with a floor area in excess of 40,000 sq. ft.

●

Canada's Future.—Speaking at a dinner meeting of the Greater Niagara Chamber of Commerce, Frank S. Washburn, president of North American Cyanamid Ltd., said "Canada is on the march—and so is the chemical industry." "For even as Canada must assume new responsibilities and meet new obligations as she reaches full economic maturity, so must the chemical industry meet the ever-changing needs of industry in seeking out new products, finding new uses for old products and finding new routes to old destinations."

Mr. Washburn said that research was the all-important factor in the chemical industry, for a chemical product "to thrive in this competitive age must have diversity of application."

Tracing the rapid growth of the industry, the speaker pointed out that the annual chemical output in Canada has increased five times since 1939. "The output this year," he said, "should be better than the $800 million peak of 1952."

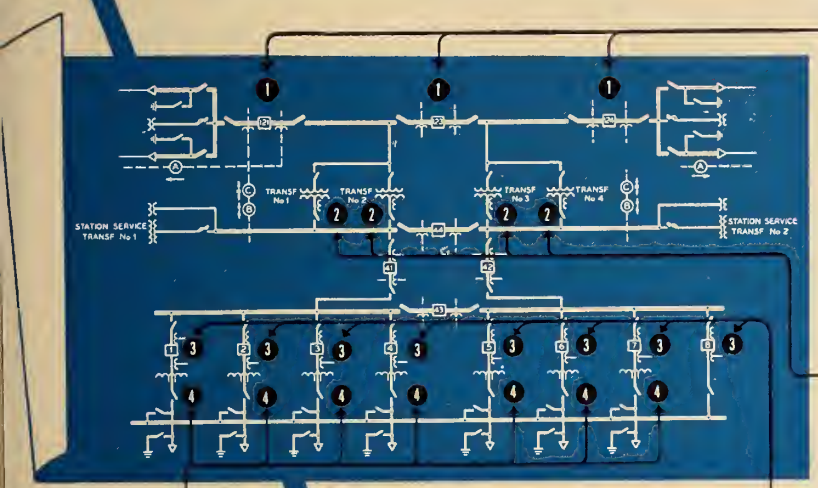
Terming this growth "only a beginning," Mr. Washburn stated that the future holds a challenge and opportunities for the chemical industries, and for Canada as a nation.

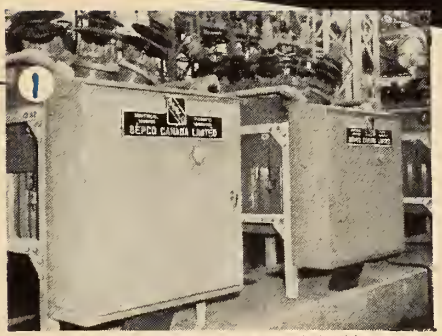
He pointed out that Canada's contribution to the free world's economy will be a vital one, in view of the fact that, despite present achievements, only 25 per cent of her area has been explored. In comparison, he quoted the Paley Report which stated that the United States was "rapidly becoming a have-not-nation".

Mr. Washburn praised Canada for her atomic and jet flight progress and praised the Canadian Government for its decision to turn over development of atomic power for industry to private enterprise. He said "While we appreciate that government control is necessary in some cases, such as development of the A-bomb, we hold that private industry is the quickest and best means to put the atom to work commercially."

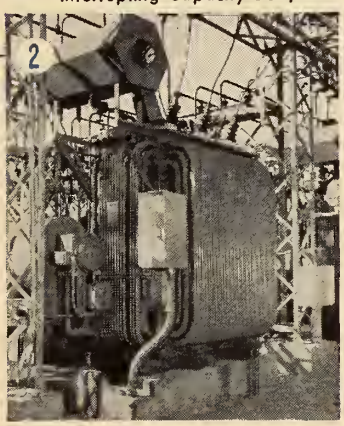
(*Continued on page 1562*)

ANOTHER OUTDOOR SUBSTATION EQUIPPED BY BEPCO-

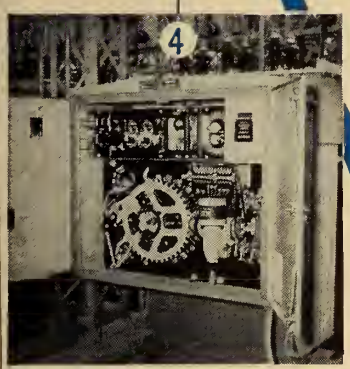




Incaming Line Breakers, 12.3 KV.
Interrupting Capacity 500,000 KVA.

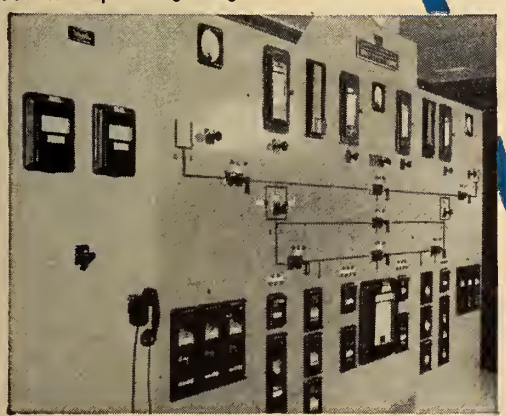


Oil Immersed Transfarmer 12,300/4,160 Valts. Self-caaled 3,000 KVA. (3,500 KVA Air-blast coaled.)



Feeder Step Voltage Regulators.

Feeder Breakers 4 KV.
Interrupting capacity 250,000 KVA.



Clase up af
Contral Switchboard.

The Cremazie Substation of Hydro-Québec, located in Montreal has a capacity of 14,000 KVA. Power at 12,300 volts from two incoming lines is transformed to 4,160 volts and distributed to 7 outgoing feeders at a regulated constant voltage.

Bepco Engineers will co-operate with you when planning your Substation.

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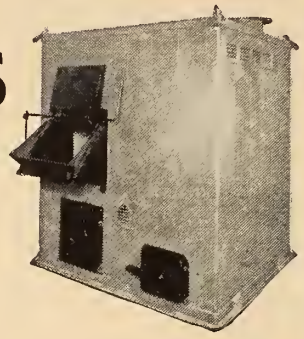
SIMPLIFIED TRASH BURNING



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- **SECONDARY AIR INTAKES:** Insures complete combustion. Keeps flue gases below 700°.
- **BRICKWORK:** The brickwork in the trash burner is entirely suspended. This frees walls from mechanical strain—has double the usual life expectancy.
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This packaged, portable unit operoting on as low as an 18 ft. refroctory-lined stock, shipped in two sections for erection. Incinerotor ond stock reodily positioned for same doy operotion. Simple concrete pod eliminotes true foundation. This unit performs without emitting fly ash, soot, sporks, odors. No property contominotion. Burns 500 lbs. of usuol plont wostes per hour with same reduced to but one pound of osh.

USE THE COUPON to find out how this unit can work for you to cut your costs, sove floor spoce now used for stocking trash, ond increase operating efficiency.

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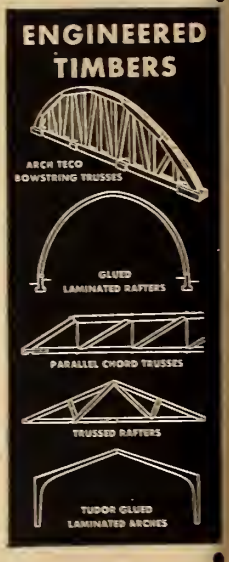

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For full information and illustrated booklets write to Timber Structures of Canada Ltd., P.O. Bax 837D, Peterborough, Ont.

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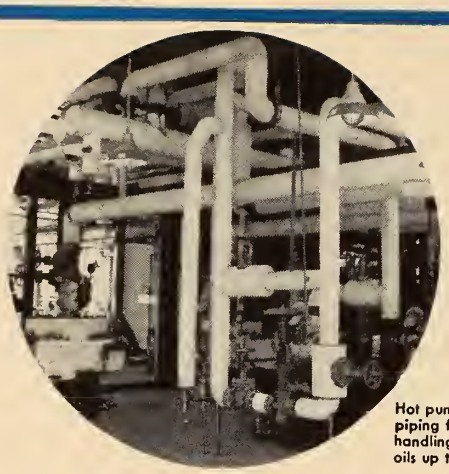
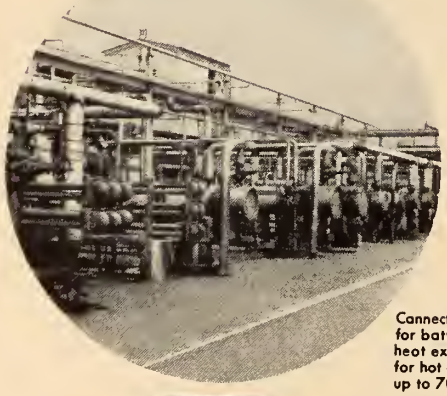
MEASUREMENT OF INDUSTRIAL PROGRESS

CANADIAN OIL DISCOVERS . . .

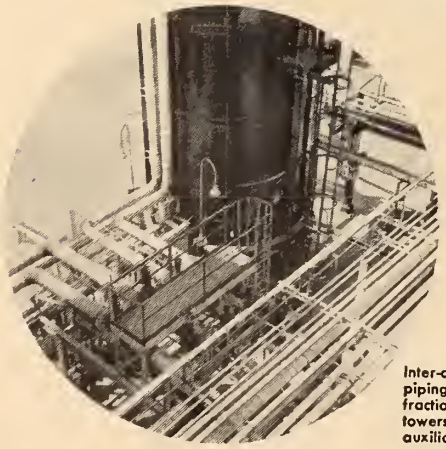
Canadian Oil Refineries, Ltd. chose Northern Power to fabricate the piping for the crude distillation unit and power house at its new plant at Sarnia, Ont. They discovered that Northern Power's skilled personnel and specialized shop facilities assured top quality, maximum economy and complete customer satisfaction.



Hot pump house piping for handling hot oils up to 700° F.



Connecting piping for battery of heat exchangers for hot oils up to 700° F.



Inter-connecting piping for fractionating towers and auxiliaries

Why this discovery is important to you !

You may be working on plans right now for a new refinery, power station, paper mill or chemical plant. If so, what Canadian Oil discovered should be of real interest to you.

Northern Power can offer you piping fabricated under ideal conditions by trained personnel qualified in all classes of work. The price (determined in advance) includes competent engineering, scheduling and shop sketches, efficient material procurement. Northern Power will finance all material inventories and payrolls; carry insurance; supply heat, light, power, water, compressed air, expendable tools and supplies. The customer pays for no waste material or spoilage. In addition, all fabricated piping is rigidly inspected and tested to meet exacting requirements of customer's specifications and applicable codes.

So, before your plans get too far along, call in Northern Power. Benefit from the expert knowledge which this versatile orgnization of piping specialists is in a position to offer . . . *anywhere in Canada.*

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how many of the ***28,179 customers*** *were yours?*

CROSSROADS OF WORLD TRADE

A Canadian textile exhibitor claimed some. He sold over 311,000 yards of corduroy, 50,000 yards of swim suit fabric and 2,000 yards of other materials.

A spokesman for a Canadian construction equipment firm reported "A hundred times more business than expected".

Two Canadian cities reported success in attracting new industries.

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Business visitors from 57 countries . . . from every Canadian province and 40 states south of the border.

Half the exhibits from Canada, the rest from 26 other countries—264,843 square feet of exhibit space taken, 40% more than the previous year . . . before the '53 Fair was over space contracts were signed for '54.

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1954 7*th Annual*

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2201 Eglinton Avenue East, Scarboro, Ontario

(*Continued from page 1556*)

Reviewing the part played by Cyanimid in Canada's rapid economic development, he pointed out that the company was Canadian-born. The Niagara Plant was established in Niagara Falls in 1909 as the company's original unit. Since then, the organization has grown both in Canada and the United States, and has established locations or connections on all continents of the world.

●

New Brake Motor.—A new brake motor employing a revolutionary new magnetic brake which cuts length requirements by 50 per cent without sacrificing brake torques, has been announced by Reliance Electric & Engineering (Canada) Ltd., Welland, Ontario.

The Reliance Brake Motor employs a brake having only six major parts which is extremely simple in construction, operation, and maintenance. Its direct, positive action eliminates all the linkage encountered in conventional designs, and attendant difficulties. Its compactness permits mounting in tight places. The motor shaft can be extended through the brake, permitting double-ended take-off or reverse rotation. Its fast action set and release conserves valuable production time.

The new brake motors are provided with automatic wear adjustment for long, trouble-free service life. The brake units are housed in a one-piece weather-tight enclosure, and are available with protected open, splash-proof, or totally-enclosed, non-ventilated motors, 220, 440, or 550 volts, 2 or 3 phase, 25 or 60 cycles, in frame sizes ranging from 203 to 326; and with brake torque ratings ranging from three pounds feet to 75 pounds feet.

The outstanding advantages of the Reliance Brake Motor, coupled with its versatility and applicability to a wide range of motor types and ratings, should make it of primary interest to users and builders of conveyors, packaging machinery, machine tools, and production equipment in the construction, foods, metal working, mining, textile, woodworking, paper and paper converting, printing trades, laundry, mechanical test equipment, and many other industries.

●

Surface Corona Discharge.—A new device for detecting surface corona discharges which often indicate trouble or cause damage to insulation in high-voltage rotating equipment, is available from Canadian General Electric Company's apparatus division.

Designed to increase safety factors by having all cable shields, metal fittings, and case at ground potentials, the portable electronic equipment is for manufacturers of large electrical apparatus such as turbine-generators and high-voltage motors.

In operation the unit under test is ordinarily submitted to a normal test voltage (line-to-ground value in most cases). The probe is positioned on a bar and pushed firmly in place, the peak-to-peak value of the corona is recorded from the oscilloscope screen, and comparative readings are made on all bars.

Operating power is furnished by a 67½-volt dry cell battery and a 1½-volt dry cell filament battery. Resonant frequency of the unit is 10 kc. For complete details communicate with the Company at 212 King St. W., Toronto.

●

New Dominion Bridge Plant.—A. H. Cowie, vice-president and general manager of Dominion Bridge Company Limited, has announced that plans are now under way for the construction of the first section of the Company's new plant on a 56 acre site in Toronto.

The first unit, providing about 60,000 sq. ft. of floor space, is expected to be in operation in 1954. The initial expenditure will probably be in the vicinity of $1-million and the long term fabrication programme will involve an expenditure of from $15 to $20-million.

Construction of the new plant is already started with Anglin-Norcross Co. Ltd. as the general contractors. The initial plant will employ about 150 men and as further units are added the number of employees will be increased, reaching an ultimate figure of about 1,500.

It is anticipated that the Company's entire Toronto operation will, eventually, be moved to the new site.

●

Log Barker.—A new Swedish portable log barker known as the "Mira" is now being manufactured in Canada at the Dominion Bridge Company's Lachine and Vancouver plants. The machine is designed for handling logs from two to twelve inches in diameter, and for long logs. Later, a machine will be made for handling logs of larger diameter, as well as one for handling four feet long wood.

Mounted on rubber-tired wheels, it can easily be moved from place to place. Actual service under varying conditons has shown that it can handle rapidly practically all types of logs, hardwood as well as softwood, crooked logs as well as logs with a large number of knots, cleaning the wood efficiently with practically no loss and with very little damage to the logs.

●

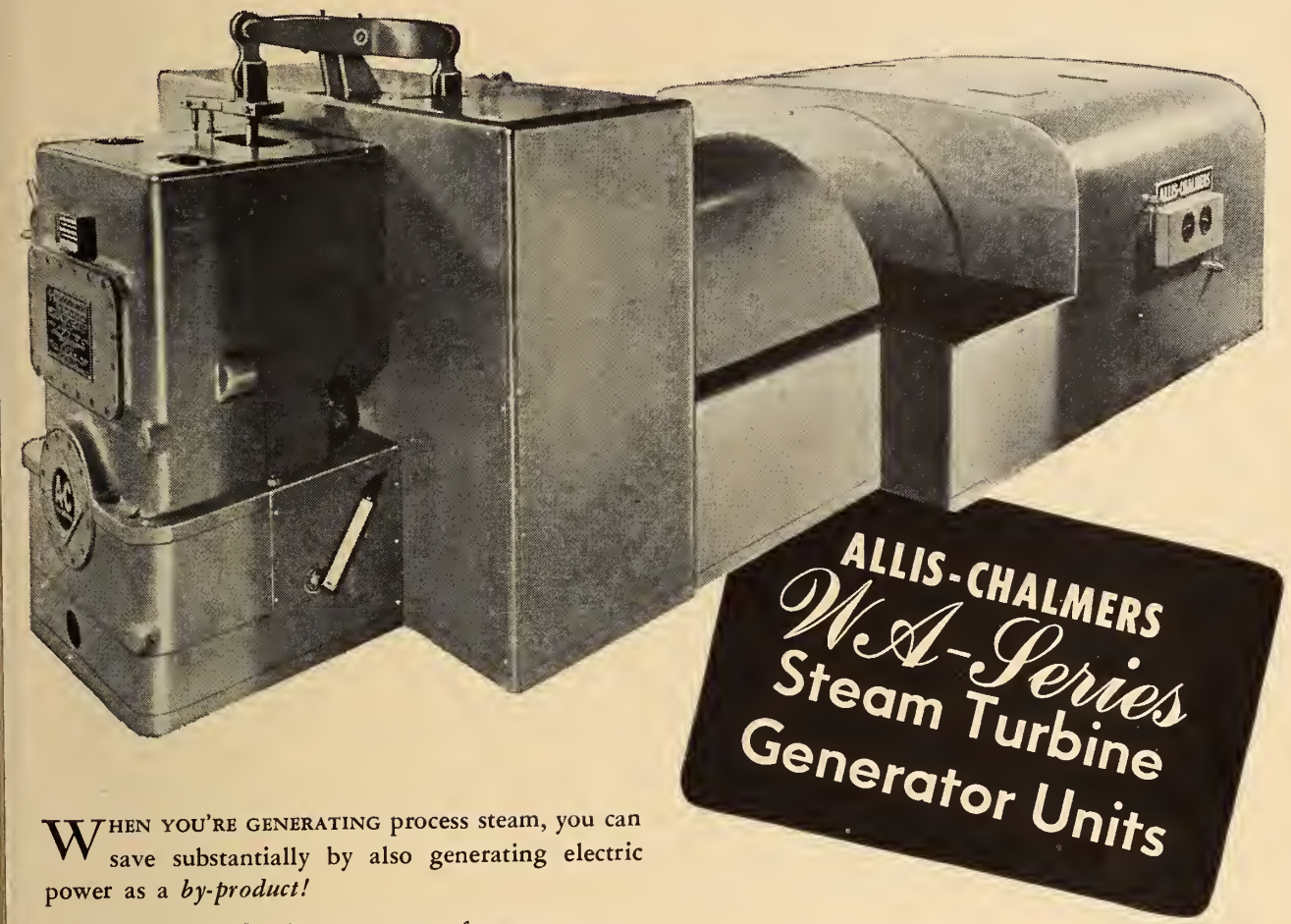
Duplex Boring Machine.—The firm of Kitchen and Wade Ltd., Halifax, Yorkshire, England, has produced a new machine for work on turbine-body steel castings. It is a large duplex drilling, boring and screwing machine whose two drilling heads are entirely independent of each other and are made right and left hand. Each is powered by a 15-hp. motor, the drive being transmitted through an 18-speed gearbox to the spindle to give speed ranges from ten r.p.m. to 300 r.p.m. The heads have a maximum centre distance of ten feet, their minimum centre distance being two feet ten inches. The spindle has a minimum diameter of five and a half inches and the nose is bored No. 7 Morse taper. A feature is that the machine has a range of screwing feeds, from four to 12 threads per inch, in addition to the 20 drilling feeds with a range varying from 13½ to 120 cuts per inch. This enables holes of from two and a half to eight inches diameter to be screwed by a single point tool, and such a tool has been designed for use on this machine. The spindle rotation is controlled by forward and reverse friction clutches; an automatic trip is fitted to the spindle feed to control depth of drilling. The spindle feed is 27 inches in length. Quick adjustment is provided for by a four-lever control on the front of the head and a slight forward movement of any one of the levers engages the power feed. A hand wheel on the lower part of the head controls the fine feed. Sideways movement of the drilling head is effected by either a hand-operated or power-operated traverse. The cross-rail has a four feet vertical adjustment provided by power-operated elevating screws equipped with safety nuts. The table is ten feet square and it has a ten feet power traverse. A high-speed drive on the table enables the operator to move work rapidly towards the spindles and then, by pressing a button, a slow feed of three inches per minute can be brought into operation to help in obtaining the precise alignment required. A lock operated by a press button is also coupled to the table traverse. It is claimed that the machine, which is controlled by push-buttons of the duplex pendant type, is light in operation. To ensure safe and efficient operation it is provided with mechanical and electrical interlocks. These prevent any movement of the traverse gear when spindle motors are energised by making all traverse motions inoperative, and safety trips are fitted at the extreme positions on all the traverses. Overall height is 23 feet and the net weight is 152,320 pounds. Automatic lubrication is provided.

●

Lightweight Structural Framing.—The Planning and Design Department of British Optical and Precision Engineers, Ltd., Mortimer House, Mortimer Street, London, W.1., has produced a series of lightweight prefabricated structural elements that can be easily erected to fit an extensive range of space requirements and can then be readily dismantled. Originally designed to be used in the installation of temporary stage structures, to carry curtains, scenery and lighting equipment, the elements have been found to have applications in industry wider than those for which they were first produced. In the design of the structural framing, it had to be adaptable in size to suit available space in a large variety of buildings, to be easily and safely erected and dismantled by totally unskilled labour, to be easily broken down into manageable units for transportation and, finally, to be of sufficient strength to support intermittent and haphazard loading over considerable spans. The basic elements are few, the two most important being the girder section (which is of the basic element for both beams and stanchions) and a box joint. The girder embodied in a typical framework is made in five lengths, in steps of six inches from two feet six inches to four feet six inches and is a Warren-girder type of lattice with top and bottom stringers of one inch diameter tube of 16 gauge mild steel, at 12-inch centres, cross-braced by three-eighths of an inch diameter rods that are welded to the stringers and with end posts cut from a small-section channel. The end posts are drilled at standard pitchings for quarter of an inch bolts which are used for securing all connections. To give maximum adaptability in construction the same pitch of bolt holes is reproduced in all the other elements. The principal element in the system is the box joint, used for forming the connection between

(*Continued on page 1573*)

Make Your Process Steam Serve Double Duty!



WHEN YOU'RE GENERATING process steam, you can save substantially by also generating electric power as a *by-product!*

For if you need a large amount of steam anyway, it costs only slightly more to establish higher pressure steam conditions for operating a turbine-generator unit as an efficient pressure reducing valve. Process steam leaves the turbine at controlled pressure; power is generated as an economic by-product.

Allis-Chalmers modern WA-Series impulse steam turbine generator units are built especially for the economics inherent in such applications. WA-Series unit designs fit into your plant; tie-in thermodynamically, as well as electrically paralleling with other units or systems.

They are being built in NEMA ratings from 2000 to 7500 kw, for both condensing and non-condensing service, with or without automatic extraction. The WA-Series brings to the industrial and utility power plant the economics of repetitive manufacture as well as the design refinements proved by long steam turbine generator experience.

Purchaser convenience and simplicity are paramount in WA-Series design. Three-bearing construction, above-floor oil piping and bracket bearing, housing type generator — all make a compact unit with simple foundation requirements.

Get the *full* story on the modern WA-Series! Be sure your next generating unit has *all* the latest features. Call your nearest CA-C Sales Office or write for Bulletin B7654 to Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Quebec.

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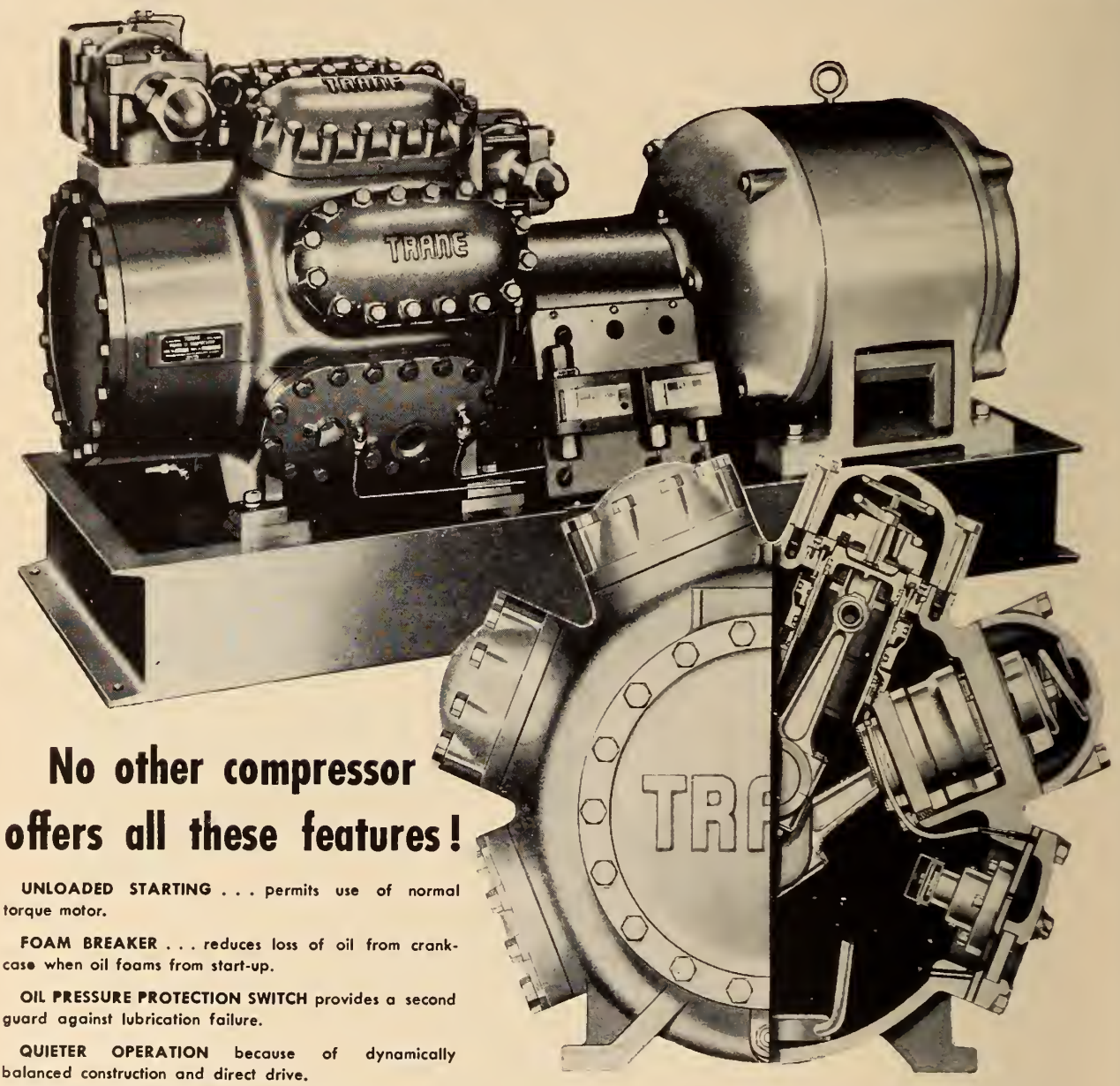
52-CAD-10

You need THIS FREON 12 COMPRESSOR to give customers

REFRIGERATION SATISFACTION



No other compressor offers all these features!

UNLOADED STARTING . . . permits use of normal torque motor.

FOAM BREAKER . . . reduces loss of oil from crankcase when oil foams from start-up.

OIL PRESSURE PROTECTION SWITCH provides a second guard against lubrication failure.

QUIETER OPERATION because of dynamically balanced construction and direct drive.

SIMPLIFIED INSTALLATION with fewer connections to make on job — it's factory assembled!

MODERN DESIGN with two piston sizes, 2, 4 and 6 cylinders, 10- to 50-ton capacity.
Available with shell-ond-tube condenser above compressor.

SMOOTHER OPERATION because of carefully balanced light-weight aluminum pistons and connecting rods.

The New TRANE RECIPROCATING COMPRESSOR

For FULL INFORMATION about the TRANE Reciprocating Compressor, contact the TRANE representative in your area, or write Trane Company of Canada Limited, 4 Mowat Avenue, Toronto 3, Ontario.

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Underfloor Distribution A Modern Necessity

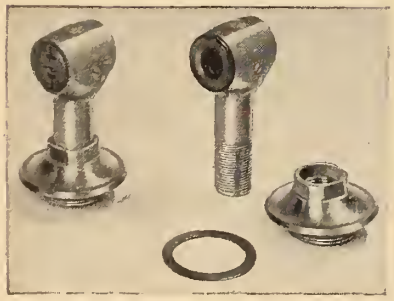
Phontom view of a Walker Underfloor wire distribution system.

Advantages to Owners and Tenants

Walkerduct provides a flexible distribution system which will efficiently meet the changing electrical needs of office, store, or factory rearrangements. Electrical outlets may be added or removed quickly and easily, without disturbing the floor or interfering with the occupants of the room. These changes can be made inexpensively as no further cost is entailed beyond pulling wires and connecting outlet fittings.

A Walker system improves the appearance of any office. Outlets are safely wired and located under the equipment, where they properly belong.

Tenants know each new electrical need is answered before it can become a problem. Owners realize that their duct systems are paying regular dividends as the expense of electrical renovations is constantly avoided.



Service Fittings

Sturdy fittings are available for various services such as power, telephone and signal circuits. Flaar flange supparts screw into inserts ond are locked-in by shank of standpipe. A gasket under flange seals out moisture.

Two Types of Walkerduct

1. The "pre-set locked-in" system for new buildings.

The standard Walkerduct system is a network of one or more rectangular steel ducts with inserts cast in the concrete floor, forming continuous, concealed raceways for power, telephone, or signal wiring circuits. By means of closely spaced "preset" inserts, formed in the duct during manufacture, convenient outlets for each service can be quickly provided to serve any desk or machine location on the entire floor area.

2. The "flush locked-in" system for modernizing existing buildings.

The Flushduct system is installed by cutting a shallow trench in the existing floor, grouting in the duct level with the old floor and recovering the area with linoleum or tile. Walker Flushduct provides the convenience and flexibility of a standard distribution system.

Various types of outlet fittings are available for high or low tension services, each of which locks tightly into the duct, assuring a safe, metallic, grounded system.

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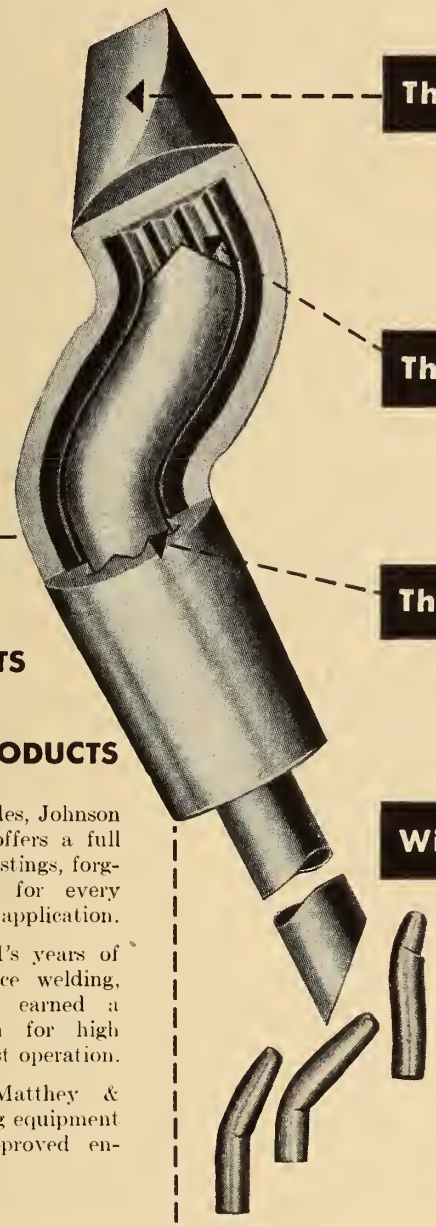

They're tougher

because they are bent cold from full hard rod stock . . . retaining maximum physical and mechanical properties, which can't be equalled by cast or forged electrodes.

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because cooling water goes all the way to the welding face . . . even on double-bent electrodes. Water tube is bent in place.*

They run cooler

because fluted† cooling water hole — an exclusive Johnson Matthey & Mallory feature — has 70% greater cooling area for higher heat transfer efficiency.

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You can probably find *the* electrode for your application in the scores of standard shapes available from Johnson Matthey & Mallory. If you need a special style, send a sketch of your requirements . . . and J.M. & M. will design and cold-form electrodes to your exact needs.

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(In the U.S. made and sold by P. R. Mallory & Co. Inc. Indianapolis 6, Indiana)

*U.S. Patent 2,489,993 †Patent pending

CUT YOUR WELDING COSTS WITH THESE J. M. & M. PRODUCTS

In addition to electrodes, Johnson Matthey & Mallory offers a full line of holders, dies, castings, forgings, rods and bars for every resistance welding application.

Backed by J.M. & M's years of experience in resistance welding, these products have earned a world-wide reputation for high production and low-cost operation.

Rely on Johnson Matthey & Mallory . . . for welding equipment and for sound, field-proved engineering service.

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POWER

...r better living!

Abundant low-cost power attracts industries, adding to national wealth. It encourages the use of labour-saving devices in the home and in many ways contributes to a higher standard of living.

Canada's installed hydroelectric power supply at the end of 1952 was 14,363,600 horsepower. This is about one horsepower per capita of population, and is roughly equivalent to the steam power which could be generated by burning some 35 million tons of coal per annum.

Power is one of this country's most valuable assets. But, great as the supply already is, increasing demand is being met by huge new projects now under construction from the Maritimes to the Pacific coast. Fortunately Canada still has vast reserves to draw upon — four-fifths of its potential remains to be harnessed.

Wresting power from nature requires careful planning, hard work — and explosives. Tunnels must be driven; canals, tailraces and foundations for dams and powerhouses must be excavated. On the average, three to four cubic yards of solid rock must be moved for every horsepower developed.

* * *

Large scale hydroelectric projects would be impractical without explosives. C-I-L is proud of the part it has played and is playing in these enterprises; for it supplies explosives and technical assistance wherever they are required for blasting operations from coast to coast. *Canadian Industries Limited, Explosives Division, Montreal.*

Facts about hydroelectric power

Canada's installed capacity of approximately one horsepower per capita is second only to that of Norway. The Province of Quebec leads the rest of the country with 1.6 horsepower per capita.

Approximately 3,000,000 horsepower can be developed in conjunction with the St. Lawrence Seaway of which about 1,000,000 would go to the U.S.A.

One of the largest power projects ever undertaken in Canada is at present under construction at Niagara Falls. To divert water from the river to the power plant requires the driving of two of the largest tunnels ever constructed. Each of them will be 51 ft. in diameter and 5½ miles long, right under the city of Niagara Falls, Ont.

Another large hydroelectric plant is under construction at Kemano, B.C. This will utilize a head of 2,600 ft., by far the highest ever created in Canada.

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"Everything for Blasting"

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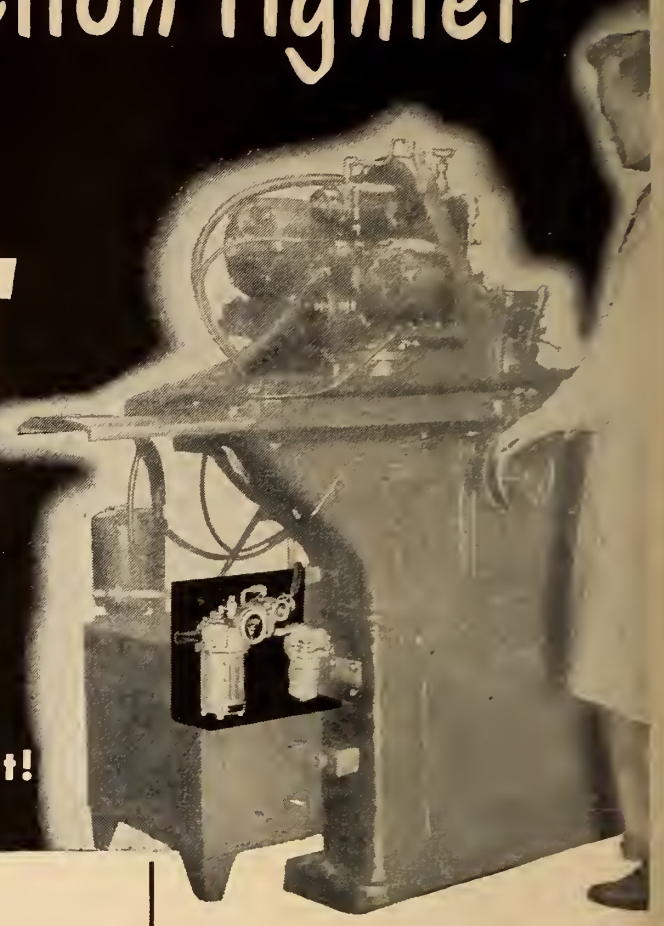
EXPLOSIVES
SERVING CANADIANS THROUGH CHEMISTRY

Air-Borne "Friction Fighter"

Alemite OIL-MIST Lubrication



*** extends bearing life as much as 17½ times!**
cuts oil consumption up to 90%
boosted production 50% at one plant!

Here from Alemite—world leader in lubrication—is lubrication progress so major—so far reaching—as to command the interest of *everyone* concerned with industrial lubrication practices and costs. Alemite Oil-Mist! The most efficient, continuous, fully automatic system in the field of machinery lubrication.

Alemite Oil-Mist! The system that atomizes oil into *mist*—distributes it through tubing to bearings—bathes *all* bearing surfaces with fresh, clean, cool oil film. A system that simplifies and materially cuts the cost of machinery lubrication. A lubricator unit that has no moving parts.

Oil-Mist uniformly maintains oil film on plain and anti-friction bearings, gears and chains *regardless of variations in load, temperature or speed.* Eliminates the "human element."

Check All the Oil-Mist Advantages

- Reduces bearing temperatures as much as 20%.
- Continuaus, unifarm lubricatian of all bearings.
- Air pressure seals bearings against dirt.
- Prevents praduct spoilage.
- Eliminates guesswark—each bearing picks up as much Oil-Mist as it needs.
- Reduces starting and running torque.

WRITE FOR DETAILS OF THE ADVANTAGES OF THE ALEMITE OIL-MIST SYSTEM . . .

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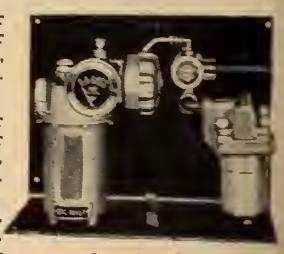
Delivers Oil to Bearings 3 Ways

Oil-Mist as Such. Most commonly applied to any type of anti-friction bearing—ball, roller or needle.

Oil in Spray Form. For open and enclosed gears and chains. Spray nozzle partially condenses mist into semi-liquid form and directs the spray onto a concentrated area.

Oil in Liquid Form. For plain bearings, slides, ways, vees, cams and rollers. In these applications, condensing fittings are used.

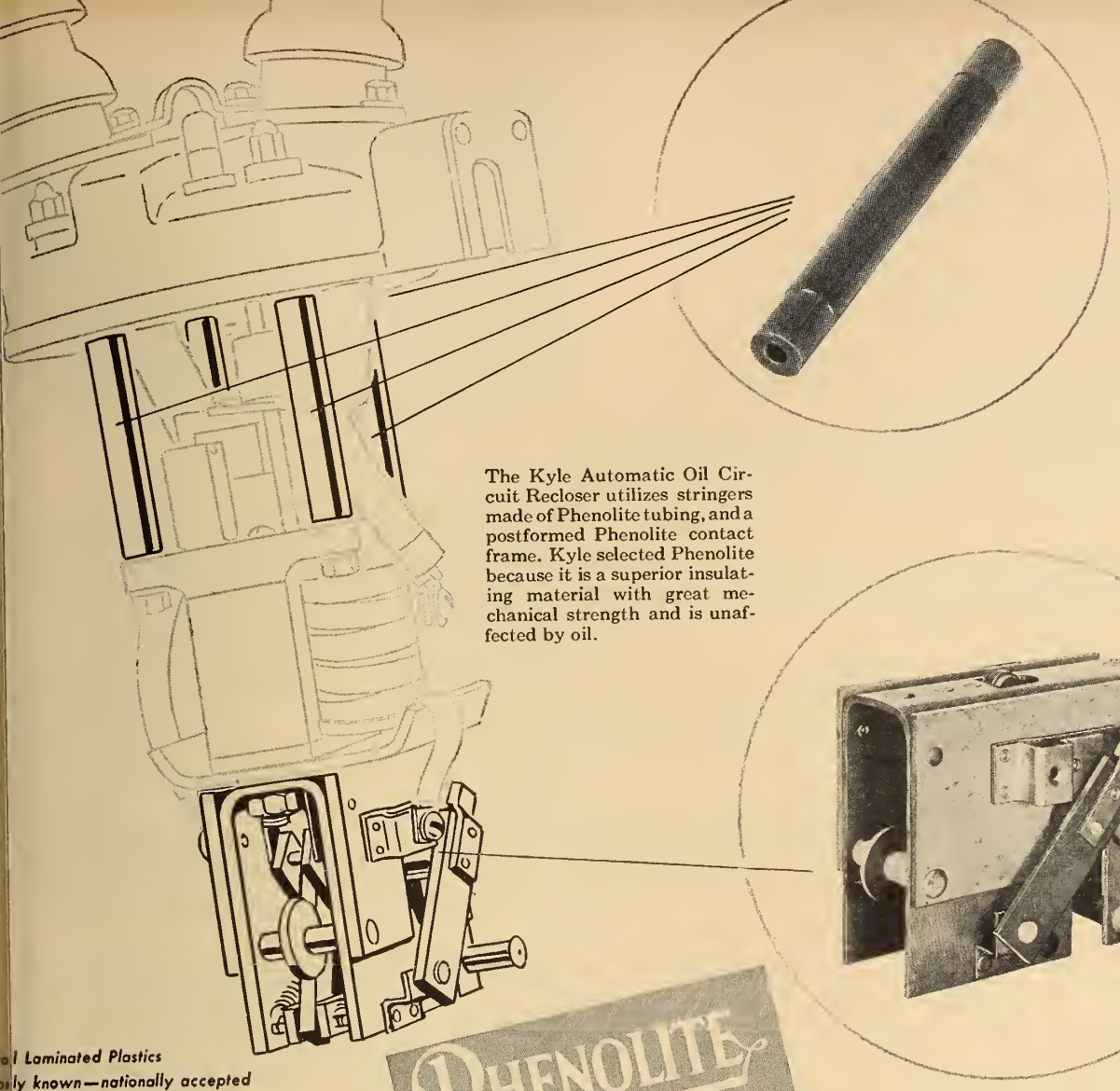


MODEL 4955-D Oil-Mist Lubricator with Water Separator and 115-volt Solenoid, mounted on bracket.

MODEL 4955-E Oil-Mist Lubricator with Water Separator and 230-volt Solenoid, mounted on bracket.

MODEL 4955-F Oil-Mist Lubricator with Water Separator and 440-volt Solenoid, mounted on bracket.

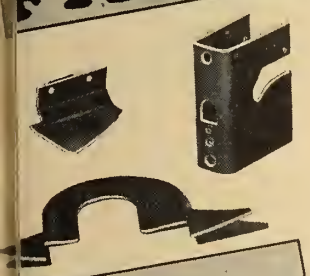
MODEL 4955-C. Oil-Mist Lubricator with Water Separator mounted on bracket.



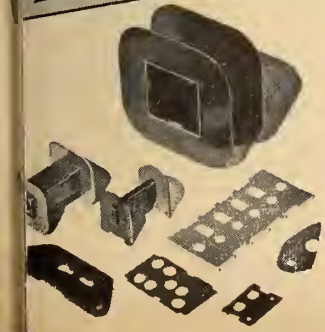
The Kyle Automatic Oil Circuit Recloser utilizes stringers made of Phenolite tubing, and a postformed Phenolite contact frame. Kyle selected Phenolite because it is a superior insulating material with great mechanical strength and is unaffected by oil.

l Laminated Plastics
ly known—nationally accepted

NATIONAL VULCANIZED FIBRE



PHENOLITE Laminated PLASTIC



contributes to an improved product— in the Kyle Automatic Oil Circuit Recloser

This practical use of Phenolite by the Kyle Products Plant of the Line Material Company is typical of its countless applications in the electrical field. Phenolite, about one-half the weight of aluminum, is the perfect insulating material for high and low voltage applications. It possesses an unusual combination of properties. Phenolite has great mechanical strength and high resistance to moisture; ready machinability; is unaffected by solvents and oils.

It can be easily punched, sawed and sheared. The toughness and high impact strength of cloth base Phenolite sheet make it suitable for gears; it is one of the strongest materials per unit weight known.

Available in various grades and colors; and in sheets, rods, tubes and special shapes. Write for detailed literature and engineering information—

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let our adhesive specialists solve your adhesive problems

plastic to metal

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sound deadening

rubber to metal

plastic to wood

cloth to wood

packaging

Whether you make mops or airplanes, adhesive problems will crop up now and then on the production line. Some difficulties you might overcome with a little experimenting yourself. But then you'll never know for sure if you are getting the best possible results. To be really certain, turn the question over to our specialists. They'll either recommend one of our hundreds of standard adhesives or develop a brand new one especially for you. Then you'll be sure of fast, positive adhesion with consequent saving of time and expense.

1. *Sound deadening and protecting air conditioning duct work.*

2. *Sealing refrigerated display units.*

3. *Laminating plastic to wood or metal counter tops.*

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(*Continued from page 1562*)

stanchions and beams, which is built up from 16-gauge angle welded in the form of a hollow box, every flange of which is drilled with a pattern of holes designed to marry up with those in the end posts of the girder sections. Other elements are the stanchion-joint plate and the floor plate, both of which are cut from sheet steel and drilled to match the companion elements, and a wall-fixing plate joggled to provide for easy erection on the wall with the minimum cutting of the brickwork. A range of U-clips and other fittings has been provided by the designers to enable cables, rails and other equipment to be easily attached.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Dominion Bridge Booklet. — Dominion Bridge Co. Ltd., P.O. Box 280, Montreal, offer Journal readers the following publication:

"Platework — for Every Industry". This 32-page, two-colour publication gives a complete description of the platework which can be supplied by the Company.

●

"Weather Magic". — "Weather Magic" is the title of a periodical which is produced, in Canada, by Trane Company of Canada, Limited.

This publication will be of interest to engineers who are concerned with air heating, cooling and conditioning. To obtain copies communicate with the Company at 767 Yonge Street, Toronto, and ask for the publication by name.

●

Fine Pedlar People Publication. — The Pedlar People, Limited, Oshawa, Ontario, are to be congratulated on the producton of a 44-page booklet produced to illustrate the growth of the Company since its formation in 1861.

The publication graphically describes the part the Pedlar People have played through peace and war in aiding Canada's progress and defence. Primarily it is a story of success which, according to a release issued by the company, was made possible only through the finest teamwork of their employees and the loyal co-operation of their many customers over the past years.

Not only is the publication highly informative, but it is beautifully produced. Copies will be sent if applications are addressed to the Pedlar People, Limited, Oshawa, Ontario.

●

M-H Technical Release. — Minneapolis Honeywell Regulator Company Limited, Leaside, Toronto 17, Ontario, offer a four-page bulltin number 2290 which describes a new model differential converter transmitter with non-bleed pilot relays. The publication covers operation, construction, specifications and applications of pneumatic force-balance unit for measuring and transmitting flow and differential pressure.

Write to the Company and ask for the publication by number.

●

"Going Up".—Turnbull Elevator Company, Ltd., 126 John Street, Toronto, publish "Going Up".

The September-October 1953 issue carries an excellent article "How to buy a Freight Elevator". To obtain copies communicate with the Company.

●

Hockey Schedule.—Engineers who are hockey fans may obtain a copy of the National Hockey League 1953-1954 schedule by writing to Ferranti Electric, Ltd., Mount Dennis, Toronto. Simply send a card and ask for "National Hockey League Schedule".

●

"Western Woods". — "Western Woods" is the title of a newsy litle bulletin which is produced for the lumber, plywood and shingle manufacturers in British Columbia. To obtain copies write to the editor, 810 West Hastings Street, Vancouver 1, B.C.

●

Air-Cooled Kiln. — The air-cooled kiln end, designed and built to keep the discharge end of kilns cool, round and rigid, is described in a new bulletin released by Canadian Allis-Chalmers Limited.

Available as an integral part of new kilns or as a replacement item, the air-cooled kiln end will pay for itself many times over in fuel, refractory brick and downtime savings, according to the bulletin.

Diagrams in the bulletin demonstrate how the air-cooled kiln end eliminates overheating and consequent warping and distortion at the kiln's discharge end.

Similar air-cooled kiln ends and floating type air sealers are available for high temperature kiln feed end applications from Canadian Allis-Chalmers.

Copies of "Air-Cooled Kiln End," 07B8040, are available on request from Canadian Allis-Chalmers Limited, Box 37, Montreal, Quebec.

●

"Heli-Call". — Heli-Coil Corporation announces the availability of the current issue of Heli-Call, the company's bi-monthly publication.

This two-color, four-page publication, devoted to new techniques in thread engineering, tells how industry is using stainless steel wire thread inserts to provide superior threads in all materials.

Illustrated case-history examples show how companies in all fields are using these wire thread inserts in design, production salvage and maintenance.

Copies of Heli-Call are available without charge from Heli-Coil Corporation, 1389 Shelter Rock Lane, Danbury, Conn.

●

Technical Meetings.—The International Nickel Company of Canada, Limited, 25 King Street West, Toronto, is releasing a series of wall-charts which carry a listing of the technical meetings and schedules for the various months. On the reverse side of the sheet, the dates of forthcoming conventions are printed.

This is a novel and most useful "memory-jogger" with respect to meetings which are of interest to engineers. To be placed on the mailing list for the regular receipt of these charts, communicate with the company at the address given above.

●

Industrial Films. — The International Nickel Company of Canada, Limited, offer a wide range of 16 mm. motion pictures for showing at gatherings of engineers. To obtain a catalogue of the films available, communicate with the Company at 25 King Street West, Toronto.

●

Foster-Wheeler Periodical.—"Heat Engineering" is the title of a publication which is produced by Foster Wheeler Corporation.

This is a highly informative technical bulletin and it contains papers and articles on many phases of engineering activity.

To receive copies of this publication, regularly, communicate with Foster Wheeler Limited, St. Catharines, Ontario. Ask the Company to send you "Heat Engineering".

●

"Rock-Busters". — "Jeffrey Primary Rockbusters" . . . A recently published bulletin by Jeffrey Manufacturing Company Limited, describes their latest impact crusher.

This machine employs the principle of size reduction by impact to a greater extent than possible in other types of mills.

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The rockbuster will be built in Canada at the Montreal Works, Ville LaSalle.

Write to Jeffrey Manufacturing Company Limited, P.O. Box 428, Montreal, or their branch offices or distributors for Bulletin No. 854 — Jeffrey Primary Rockbusters.

●

"Lorco" Compounds. — Lord Chemical Corporation, York, Pa., has issued a 32-page handbook and catalogue on "Lorco" compounds for descaling, deburring, abrasive cut-down, non-abrasive cut-down, finishing, coloring, burnishing, metal cleaning and rust inhibiting. To obtain copies of the publication, communicate with Lord Chemical Corporation, 2068 S. Queen St., York 9, Pa.

●

Barber-Colman Catalogue. — Complete information on Barber-Colman Electronic Controls and Heating, Ventilating, and Air-Conditioning is now available in a new catalog F 6166.

The new catalog describes the flexibility of Barber-Colman Electronic

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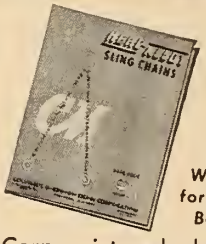

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The new catalog also contains a complete description of the various elements required for system application and illustrates their usage.

Requests for the new catalog should be addressed to Barber-Colman Company, Rockford, Illinois.

●

Shawinigan Wins An "Oscar". — For the sixth year out of the past seven, The Shawinigan Water & Power Company, Montreal, has won the Financial World's award, "Oscar of Industry", for the best annual report among Canadian utility companies.

The 1952 annual reports of 5,000 companies in the United States, Canada and Latin America were judged by an independent jury made up of experts in finance, investment analysis, research, public relations, typography and design, to decide the winners of bronze awards in 100 different classifications.

Shawinigan's report for 1952 was a 44-page booklet fully illustrated with many colour-photographs and charts. A limited number of copies are available and interested readers are advised to write promptly, to the Department of Public Relations, The Shawinigan Water & Power Company, 600 Dorchester St. W., Montreal 2, Que.

●

Industrial Inferential Meter.—A colorful and information-packed bulletin, describing the Type MO Meter, has been prepared by the Simplex Valve and Meter Company, Philadelphia 42, Pa. This 16-page bulletin (No. 500) contains data on operation, construction, accuracy, primary devices and other general information of interest to power, process and sanitation engineers who deal with fluid flow problems.

The Type MO instrument is perhaps the most accurate Venturi type meter now available. It provides a means of obtaining very accurate measurement of fluid flows over remarkably wide ranges and is designed for water, sewage, sludge and industrial liquors.

Available in the indicating, recording and totalizing form, it can be operated as a direct mechanical instrument or as an electric or pneumatic transmission device.

●

Humidity Engineer. — The applications of humidity conditioning to the packaging materials and foundry cupola field are presented in a new issue of The Humidity Engineer, published by the Kathabar Division of Surface Combustion Corporation, Toledo, Ohio.

The deterioration of packaging materials, such as cellophane, while in storage or during processing, due to exposure to extremes of temperature and humidity, has long been a serious problem to producers of these materials. How this problem was successfully solved by Milprint, Inc., at its West DePere, Wisconsin plant is the subject of one of the feature articles.

Another article discusses the system

(Continued on page 1579)

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(*Continued from page 1574*)

of moisture control for cupola operation installed by Crane Company in its new Chicago foundry and the metallurgical advantages such control provides.

Copies of this issue are available from The Editor, Humidity Engineer, Surface Combustion Corporation, Toledo, Ohio.

●

Iron Fireman Catalogue.—A new 16-page catalog (No. 5052) on Iron Fireman horizontal rotary oil burners, combination oil-gas burners, and forced draft packaged burners for oil and combination oil-gas firing, has just been issued. Illustrations and text cover features of the burners, including Oil Volumeter, prewired control panels, ignition system, oil pre-heating apparatus, and forced draft equipment. The catalog contains numerous cutaway illustrations and full data on models and capacities. Copies available, no charge, from Iron Fireman Manufacturing Company, of Canada, Ltd., 80 Ward Street, Toronto.

●

Link-Belt Book. –Link-Belt Limited has just released a 12-page Book No. 2465 on its complete line of cast malleable and Promal elevator buckets, including Styles A, AA, AA-RB, B, C, and Continuous, for handling such diverse materials as coal, coke, ores, grain, cement, chemicals, pulp, clay, sugar, salt, etc.

The buckets are smooth and seamless, with well-rounded corners to promote easy discharge. Corners are reinforced for added strength. All buckets can be punched for assembly on belts or chains.

Fifty-five standard sizes are listed. Tables give dimensions, weights and capacities.

Detailed information is provided on the mounting of buckets on belts and chains, with tables and diagrams on bucket punching. Various chain attachments and elevator bolts are illustrated.

A copy of Book 2465 will be furnished by Link-Belt Ltd. on request.

●

Petro Catalogue.—A new general catalog of commercial-industrial automatic heating and power equipment has been released by Petro. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of Petro oil, gas, and combination oil-gas burners are given. Catalog (form 3048) available without charge from Todd Engineering Co., Limited, Petro distributor in Canada, 2231 Bloor Street West, Toronto 9.

●

Waldron Catalogues. — Peacock Bros. Ltd., P.O. Box 6070, Montreal, offer copies of Waldron Catalogue 50 and 57. These catalogues describe fully the very wide selection of gear type and pin type models of flexible couplings that are available.

These couplings range from tiny nylon couplings designed for the smallest fractional H.P. drives, to tremendous steel couplings several feet in diameter.

Ask the Company to send you their complete range of the bulletin on "couplings".

●

Flow Control.—Bulletin 470, "Dynamic Flow Control", has just been issued by The Foxboro Company of Foxboro, Mass., introducing the Model 59 Valve-Mounted Controller for high speed flow control applications. The new eight-page bulletin covers a typical flow control system, dividing it into its four components: the M/59 Controller; the set point transmitter (M/53 Recorder); the measurement transmitter (Foxboro d/p Cell); and the Foxboro Stabilflo Control Valve.

A two-page explanation of the M/59 Controller mechanism centers on the unique provisions for proportional, derivative and reset control actions. Four bellows operate within a sealed case to position a balance-beam and apply corrective output pressure to the control valve in response to a process upset or control point change.

Complete controller specifications and diagrams are included in the new bulletin, copies of which will be sent on request from Peacock Brothers, sole sales agents in Canada, Ville LaSalle, P.Q.

●

Floors. — Those concerned with floor maintenance will find "Floors and Floor Problems", an attractive 24 page brochure released by The Tremco Manufacturing Company, Cleveland and Toronto, very interesting.

"Floors and Floor Problems" is illustrated by photographs, drawings, and diagrams, and thoroughly explores such subjects as the various types of floors, how they are built, what factors enter into their deterioration, how floor troubles can be diagnosed and treated.

"Floors and Floor Problems" is based on information supplied by the Tremco Laboratory, and on the actual field experience of Tremco's 125 representatives. For easy reference, the booklet is divided into 10 sections, and provides a table of contents. Typical headings indicating its scope are "Practices of Floor Construction", "Why Wood Floors Deteriorate", "Why Concrete Floors Deteriorate", "Special Problems of Industrial Floors", "Floor Problems of Office, Schools, Institutions", etc.

Copies of "Floors and Floor Problems" may be obtained from local Tremco representatives, or by writing The Tremco Manufacturing Company (Canada) Ltd., 220 Wicksteed Avenue, Leaside, Toronto 17, Ontario.

●

Protective Insulation. — The Flintkote Company of Canada, Limited, 30th Street, Long Branch, Toronto 14, has announced the issuance of a new suggested specification for the protection of insulation applied to pipes, leads, ducts and lines above grade. The bulletin is designed to supply technical information on this subject in a concise illustrated form to assist engineers, contractors, etc., with information resulting from many years of experience in the field. It gives detailed instrumental information as well as outlining the many advantages of the method.

●

Link Belt Books. — Link-Belt P.I.V. positive, infinitely variable speed drives are now available in two new types for 20 to 25 horsepower applications.

In addition to the basic H-6 P.I.V. of 25-horsepower capacity, Link-Belt can now supply an HG-6 drive, furnished with either a single reduction input or single reduction output helical gear attachment, or an HGG6 drive, furnished with both single reduction input and single reduction output helical gear attachment.

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Link-Belt Folder No. 2374 just released by Link-Belt provides detailed information on the size 6 P.I.V., in its three types and many ratios and assemblies. A copy will be furnished by Link-Belt Limited on request.

●

New Wakefield Catalogue. — Wakefield Lighting Limited has just published its new catalogue, "Over-All Lighting", consisting of 36 pages replete with illustrations, engineering data, photometric curves, spacing and layout information.

The catalogue covers the detailed construction and application of the Wakefield Grenadier, the Pacemaker, the Commodore, the Star, and the Wakefield Ceiling. The Ceiling combines high level illumination with low brightness control, noise reduction by means of acoustical baffles, and air diffusion for conditioned air. The 36 page booklet is available from Wakefield Lighting Limited, 395 Wellington Road South, London, Ontario, or from the Toronto office, 758 Yonge Street, Toronto, Ontario.

●

Westeel Catalogue. — Westeel Products Limited are distributing copies of their new Regent Aluminum Window Catalogue which is just off the press. This catalogue provides a ready reference on Westeel's new heavy extrusion window designed especially for commercial and institutional installations and Canadian conditions. A copy may be obtained by sending a request on your letterhead to your nearest Westeel plant or office. Ask for Regent Aluminum Window Catalogue No. 41.

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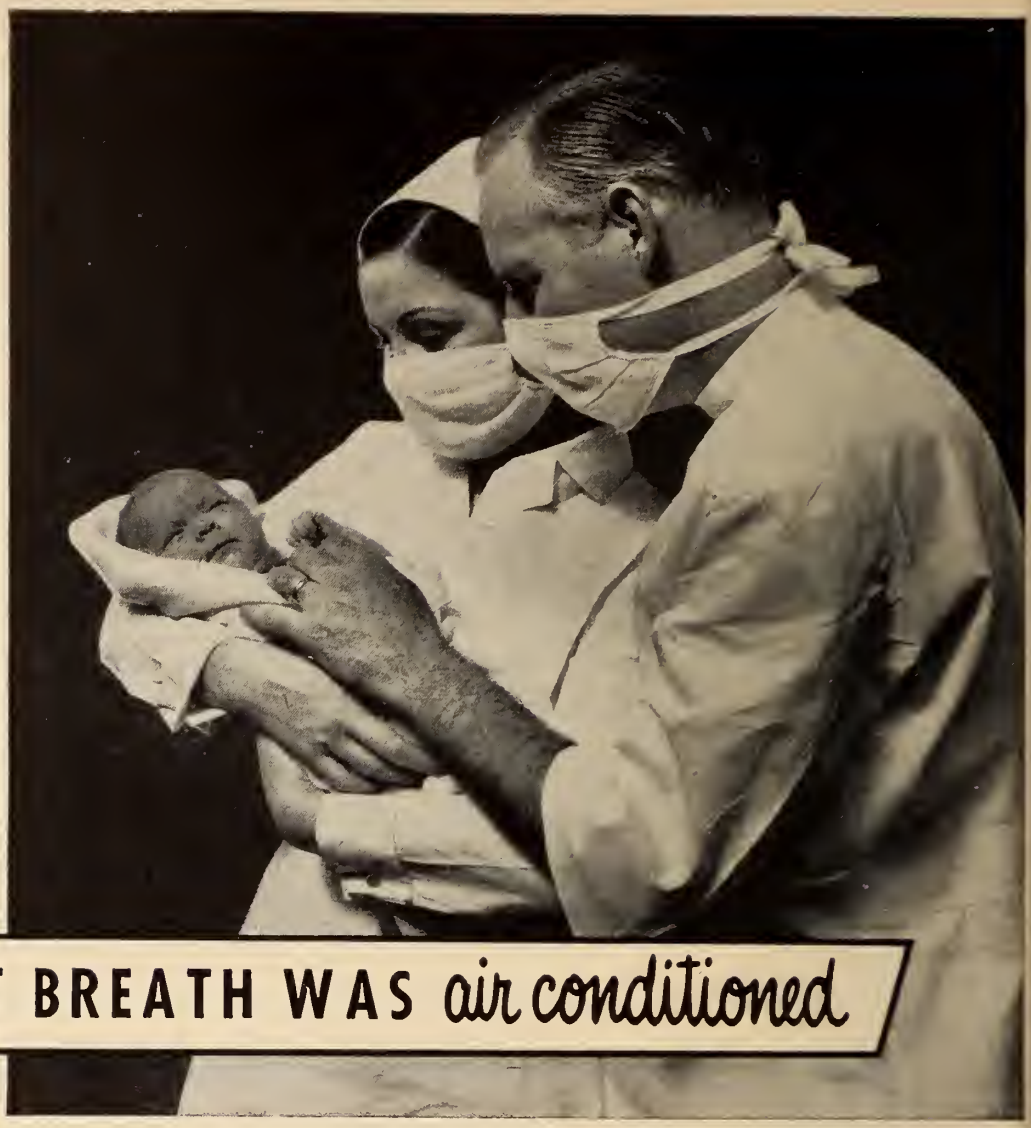

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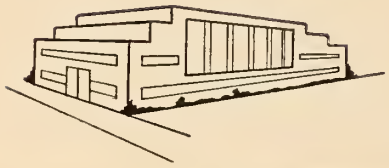

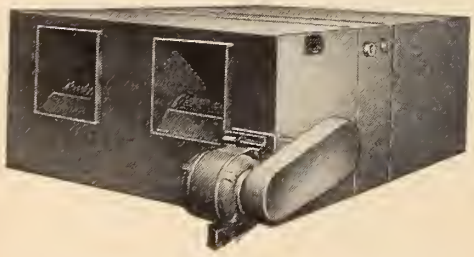

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Concrete Shell Roofs

by

W. Sefton, M.E.I.C.

C. D. Howe Company, Limited,
Montreal.

A paper presented to a joint meeting of the Province of Quebec Architects Association and the Montreal Branch of the Engineering Institute of Canada on June 4, 1953.

Reinforced concrete has come a long way since it first began to be used freely at the turn of the century, but most of the structures built of it even now can hardly be called light and airy. Notable exceptions are arched shell roofs, of which that of the Quebec Arena, described in the *Journal* some time ago, is an example. This paper is a general review of the history of such shells, a simplified discussion of their design methods and a prophecy of their future. Twenty-five years hence it will be interesting to note how close these prophecies are to the truth.

One of the aims in the construction field has always been to cover larger areas with fewer points of support, and this has been an important factor in the evolution of architecture and engineering. One cannot avoid the suspicion that at times the evolutionary processes have been retrogressive instead of progressive. In the field of reinforced concrete alone there are examples of tendencies which have not been entirely to the advantage of progress in construction.

The most serious of these has been the tendency to make a fetish of exact mathematical analysis, based on imperfect assumptions. Reinforced concrete design, now reaching new heights of attainment in the Old World, has been hamstrung from the early days by comparison with timber, steel and iron. It has come to mean only slabs, beams and columns and, as an afterthought, arches.

It has been found possible to build arched concrete structures less than 3 in. thick with spans exceeding 100 ft. Slabs only ½ in. thick have been built spanning 25 ft., and subjected to a load of 100 lb. per sq. ft. without measurable deflection. In fact, at least 500 arched shells of various shapes and sizes, have been erected without failure in the United Kingdom alone since 1945, and many others in Germany, Spain, France, etc., since 1926.

Fig. 1. Fronton Recoletos, Madrid. By Torroja.
Photographed from the Architects' Year Book: 2, Paul Elek, London, 1947.

One of the commonest forms of shell construction occurs naturally and on a small scale in the ordinary egg. Its shell is very thin, yet when one exerts considerable pressure on the two ends together, without touching the sides, it is impossible to break it with the pressure of the human hand.

Concrete acts in a very similar way but on a much larger scale. Pressure on an arched shell from whatever direction gives rise only to stresses in the plane of the material—membrane stresses. No cross bending moment is set up and no cross shearing forces. Here is the essential difference between designing for one foot width of slab and making every succeeding foot width the same, and regarding the arch as having length as well as width.

The definition of a shell could be, "a structure in which all external loads give rise only to stresses parallel to the surface of the structure." Starting from this definition, shell structures have been built in concrete in many variations:—shells of elliptical cylindrical or polygonal cross section, short shells and long shells, corrugated shells, plain or ribbed domes, barrels of northlight construction and half barrels (cantilevered from the springing).

Aesthetically, the writer considers that they are superior to any other form of roof in most types of structure. More practically, the advantages proved for them are lightness, cleanness, good acoustics and resistance to fire. Modern techniques are also giving them the advantage of smaller cost than for any other roofs of comparable spans.

Fig. 2. Madrid Hippodrome under test. By Torroja.
Photographed from the Architects' Year Book: 2, Paul Elek, London, 1947.

History

The history of shell roofs begins in the early days of Rome with the development of arches. Then and in Byzantine and Medieval architecture, arches were a popular method of spanning large distances and the main preoccupation of the architect-engineer-builder was dealing with the thrusts at the springing of the arch.

The dome of the Pantheon at Rome has a plan diameter of about 120 ft. In the roof of Santa Sophia at Istanbul the central dome of 100 ft. diameter is aided by two subsidiary half domes, giving a total coverage without columns of 225 ft. by 100 ft. Incidentally, the dome of St. Peter's, Rome, has a diameter of 131 ft. and weighs 10,000 tons, while that at Leipzig (a shell) has a span of 248 ft. and weighs only 2,160 tons.

The dome has developed continuously right up to the present day, and in comparatively recent times has developed in shell form.

Until recently development has continued through a purely practical process of trial and error. Fortunately, the properties of the dome early attracted the attention of mathematicians who were instrumental in freeing it from the practical limits reached by the use of existing materials.

The earliest paper recorded was "Notes on the Internal Equilibrium of Solid Homogenous Bodies", by G. Lame and E. Clapeyron, presented in Paris in 1828. The second was by A. E. H. Love of Cambridge, England (1892). Since then many papers of varying types have been presented in Europe. Notable among the authors are Reissner, Meissner, Timoshenko and Honegger. 1925 marked the beginning of the mass attack on shells in Europe, and, subsequently, to a limited extent in the United States. From 1925 to 1939 prominent personalities associated with shell construction and development are Dischinger, Finsterwalder, Emperger, Kleinlogel, Ritter, Reissner, Schorer, Flugge, Tedesko, Jakobsen and Freyssinet. Since 1945 upwards of 200 papers have been written on the subject of shells; and it is regrettable that by and large, engineers and architects in the Western Hemisphere are not aware of these papers.

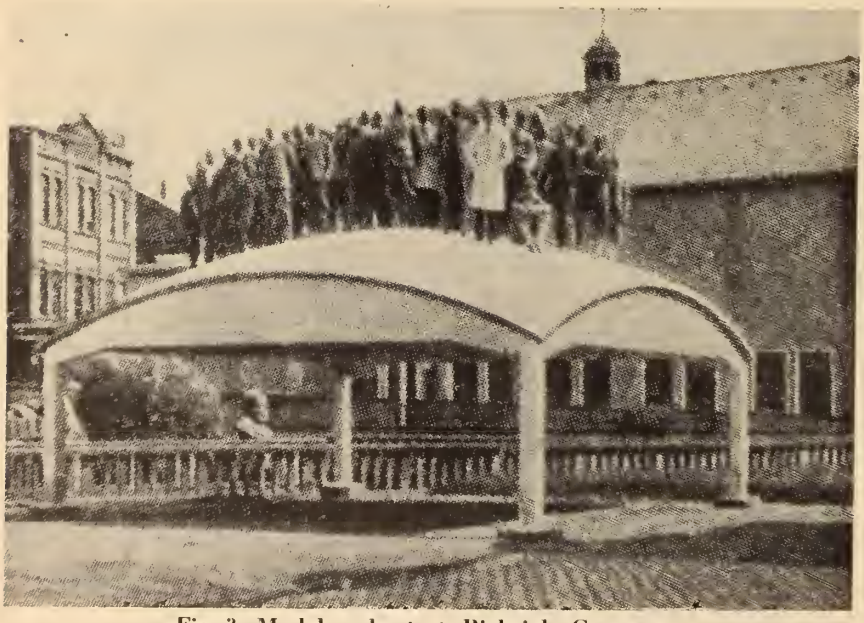

Fig. 3. Model under test. Biebrich, Germany.
Photographed from the Architects' Year Book: 2, Paul Elek, London, 1947.

The mathematical analysis of domes led to the development of arched shapes, curved in one direction only, or barrel vaults. One of the first of these barrel roof structures was at Frankfurt-on-Main in 1927. It was a multiple structure and covered a market hall. There were 15 elliptical barrels subdivided by expansion joints into three groups of five, each 46 ft. 3 in. arch span and 121 ft. clear span longitudinally. Intermediate shells were $2\frac{3}{4}$ in. thick and external shells were $3\frac{1}{8}$ in. thick.

This structure is of interest because, before the authorities permitted it to be built, they required a practical test. A one-third scale model was constructed, 36 ft. 10 in. long by 15 ft. 10 in. wide and the shells were 0.59 in. thick. A loading of 62.16 lb. per sq. ft. on one side only had no adverse effect. 100 lb. per sq. ft. produced no measurable deflection. The first crack appeared at 200 lb. per sq. ft.

In Budapest, 18 shell units were constructed to a flatter curve, to

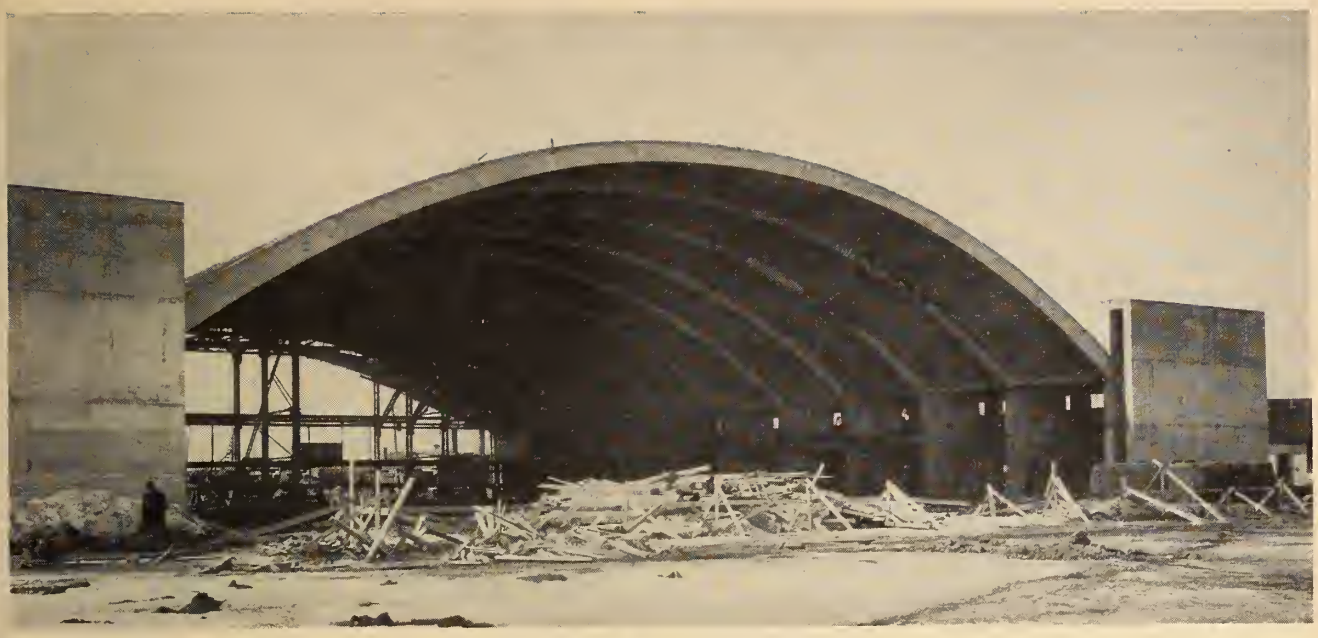

Fig. 4. Hangar at St. Hubert, Que.

roof a market hall with a length of 760 ft. and a span of 135 ft. The thickness of the roof was $2\frac{3}{8}$ in. Tests were carried out which showed that the safe load was four times the design load. Considering the live load only, the factor of safety was 11.

In 1935 the Fronton Recoletos (Fig. 1) designed by Torroja was constructed in Madrid. Two intersecting cylindrical shells $3\frac{1}{8}$ in. thick cover an area of 180 ft. in length, by 106 ft. across the barrels. Much of the area is glass. A model was made of this, too, and tests carried out prior to construction.

At least one case exists of cylindrical shells built of glass with reinforced mortar joints between the glass. This was built in Prague.

In 1932 in Buenos Aires, northlight shell roofs were constructed 2 in. thick with spans of over 30 ft. One of these was subjected to a major fire and remained undamaged.

The Hippodrome at Madrid, also by Torroja, built in 1940 is cantilevered 42 ft. and is in the shape of a hyperboloid. A model of this was also tested (Fig. 2).

In 1940 Robert Maillart, the Swiss engineer-architect was responsible for the shell arch at the Zurich exhibition. This was of parabolic cross section, 53 ft. span and 70 ft. long, 37 ft. high and $2\frac{3}{8}$ in. thick. It was constructed by guniting. This structure was tested after the exhibition and carried concentrated loads of $2\frac{1}{2}$ tons in a total of 30 positions at the same time. It was also subjected to loading from one side only. In fact, when the shell was no longer required it had to be destroyed by blasting as no other method of destruction succeeded.

A test was carried out at Biebrich (Fig. 3) on a shell 24 ft. by 24 ft., $\frac{19}{32}$ in. thick in the centre and 1 in. at the edges. It was loaded with 61 lb. per sq. ft. uniformly. The deflection at the centre was less than $\frac{3}{32}$ in. With loading on one side it was equally satisfactory.

Since 1945 it is in England that the most remarkable increase in shells has occurred, exponents being Twisteel Reinforcement, Limited, with Mr. C. V. Blumfield, Dr. Hajnal Kanyi and Dr. Budgen; Chisarc and Shell D with Mr. H. G. Cousins; and Ove Arup with Mr. Jenkins, to mention only a few.

Examples and Selected Features

Examples selected from a large number of structures available are a hangar at St. Hubert, Quebec (Fig. 4), and the Royal Marine Drill Hall at Deal, England (Figs. 5 and 6—5 spans of 45 ft., 90 ft. long and 3 in. thick).

A series of tables made by the Twisteel Company in England for the guidance of architects in 1946, gives an indication of probable thicknesses for different spans and lengths and for different types of shells. In no case does the thickness exceed 3 in., even for lengths of 180 ft. and arch spans of 50 ft. In fact, these spans are modest for this thickness.

From the figures it will be noticed that notwithstanding the slenderness of the shells, considerable parts of the concrete have been omitted for glass in a most attractive way.

The reflection from the smooth soffit of the arch gives a better lighting per unit than any other type of building with comparable spans.

The type of glazing does not materially affect the shell. The circular lens type of window is most satisfactory from the point of arrangement of reinforcement, but rectangular openings are used in most shells. These require special attention to corner reinforcement details and to the thin concrete ribs framing them.

In multiple barrels, the shells are often constructed as balanced cantilevers with the glazing at the edges of two adjacent cantilever sections. This positions the lights in the centre of the arches. North (and south) light shells have been developed and built to an increasing extent; these consist of part shells spanning between end supports with vertical or nearly vertical glass panels from the high edge of one shell to the springing of the next.

Where a large space is to be covered, it is usual to place the longitudinal axis of the shell in the shorter direction and to make up the longer direction with a sufficient number of shells. This is found to be beneficial in cost, in appearance, and in acoustic value of the roof.

The shells covered by the Twisteel figures are normally of the long type, that is, where the length along

Fig. 5. R. M. Drill Hall, Deal, England. By Twisteel Reinforcement.

the longitudinal axis of the shell is greater than the span of the arch. However, in the case of the Quebec Stadium the span of the arch is 240 ft. The length between stiffening frames is 30 ft. and the overall length is 350 ft. The thickness of the shell varies from 4 to 6 in.

The thicknesses of 2 in., 3 in. and 4 in. are not normally determined primarily by stress considerations. Often, and even for long spans, thicknesses greater than 1 in. are not required by considerations of compression, nor yet by tension. However, the reinforcement, though comparatively light, is required in several layers at specific points of high tension. With a minimum cover of ½ in. top and bottom to the outer surfaces of steel and, say, with two layers of mesh each with two ¼-in. bars, the minimum thickness is obviously 2 in.

In the discussion on future possibilities it will be shown that tension areas can be eliminated almost completely, and this points to the possible reduction in shell thickness on moderate shell spans.

Costs

The latest figures available to the author, are figures of English construction and are contained in the report of the symposium on shell construction held in 1952 in England. Mr. H. G. Cousins gave an interesting paper on costs, and discussed the economics of designs in relation to spans, widths, labour and material costs, etc. His general conclusions were that when the shells are so extensive on any one site that travelling scaffolding can be used effectively, then the cost of the cheapest form of shell is 4s. or 55c per sq. ft. of floor area. Normally, the cost would vary from 8s. to 12s. or $1.10 to $1.65 per sq. ft. of floor area. For high or exceptionally complicated buildings, the costs might increase to 20s. or $2.75 per sq. ft. of floor area. These costs are for the concrete in columns and roofs only and are for construction in the United Kingdom. For comparison with Canadian construction costs, it should be assumed that labour costs are probably a little over twice as high here as in the United Kingdom, and that material costs are a little under twice as high.

In shells the labour cost is higher than the material cost. Consequently, the cost of the shells and supports would vary from $1.10 to $5.50 with the normal range lying near $2.00 per sq. ft. of floor area. The cost of shells using advanced techniques would probably lie well below $2.00 per sq. of floor area.

Within these limits the various types of shells present different cost pictures, as is the case with other buildings of varying spans and heights. Obviously, too, the amount of thought which has gone into considering the effect of general architectural design will reflect itself in the final cost. The choice of accessories, such as bonded roofing, roof glazing, etc., can have a material effect on the cost of the roof as a whole. Shell roofs can be built in Canada now more cheaply than any other type of roof, span for span and quality for quality.

Principles of Design

The principles of design controlling shell structures are very simple; successful principles always are. Anybody can design a shell today, given a certain amount of mathematical ability, access to some of the papers listed at the end of this article, and last, but not least, a fair amount of practical construction experience; in fact, in no field is practical experience of construction more desirable.

Fig. 6. R. M. Drill Hall, Deal, England.

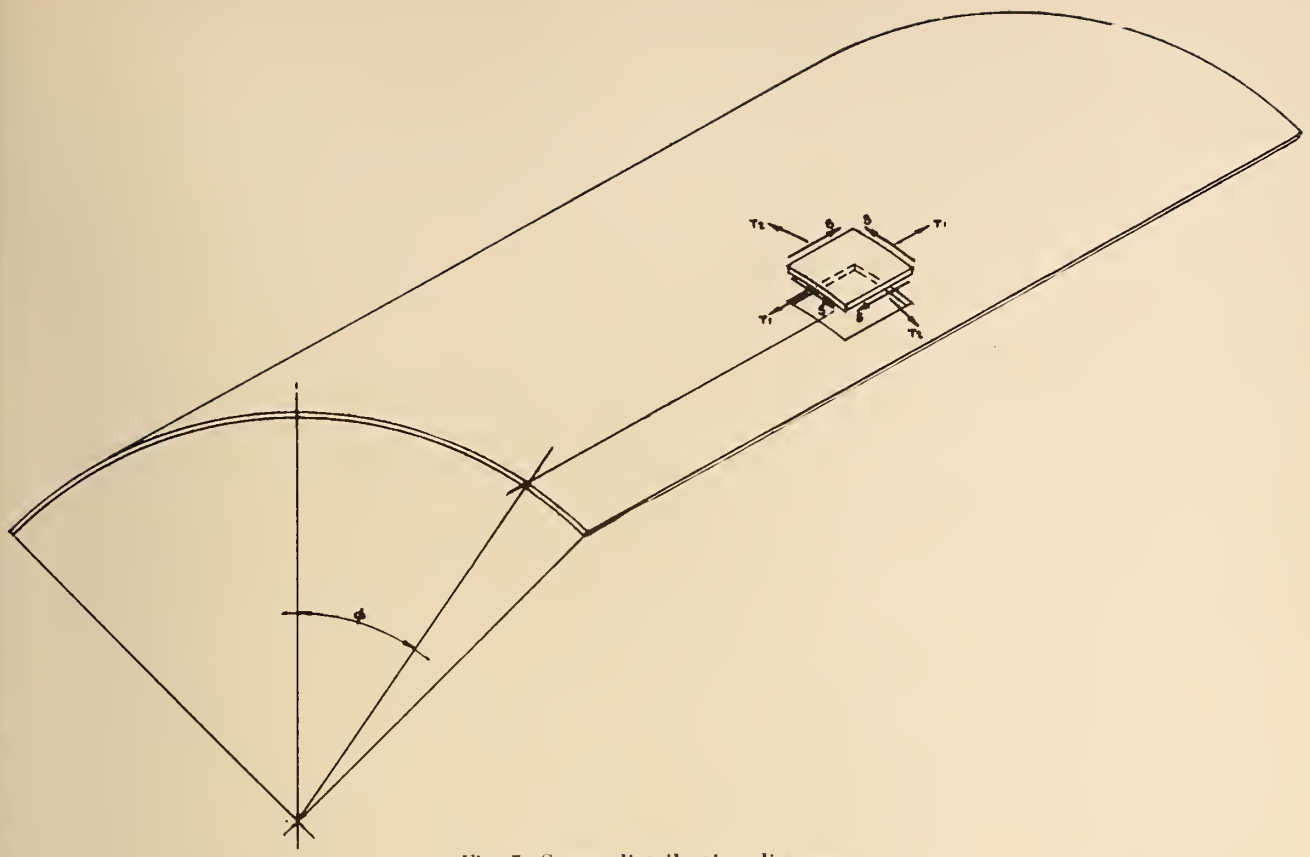

Fig. 7. Stress distribution diagram.

The shell receives loads of any magnitude and coming from any direction. These are external forces and can be considered as being wholly resolved in three directions mutually at right angles on axes X, Y and Z. The magnitude of these forces can be determined as for any external load system on any structure.

The shell transfers these loads into membrane stresses acting in the plane of the shell itself. These stresses can be considered in two directions at right angles on any part of the shell. The third direction by definition is not relevant. The two right-angle directions are normally taken parallel to the main shell longitudinal axis and at right angles to it.

If we consider a small element of surface of the shell in which curvature may be neglected, then the forces on the element are T_1 and T_2 perpendicular to adjacent forces and to each other, and corresponding complementary shearing faces along the edges of the element.

These forces can be statically resolved into two principal stresses at each point of the shell surface and consequently curves of principal stress lines can be drawn around the surface of the shell (Fig. 7) which will show the only stresses acting in the shell at any point. Where these stresses are compressive the concrete takes care of them. Where the stresses are tensile, reinforcement for them is provided in the shape of mesh. This explanation of stress over-simplifies the problem, but indicates the designer's line of attack.

From the purely theoretical point of view, reinforcement should be bent to follow the lines of principal tensile stress. Practically, standard mesh reinforcement is used, cut and placed obliquely to follow the lines of principal stress as much as possible, to obviate the labour and cost of placing each bar to follow a curve of stress. This system is adequate and well proven by experience. In places where stresses are high, two layers of mesh are often placed on top of each other.

The estimation of forces T_1, T_2 and S is one of the chief problems. For simple shells without complicated stiffening and tie bar systems, three simple differential equations are used. These are, in one form:—

$$T_2 = - w R \cos \phi$$

$$S = - x \left(w \sin \phi + \frac{\delta T_2}{R \delta \phi} \right) = - S_0 x$$

$$T_1 = - \frac{L^2 - x^2}{2} \cdot \frac{\delta S_o}{R. \delta \phi}$$

in which

R = Radius of curvature of point being considered.

ϕ = Angle at point between the perpendicular to the tangent and the vertical.

x = Distance along the longitudinal axis from the centre of the span.

L = Half the longitudinal span.

w = Unit weight of the shell.

End frames and tie beams are provided in many designs; where these join the shell, local stress conditions are radically changed. End conditions caused by non-shell type structures attached to the shell are the major source of difficulty in design. The tie beam in the valleys between two shells used by some designers, is not always necessary, and often its function can be performed by the thick junction of the two shells themselves. End frames can be replaced by arched stiffening beams. In long shells end conditions play a relatively small part. In short shells they play a great part.

In the case of shell domes, the principles of design are hardly

different from traditional dome design, in which it has long been known that stresses are principally within the thickness of the material.

Consideration of an arched shell as a long span beam of curved cross section will help to explain why a shell does, in fact, have enormous strength. A shell with an arch span of, say, 35 ft. and a rise of 8 or 9 ft. has a large moment of inertia and a large section modulus. Consequently the bending moment, which is also large, divided by the large section modulus will give only an average bending stress.

A paper given in February, 1953, in London, to the Institution of Civil Engineers by Waller and Aston, indicates a slightly different approach along the road to regarding shells as ordinary structures. This paper is on corrugated concrete shell roofs. Its design section discusses the design of shells of inverted catenary section, with corrugations at right angles to the line of the arch to resist cross bending moments due to shrinkage, temperature and other non-uniform loads.

The fact that all forces in shells are in the plane of the shell means that if the tangent of the shell at its supports is not vertical, then the edge forces parallel to the line of the arch have horizontal as well as vertical components. To a limited extent these may require edge beams and columns to resist them. If one uses a circular arch, then the rise will have to be half the arch span for vertical tangents, consequently an elliptical arch is preferable because the rise may be made a small fraction of the arch span while still maintaining vertical tangents. Unfortunately the radius of curvature of the arch is then variable and this makes analysis more difficult. Tables have been prepared which eliminate much of this difficulty and the writer thinks that elliptical shells are more economical than either semi-circular or segmental shells.

Construction Methods

Various methods of construction have been used with success on the shells so far constructed, and all have had one thing in mind. All methods have been attempts to construct shells efficiently at low cost.

The earliest shells were constructed by traditional methods of erecting forms on scaffolding and placing concrete on them by hand from wheelbarrows riding along the crown of the arch. In these shells the reinforcement was made to follow the curves of stress by bending it around nails driven into the forms. The concrete had a low water content and was worked into place by floats and trowels.

Subsequent shells were poured directly onto insulating board, which was left as part of the finished structure and provided a base for painting as well as served its insulating purposes. This practice has been largely discontinued, as even with wire ties fixed to the concrete, the board sometimes comes away from it. It is just as easy to add the insulating material to the top of the shells under a multi-ply waterproof material. One shell at least, was placed direct on corrugated metal forms which gave it a pleasing soffit.

The Zeiss shells in Germany and Maillart's shell at Zurich were gunited. The corrugated shells referred to above are constructed on hessian or sacking stretched across wires which gave the corrugated shape. The concrete is then sprayed on the hessian.

Precasting and Prestressing

For large span shells the tie beams and cross frames have been in prestressed concrete. Interest is currently centered on a shell dome constructed on the ground and jacked to its final position. This eliminates scaffolding and might be considered one of the steps on the road to precasting. Precast shells may be the answer to radically reducing the cost of shells.

The shape of the shell leads to expensive formwork (Figure 8). The normal position of a roof is up in the air and consequently a considerable amount of special scaffolding is required. The writer has developed a precast post-tensioned shell roof, in which all the members are precast and precompressed by post-tensioning wires or bars, after the shell elements are assembled in place (Figure 9). This method produces an arch shell from which the cost of scaffolding has been entirely eliminated, and the cost of formwork and the weight of reinforcing steel reduced considerably below any other type of shell or any type of steel roof.

Fig. 8. Quebec stadium scaffolding. By Roberts & Schaeffer.

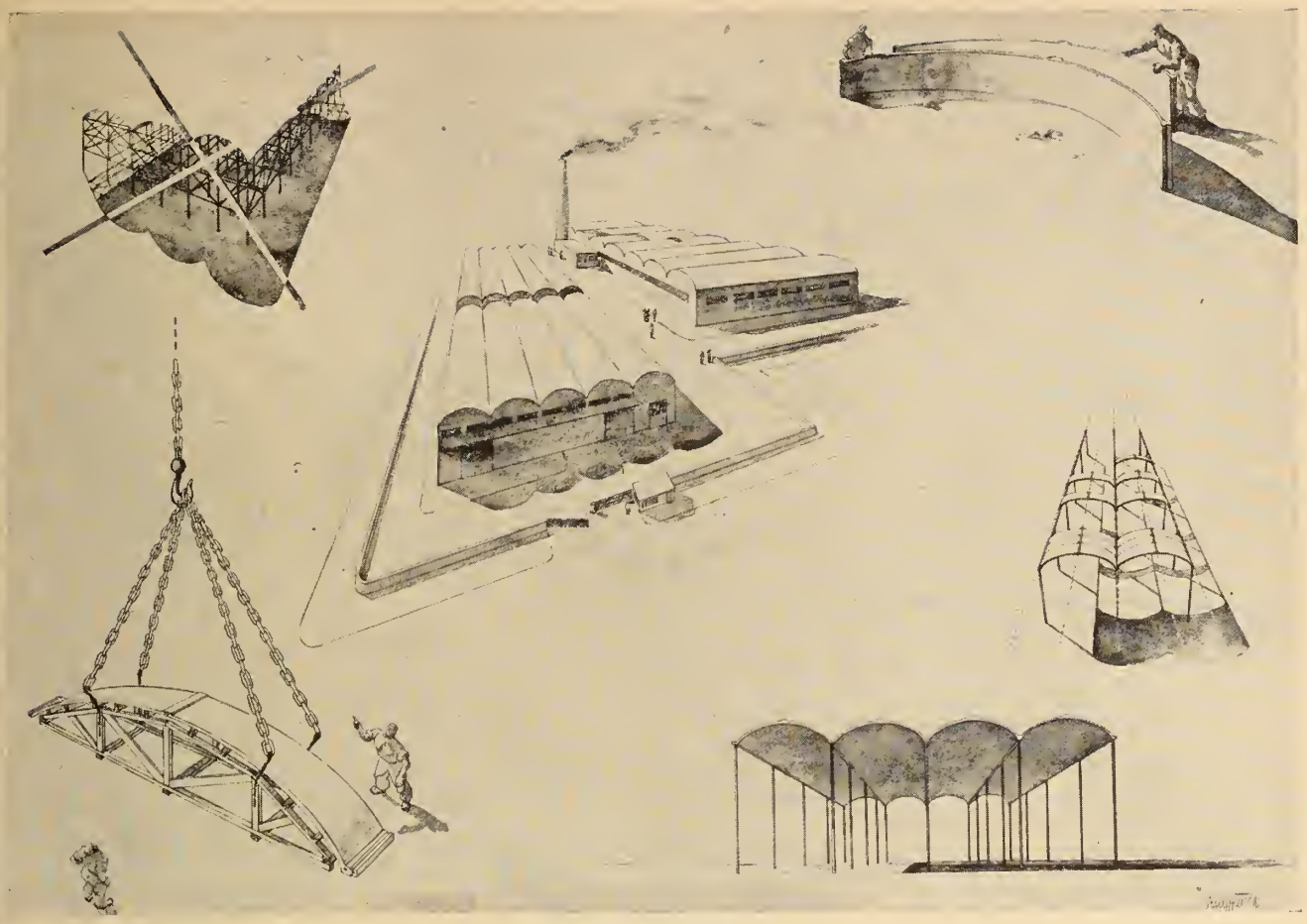

Fig. 9. Sefton roof.

In this method of construction, complete arches are cast in a mould on the ground, only 2 to 3 ft. in width. The same mould can be reused many times. The columns of the building are erected and temporary beams erected between them. The shells are lifted into place by means of a braced timber frame, since they weigh approximately only 1 ton each. When all the narrow units are pushed close together on the temporary beams, the post stressing wires or bars are passed longitudinally through them all at the eaves and the crown and the post-stressing force applied. The wires or bars are then grouted in. The temporary beams are removed and the result is a completed shell. With an efficient organisation, a roof 100 ft. long, can be erected in two days.

The writer feels that this roof and the many others of its type which are certain to be developed in the future, hold the key to the rapid spread of shells on the American continent, where, although economy in materials is not of primary importance, economy in money is.

An account of construction methods would not be complete without mentioning that the mix commonly used for shells is 1:1.5:3 using $\frac{3}{8}$ in. maximum size of aggregate. The strength requirement for normal cast in place shells is average, about 3,000 lb. per sq. in. at 28 days. The strength required for prestressed or poststressed shells is greater and could normally be 6,500 lb. per sq. in. for larger shells at 28 days, again an average good concrete.

Where insulation of the roof is required any standard method of insulation is applicable to all shells. Where waterproofing of the shells is required, any standard method of waterproofing may be used, but the writer is convinced that the best waterproofing agent for concrete in any part of any structure, especially in prestressed structures, is average workmanship in making the concrete, with top grade control of the mix and placing.

Standards of Workmanship

No special degree of proficiency is required of any workman involved in the construction of shells. Any average labourer and any average skilled man can build shells, provided that the concrete is controlled and the work properly supervised. This, of course, also applies to any other type of concrete construction.

A contractor who keeps together a team of men who have constructed shells previously, will have an advantage in speed and efficiency of construction, with a consequent increase in profit and lower bids than his competitors.

Trends

Shell development is different in different parts of the world. In Europe the shell is an established design and, not only is it appearing in new and attractive shapes, but it is also giving rise to other forms of construction which depend on the arch for their stability. In North America a number of shells have been built, mostly of a large but sensibly simple type. Architects are beginning to branch out into more daring shapes such as in the latest Massachusetts Institute of Technology.

It may be that future development in Canada, not only for shells

(*Continued on page 1595*)

High Voltage Airblast Circuit-Breakers

by

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Should future increases in voltage and short circuit ratings for circuit-breakers be met by further development of conventional types, or by breakers employing forced blast interruption? Discussing dead and live tank oil circuit-breakers and airblast breakers from various angles, the author draws the conclusion that the airblast type will likely be accepted as the best design for highest voltages and mva. ratings in the future, particularly in cases where the service duty is severe.

The growth in generating capacity and the extent of interconnection of high-voltage networks has required a continual increase in circuit-breaker voltage and short-circuit ratings. Voltages of 380-kv. are now established. Short-circuit ratings, tripling in a period of 10 years, have now exceeded 15,000 mva. This trend is evident, not only on the American Continent, but in Great Britain and in Europe.

The question facing both users and designers of high-voltage circuit-breakers for these increasing duties is broadly this: Should these requirements be met by further development of the conventional dead-tank oil circuit-breaker, or its derivative the live-tank low-oil circuit-breaker? Or should it be met by the design of circuit-breakers employing forced-blast interruption in the form of compressed air?

Ideally, circuit-breakers with the highest voltage ratings should have the following characteristics. They should be able to interrupt inductive and capacitive circuits, and fault currents of all values within their rating. They should make the interruption at the first "current-zero" after contact separation, without risk of restriking, without producing overvoltages in the network, and without temporary or permanent deterioration of insulation or interrupting ability.

The opening time, that is to say the time interval between receipt of tripping impulse and contact separation, should be the minimum mechanically possible. Electrically and mechanically they should have high reliability.

The dead-tank oil circuit-breaker has provided good service for many years, and by continual development it has been found possible to meet the essential requirements of the largest networks. But in this process the oil circuit-breaker has lost its simplicity, and has become severely stressed electrically and mechanically.

At the same time, this type of circuit-breaker does not approach the ideal described above. High-speed high-voltage oil breakers have arc durations under unfavourable conditions of the order of 4 half-cycles; they produce carbon which, with absorbed moisture, results in deterioration of insulation.

Because of the generation of gas, there is the possibility of some momentary reduction in interrupting level. This may affect high-speed reclosing rating, and reliability on a second interruption. Lastly the problem of disconnecting very long lines without restrikes, and of interrupting out-of-phase voltages and other overvoltage conditions, presents severe difficulties with oil circuit-breakers.

The live-tank low-oil circuit-breaker possesses the same limitations with respect to ideal performance as does the dead-tank oil circuit-breaker. In addition, the economy in oil volume, possible with live-tank construction however desirable it may be, aggravates the limitations attributable to carbon, moisture, and gas. Moreover the difficulty of obtaining high-speed interruption, and of proving short-circuit capacity for high ratings, is increased by the small number of breaks which can be accommodated in the conventional live-tank design.

There is, therefore, a sound technical incentive to develop a circuit-breaker which will meet more closely the ideal service requirements, without the degree of compromise required in oil circuit-breakers. The modern airblast circuit-breaker offers this possibility, and is therefore especially suited for the highest voltages and the most severe duties. It matters little whether these are defined by short-circuit capacity, the frequency of fault interruption, 60-c s overvoltage, length of transmission line to be disconnected, or by climatic conditions. In all these aspects, airblast breaker performance is almost ideal.

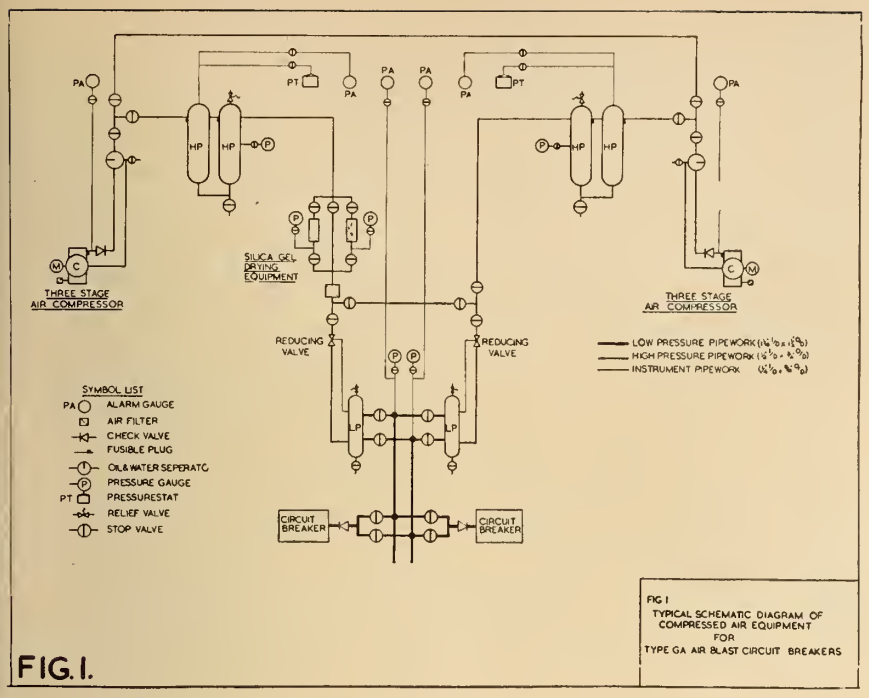

FIG. 1
TYPICAL SCHEMATIC DIAGRAM OF COMPRESSED AIR EQUIPMENT FOR TYPE GA AIR BLAST CIRCUIT BREAKERS

FIG. 1.

It may be appropriate here to mention that some of the earliest airblast development was carried out in England. The staff of the British Electrieal Research Assoeiation, who established fundamental principles and patents for this type as far back as 1926, were responsible for it. Milliken also deserves credit for the inventive genius he displayed in his patents taken out in Canada in 1929.

The work of these pioneers bore little fruit in the English-speaking world for several reasons. Uppermost amongst these was the rclatively satisfactory performance of the heavy types of oil circuit-breaker built in Canada and in England. These heavy types compared with the lighter designs built, as the result of economic pressure to conserve steel and oil, on the European continent. Further, there were problems of construetional detail, not appreciated fully at that period, which resulted in erratic operation of early airblast designs.

The major constructional features of modern high-voltage airblast circuit-breakers are here reviewed, with special reference to the designs with which the author is associated. System requirements are then compared with the performance offered.

Compressed Air

Compressed air is used for many vital mechanical services. It possesses dielectric qualities equivalent to those of oil. Its interrupting properties can be superior, for it is relatively free from the inertia problems assoeiated with liquids. Its use for the operation of oil eireuit-breaker meehanisms is now widely aceepted.

Experience has shown, however, that the normal industrial eompressor plant is not entirely suited to the speeial requirements of switchgear work where the amount of air used is small, and where leakage is likely to be predominant. Speeial 3-stage compressors, reducing valves, and aceessories have, therefore, been developed for airblast circuit-breaker operation. These, together with a complete duplication of eompressor plant, afford the seeurity that is essential.

A typical system is shown in Fig. 1, eompressing at 600-lb. and using air at 300-lb., with provision for chemical drying in extreme climates. Sueh plants normally pump for about one or two hours per day They are arranged to store suffieient air for one opening duty for each breaker in a substation, in addition to two operations available in the loeal storage provided with eaeh breaker.

Features of Airblast Breakers

The airblast circuit-breaker can be broken down eonveniently into elements which may be treated separately, not only in description, but also in both design and manufacture.

Interrupting Elements

Airblast interrupters for high-voltage construction are usually of single-flow type (Fig. 2). Nozzle and moving contact eontours are important. They determine the dielectrie breakdown characteristies in the region of eurrent-zero and during the following reeovery-voltage period. On aeeount of the great energy released by the are during the period of peak a-e. current, the flow of eompressed air in the region of the nozzles pulsates. The flow may be entirely stopped or even momentarily reversed.

Streamline flow in the vieinity of the nozzles is not therefore in itself a measure of effieient design, because the flow conditions by the time eurrent-zero is reached are still of a turbulent character. It is,

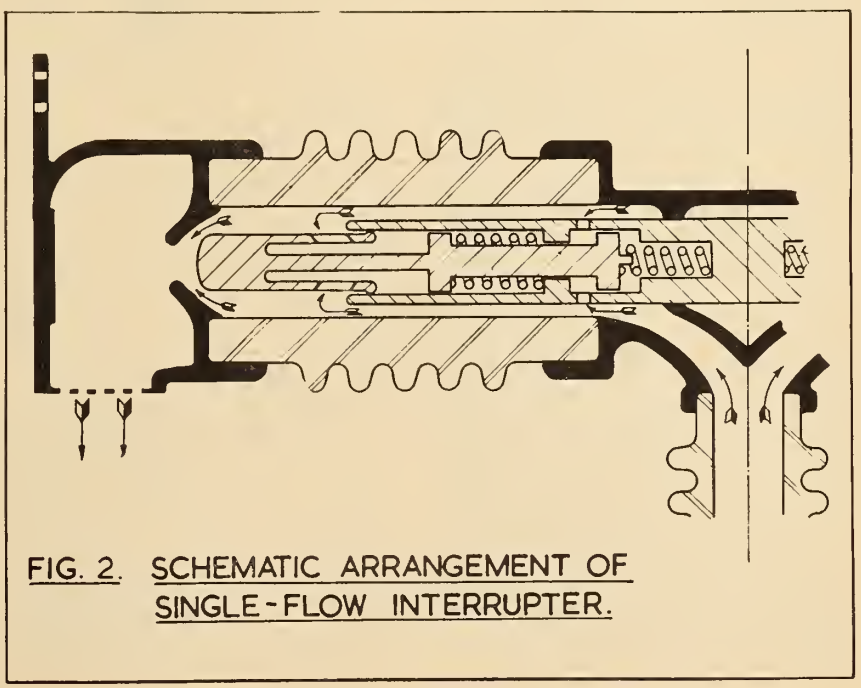

FIG. 2. SCHEMATIC ARRANGEMENT OF SINGLE-FLOW INTERRUPTER.

however, necessary to ensure that ionised gas in the region of the throat is removed before the recovery voltage transient builds up. Therefore, in order to prevent erratic interruption and restrikes within the few cycles following interruption, contours which assist efficient seavenging are essential for heavy-current conditions. These same contours form also the electrode surfaces, which must withstand the 60-c/s and transient recovery voltages in the open position. They therefore require consideration from the aspects of field form and stress concentration.

The conditions for good field form and scavenging are not always compatible; that is to say, they can be varied to suit either high-current or high-voltage duty, but not always both at the same time. Change of contours alone thus makes possible an appreciable adjustment of circuit-breaker performance, in terms of limiting short-circuit current and recovery voltage.

The performance of a given nozzle can also be adjusted by the receiver air pressure used. This, however, is not normally convenient, because standardisation of compressor plants requires operation at a fixed working pressure.

Performance can also be adjusted by varying the rate of flow of air, by alteration of size of nozzle throat, blast pipes and blast valves, or by varying the number of interrupters supplied from a given valve and supply system. Such adjustments provide wide flexibility in design, while retaining standardised components.

Air Supply Systems for Interrupters

In order to make the most effective use of a multi-break air-blast circuit-breaker, all interrupters should be provided with identical air-flow conditions. This ensures that all interrupters have equal interrupting ability. Similarity in aerodynamic conditions is, therefore, desirable both as regards timing, direction, and rate of flow.

To obtain this similarity, it is necessary that the air supply paths from the valve gear to each interrupter should be identical (Fig. 3). Lack of symmetry causes unequal interrupting ability. If the air supply to one nozzle has to flow past the arc drawn in another, the air supply to the more remote nozzles may be interfered with by the release of arc energy in the breaks nearest to the valve gear, with resultant deterioration in performance.

Voltage Control

With an arrangement such that all interrupters have equal breaking capacity, it becomes desirable to control the distribution of voltage across series interrupters during the period subsequent to arc interruption. For this purpose either capacitance or resistance shunts (which latter may be linear or non-linear) are suitable. Capacitance grading is a simple structural solution, but may cease to be effective if resistance leakage paths exist to earth or across the interrupters.

Under conditions of severe contamination due to fog, salt, or dirt, insulators may pass surface leakage currents sufficient to distort severely the capacitance grading. Linear or non-linear resistance currents can both be effectively applied even under conditions of extreme contamination, because much larger grading currents are then practicable.

The relative merits of the two forms of resistor depend on other uses to which the resistors may be put, and on the means used to interrupt the grading-resistance current. For circuit-breakers inherently capable of interrupting maximum system-voltage transients without artificial damping, and without restriking (provided only that voltage grading across the interrupters is incorporated), a resistor of high ohmic value, passing about one ampere at phase voltage, is suitable (Fig. 3). With such breakers, the non-linear ceramic resistor has considerable attractions.

Due to the non-linear characteristic (in which i varies as V^4) relatively large grading currents are available at the time of peak recovery voltage. This characteristic also facilitates interruption of the grading current itself, introducing a long pause at current-zero. In the designs here described, non-linear resistor shunts are used. The currents in these shunts are inter-

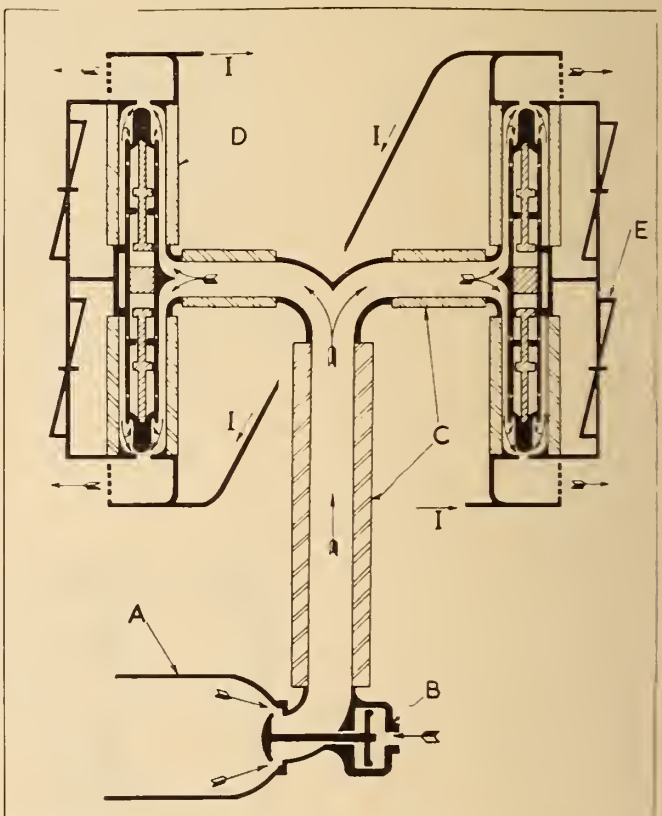

FIG.3 SCHEMATIC ARRANGEMENT OF FOUR INTERRUPTING ELEMENTS WITH IDENTICAL SYNCHRONISED AIR SUPPLIES.

A – AIR RESERVOIR.
B – BLAST VALVE AT EARTH POTENTIAL.
C – PORCELAIN BLAST TUBES.
D – PORCELAIN INTERRUPTING CHAMBER.
E – NON-LINEAR RESISTOR.

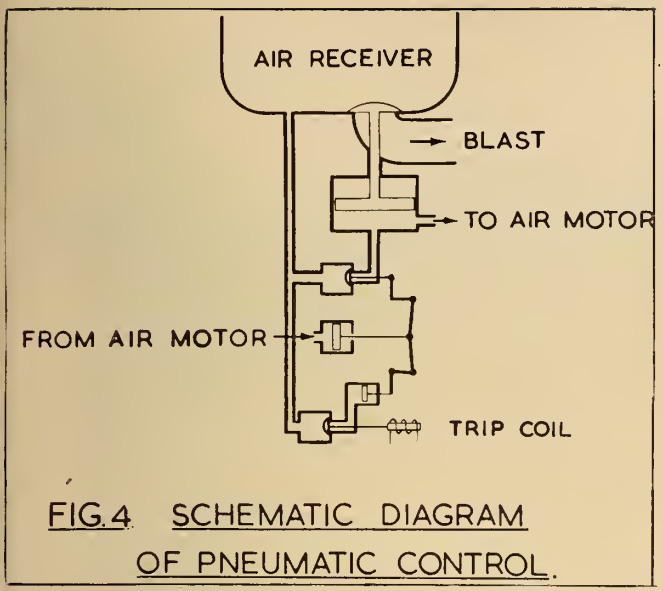

FIG.4 SCHEMATIC DIAGRAM OF PNEUMATIC CONTROL.

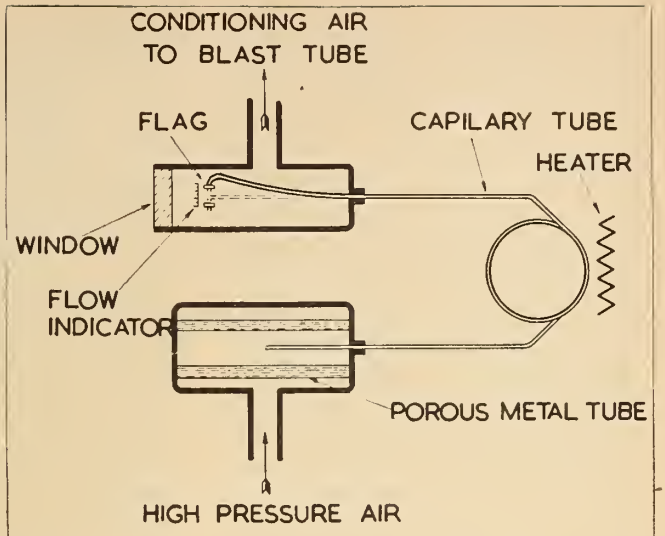

FIG.5. SCHEMATIC DIAGRAM OF AIR CONDITIONING UNIT WITH AIR FLOW INDICATOR.

rupted by an open-type sequence switch, with the aid of exhaust blast gas directed so as to induce a flow of air through the sequence switch gap.

Overvoltage Suppression Devices

All types of circuit-breaker tend to interrupt small inductive currents a short time before current-zero is reached. They thereby transfer the energy stored in the inductance to the local capacitance, with resultant overvoltage surges. Peak voltages produced in this way, and of the order of the impulse level of associated plant, are not unknown.

They are most likely to be produced during the disconnection of transformers or reactors. Such voltages become more dangerous as system voltage is raised. This is the case because the ratio of apparatus impulse level to rated voltage, and therefore the permissible transient overvoltage, falls as system voltage rises. No satisfactory system of preventing this type of overvoltage arising has yet been devised, but two alternative ways of modifying its magnitude present themselves.

The circuit-breaker contacts themselves may be used as a safety valve for limiting the peak voltage, if the gap strength can be so proportioned that it will not withstand surge voltages approaching the impulse level of the network. This requirement however, presents difficulty, because short-circuit interruption requires the gap system to be designed to interrupt a peak voltage of the order of 70 per cent of the impulse level of the network.

With all interrupters the range of breakdown strength of the gap at the time of interruption is wide. A circuit-breaker that will withstand 70 per cent of impulse voltage level reliably may well withstand a higher value on occasion, and thereby make it impossible to obtain effective voltage limitation by this means. When, however, high ohmic resistance shunts are incorporated in the breaker, these can readily be so proportioned as to provide adequate damping of surge voltages. This is in addition to providing voltage grading across interrupters.

Sequence Isolation

The interrupting contacts of an airblast circuit-breaker require only a short travel for successful interruption when swept by compressed air, the dielectric strength of which exceeds that of oil. This minimum travel is, however, insufficient to withstand the 60–c/s and impulse test levels necessary in the fully-open position once the air blast is turned off. Various alternatives have, therefore, been developed to provide the required insulation level across the breaker in the open position.

The earlier airblast circuit-breakers merely increased the contact travel, in an air-conditioned tube, beyond that necessary for interruption, until sufficient gap was introduced. This was found to have serious mechanical disadvantages at higher voltages, on account of the long stroke required in the absence of compressed air.

An alternative method is, therefore, to hold the contacts open in compressed air, which is retained as the dielectric medium between the nozzle and contacts throughout the period when the breaker is open. This enables the stroke required for isolation to be reduced greatly. It simplifies the contact mechanical problem, at the cost of pressure retaining valves on the exhaust side of each interrupter.

The designs here described are representative of a third alternative, in which the functions of interruption and isolation are separated, and are carried out by different mechanisms. The interrupter component is then designed solely for optimum performance. A separate sequence switch in free air, arranged to open after interruption of the fault, serves to provide the required insulation level. Ice formations that may occur are blown off by exhaust gas blast.

Valve Gear

The control of the compressed air required for blast and mechanism operation is a major feature, on which the reliability of the circuit-breaker depends. The design and manufacture of these components requires careful detail attention and a manufacturing technique appropriate to precision components. Given this attention, these components can be made with the highest degree of inherent reliability.

The requirements for such valve

gear include permanent air tightness, combined with the ability to remain closed under load for long periods without sticking or the development of creep of the valve seats; these properties must be retained over a wide range of ambient temperature in positions exposed to direct sun or extreme cold.

Stainless-steel metal-to-metal valves, and valve seats providing high pressure line contact, have been shown to be especially suited to meeting these requirements. They combine the necessary degree of air tightness with complete absence of deterioration in service, either as the result of large numbers of operations or as the result of long periods of disuse.

A typical blast valve with electropneumatic control is shown schematically in Fig. 4; the unit is designed to open a large stainless-steel valve in one cycle total time. The electropneumatic component includes mechanical trip-free linkage and sequence interlocks.

Insulation

Permanent dielectric security can be provided if all insulation exposed to air is ceramic. This applies especially to the support columns and blast tubes. It applies also to those components with intermittent electrical stressing, such as interrupter housings. This is because deterioration of the insulation of these components can result in failure under short-circuit conditions.

The restricted tensile strength of porcelain makes it desirable to relieve blast tubes of indeterminate stresses. This can be achieved if the blast tubes are resiliently mounted under spring loading, and if they are relieved from external structural forces such as tensile loading and wind reaction. These forces may then be carried by separate insulators mounted concentrically around the blast tubes.

The elimination of exposed non-ceramic surfaces ensures freedom from moisture absorption, but the inside surfaces of the blast tubes require controlled air conditioning to ensure freedom from condensation. It is, therefore, accepted practice to bleed air through such pipes, the air being expanded from the compressor storage through suitable reducing valves. Such air, expanded in a ratio of the order of 40 to 1, is very dry and prevents condensation with sudden falls in temperature.

A simple system which provides direct flow-control and indication is arranged with a stainless capilliary tube for each pipe (Fig. 5). Such a tube reduces pressure, and controls the rate of flow to the desired level by means of internal friction losses. Each capilliary tube is encastered about 2 inches from its outlet, and delivers air at right angles to the axis of the tube. Jet reaction from the escaping air causes deflection and visible indication of the rate of air flow in each pipe.

High-Speed Reclosing

High-speed reclosing with air-blast circuit-breakers presents no difficulties, because the interrupting performance is not affected by previous arcing history. All that is needed, therefore, is a solution to the mechanical problem of opening and reclosing the circuit-breaker in the required time. This is inherently simple with compressed air drive.

General Arrangement

The general arrangement of a 275-kv., circuit-breaker, forming one of a series of designs for service on networks of 132-kv., to 400-kv., is shown in Figs. 6 and 7. This breaker employs 8 breaks, all arranged with symmetrical air supply.

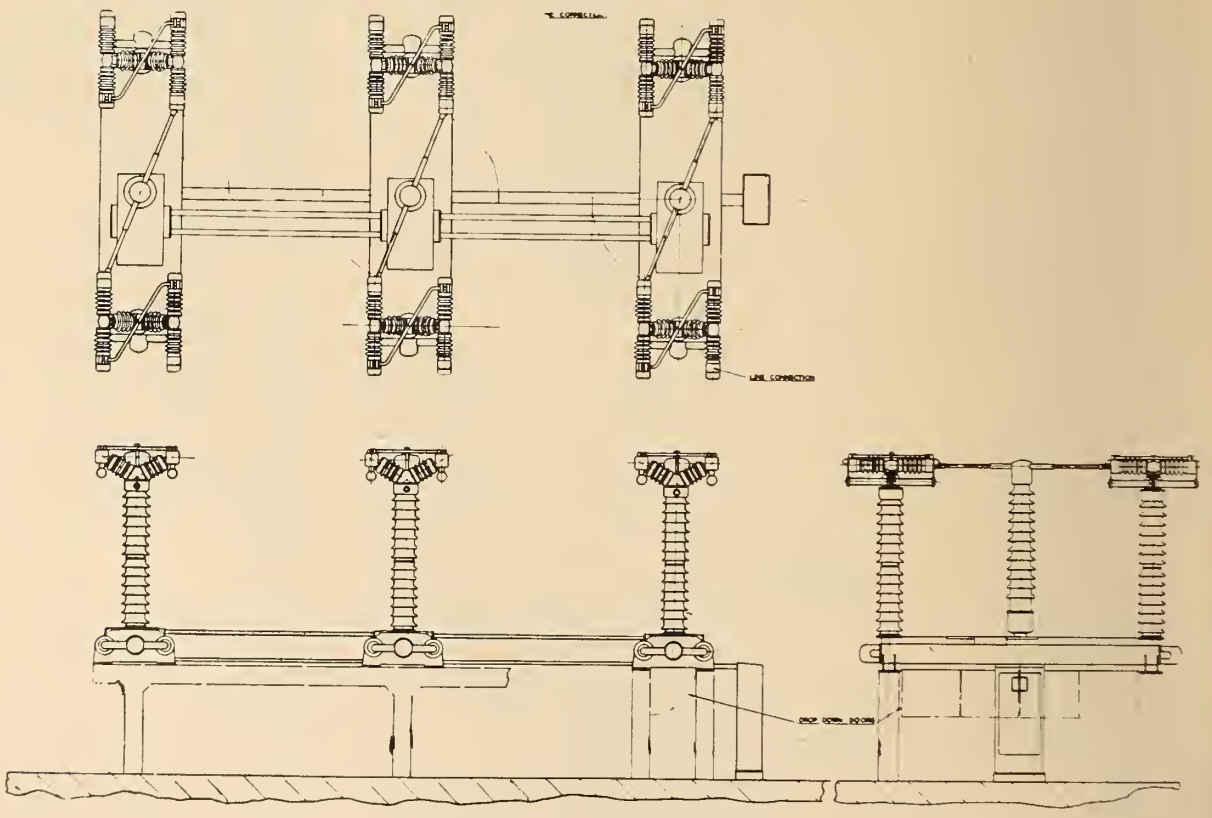

FIG. 6. THREE PHASE 220/275 kV AIR BLAST CIRCUIT BREAKER WITH 8 BREAKS PER POLE.

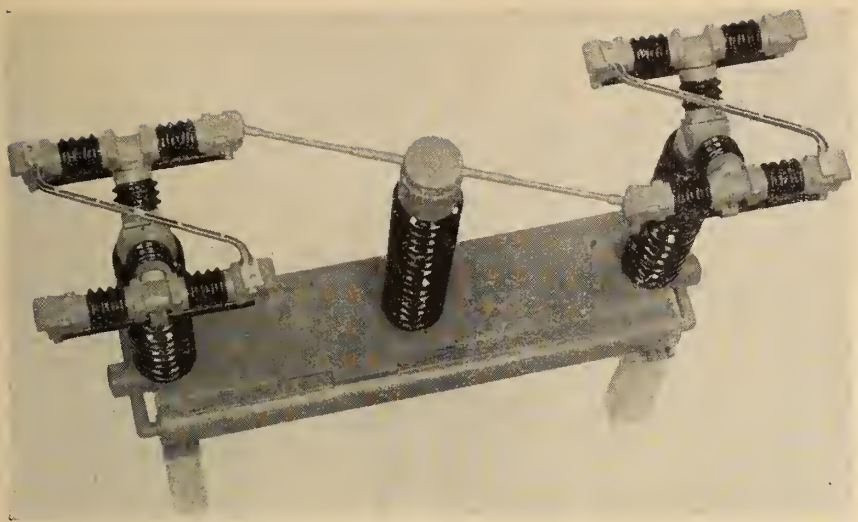

Fig. 7. Single pole 275-kv. airblast circuit breaker with 8 breaks per pole.

The assemblies of interrupters mounted on columns are carried from the welded frame, incorporating drawn steel tubes which form the air reservoir, Each complete pole-unit can be broken down for shipment into a dozen small components, which lend themselves to easy transport and erection.

System Requirements Compared with Breaker Performance

The multi-break construction employed in the modern airblast circuit-breaker provides a flexible means of matching circuit-breaker performance with network requirements. Especially is this so in designs such as those described. In these, voltage control and symmetry of design make it possible to assess accurately, from power tests made on one or more units, the limiting performance of a number of breaks.

Short-Circuit Performance

The limiting performance of single and multi-break interrupter combinations has been determined by several thousand short-circuit tests made at voltages up to 340-kv., in association with the maximum available test-plant capacity. Test-plant results have also been checked by short-circuit tests made on the network of Electricité de France at Fontenay, Paris.

It is found that the performance characteristic, as regards both 60-c/s voltage and transient recovery voltage, increases almost in proportion to the number of breaks. The characteristic is dependent on RRRV. For example, the limiting performance at constant voltage of one break, with a given air supply and nozzle rate, falls from 1,500 volts-per-microsecond at 6,000 amps to 300 volts-per-microsecond at 26,000 amps. The characteristic varies also with the current interrupted. Thus with constant RRRV, the 60-c/s voltage limit may be 60-kv. at 6,000-amp. falling to 30-kv. at 26,000-amp.

The performance of complete 3 phase multi-break circuit-breakers in terms of mva. and kv. for the worst system recovery rate conditions, is shown in Fig. 8. These curves are typical only, and the rating can be increased or reduced by alterations to the rate of supply of air and the nozzle design. They serve to indicate the overvoltage capacity of the breakers at reduced mva.

Comparisons of Performance with Network Requirements

A primary requirement for short-circuit interruption on a network is high speed. The consistency of performance of forced-blast interruption, limiting arc-duration to one cycle at all breaking-currents within the rating, enables a consistent short-circuit break time to be obtained. This short arc-duration reduces greatly contact deterioration and therefore maintenance, the contact life being adequate for as many as 30 short-circuits at say 5,000 mva. To the arc duration of 1-cycle must be added 2-cycles of mechanical time affording a 3-cycle overall performance.

Comparison with Respect to Voltage

It is accepted practice in standard specifications to test single-phase circuit-breakers with 1.5 times rated phase-to-neutral voltage. It is, however, becoming increasingly recognized that more severe voltages do arise in H.V. networks. The conditions arising from out-of-phase switching during disconnection of two networks may involve an overvoltage. This may be of the order of

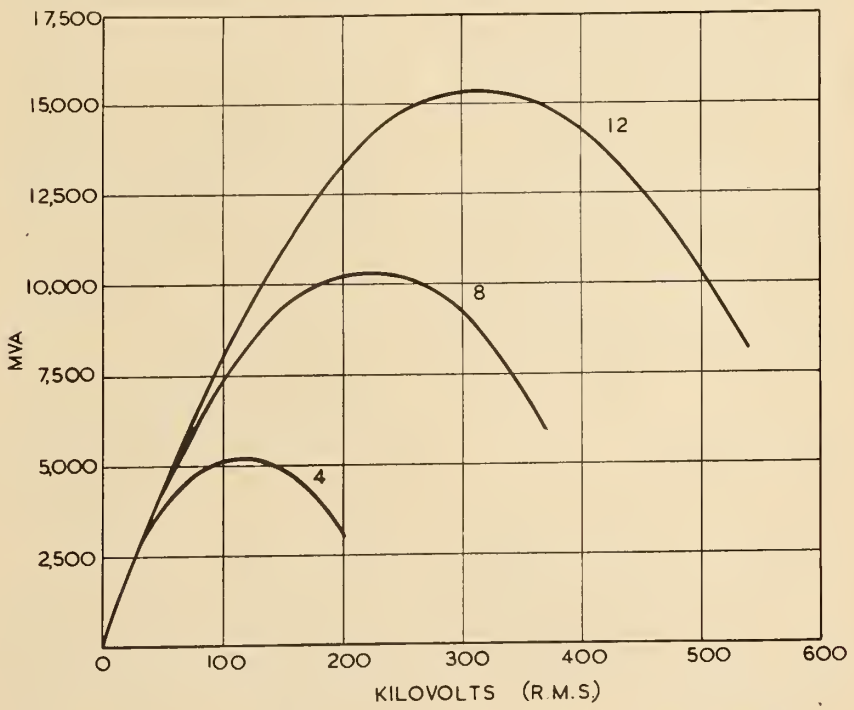

FIG. 8. TYPICAL INTERRUPTING PERFORMANCE OF A THREE-PHASE AIRBLAST CIRCUIT BREAKER WITH 12, 8 & 4 SINGLE-FLOW INTERRUPTERS PER POLE.

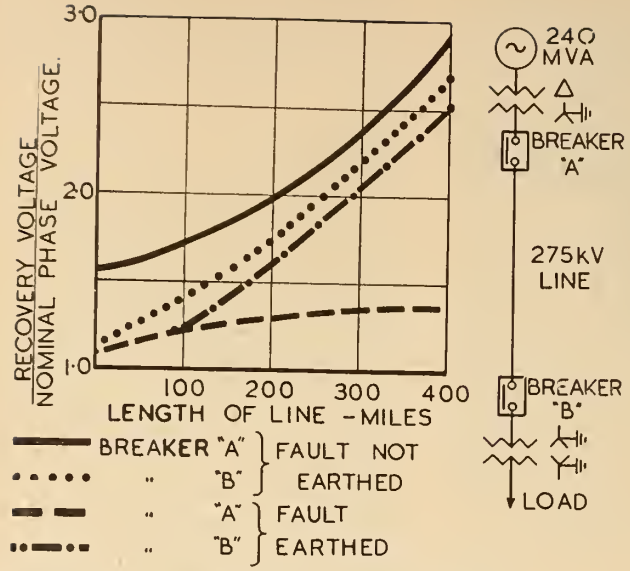

FIG. 9. MAXIMUM RECOVERY VOLTAGE IN ANY PHASE FOR THREE PHASE FAULTS ON NETWORK WITH SOLIDLY GROUNDED NEUTRALS.

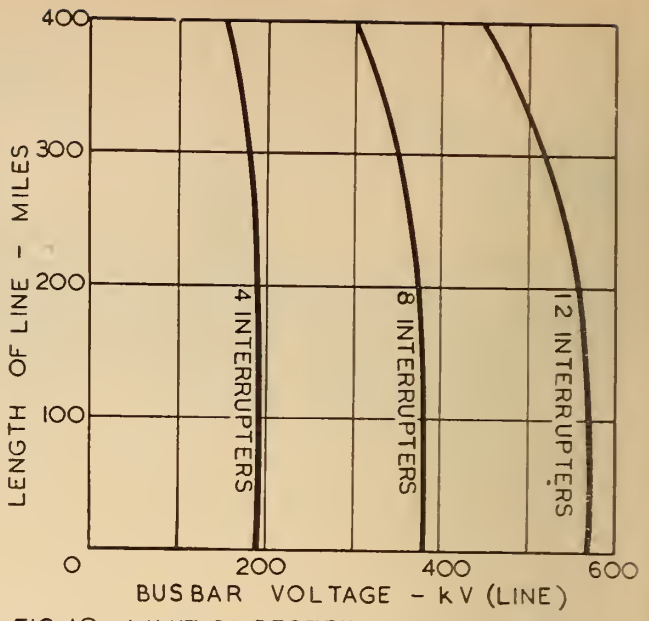

FIG 10. LIMIT OF RESTRIKE-FREE LINE DROPPING PERFORMANCE OF MULTI-BREAK AIRBLAST CIRCUIT BREAKER.

2.5 times phase-to-neutral across one pole. This overvoltage may be associated theoretically with currents up to 50 per cent rating in extreme cases, although much smaller currents are more probable.

Under 3-phase fault conditions excess voltages up to 2.3 times phase-to-neutral may arise across one pole in long networks (i.e. of the order of 300 miles) even without asynchronism. (Fig. 9) But here again these conditions are unlikely to be associated with currents in excess of one half the rating.

The duty imposed by these severe overvoltage conditions is met closely by the characteristic of the airblast circuit-breaker. In order to provide rated short-circuit current at 1.5 times phase-to-neutral voltage, a factor of the order of 2.5 phase-to-neutral voltage is inherently available at smaller currents.

Comparison with Respect to Rate-of-rise of Recovery Voltage

The severity of a short-circuit is determined, not only by current and recovery voltage amplitude, but also by system natural frequency and the rate-of-rise of recovery voltage. The characteristic RRRV conditions for all high-voltage networks are such that the rate falls off as mva. rises.

The rate to be expected under the most unfavourable conditions is of the order of 5,000 volts-per-microsecond up to one third maximum network fault capacity. The rate falls off steeply, to a value between 400 and 1,200 volts-per-microsecond at 100 per cent rating.

The great majority of networks fall into the lower class, having extreme rates of the order of 400, and the majority of all faults occur with rates well below the worst case.

Airblast circuit-breakers designed for the 275-kv. British Grid, as also those described in this paper, must have the ability to interrupt with an RRRV of 10,000 up to one third fault capacity, falling off to 4,000 at 100 per cent capacity. Such designs have, therefore, a factor-of-safety throughout the current range, increasing from two at small currents to between 3 and 10 at larger currents. This is dependent on the type of network, for the extreme situations. The ability to demonstrate an actual factor-of-safety in this manner is only practicable with designs which are sensitive to RRRV, and which are tested at rates in excess of the worst system conditions.

Short-circuit tests made on actual networks, although of great value, are usually made at RRRV below the worst system conditions. Published figures are usually of the order of 2,000 volts-per-microsecond at low fault capacity, and 200—400 at maximum capacity. This emphasizes how desirable it is that tests made on networks should be supplemented by tests on test plant. The severity of the latter can be made to exceed greatly that found in the worst system conditions.

Disconnection of Long Lines

The duties imposed by disconnecting long lines at no load are arduous if restriking and risk of overvoltage are to be eliminated. The 60-c s voltage appearing across the contacts one half-cycle after current-zero is twice the line-to-neutral value for short lines. This voltage is increased when opening long lines. The far end is then at a higher voltage than the sending end, by voltage reflections originating in redistribution of the energy stored in the line capacitance.

The 60-c s voltage conditions may also be aggravated, when disconnecting single-phase faults, if the fault results in extensive loss of load on the generating plant. The second and third healthy phases may then be disconnected. This is done by the sending end breaker at a time when the recovery voltage is increased by the extent of full-load voltage drop in generator and transformers. This may result in an overall increment of up to 30 per cent in voltage duty in extreme cases in weak networks.

The restrike-free performance of complete airblast breakers is given

in Fig. 10 in terms of busbar voltage, at the time of disconnection, and length of line. These curves are for a typical nozzle and typical air supply rate, and are based on test-plant investigations supported by network tests. They show that restriking can be eliminated.

Conclusion

The performance of airblast breakers can be closely controlled and demonstrated in terms of current, voltage, and natural frequency. This enables the actual factor of safety of the breaker, compared with network conditions, in terms of recovery rate and voltage, to be determined throughout the range of current duty.

The airblast circuit-breaker can approach closely the ideal conditions for short-circuit and capacitance switching. It can be designed to limit to safe values voltages produced by the breaker itself, when disconnecting small reactive loads. With proper attention to basic requirements, dielectric and mechanical reliability can be ensured, because the general construction is especially suited to this end.

Thus, the dielectric properties of compressed air are not subject to deterioration caused by the presence of carbon and moisture. In the designs described, ceramic insulation is relieved of shock stresses, and contact deterioration under short-circuit conditions is slight.

The airblast breaker is, therefore, in the author's view, likely to become accepted as the correct design for the highest voltage and mva. ratings, more especially where the service duty is severe.

Acknowledgement

The author is indebted to Mr. West, Director, Metropolitan-Vickers Electrical Co. Ltd., for permission to present this paper. √

CONCRETE SHELL ROOFS

(*Continued from page 1587*)

but for any other type of new structure, can be attained only by the cooperation at all levels of all concerned with construction. It might be relevant to reflect that in 1926 shells were just being built in any numbers in Europe. If there had then existed in Canada a committee whose duty it was to watch for and have translated, if necessary, any descriptions of developments of this kind in any part of the world; and if this committee had also had the power to disseminate selected accounts of this type; then this country might well be ahead of all others in the field of modern construction technology. Who knows what modern designs and techniques are being used in distant places, and who knows how much money such techniques could save Canadian Industry ?

One of the greatest factors which will develop shell construction in Canada is the introduction into engineering schools and universities of instruction in the elements of shell design and the attendant consideration of research problems. If the young engineer and the young architect are aware of shells, then shells will be built.

Future Possibilities

Shells will undoubtedly develop through precasting and prestressing techniques. With the consequent reduction of costs, double shells may be developed to give insulation value and space for services.

Shells may be used for walls retaining granular materials. Shells may be used in pitched roofs and shells have already been used with earth fill as short-span bridges. North America may in measurable time be covered with shells which will be in standard modular sizes. In Canada, it is likely that exhibition halls, stadiums and even stampede corrals will use shells for roofs. In view of their cleanliness, supermarkets and neighbourhood shopping centres will require shells. An increased use will be made of balanced cantilever shells for railway station platform roofs. Storage buildings such as those built in Germany and still standing today after direct hits from bombing, and holiday resort buildings, restaurants and large garages, are all suitable for shells. The future of shells is unlimited.

Acknowledgements

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Future annual meetings of the Engineering Institute

QUEBEC, QUE., May 12, 13, 14, 1954, Chateau Frontenac

TORONTO, ONT., May 11, 12, 13, 1955, Royal York Hotel

MONTREAL, QUE., May 23, 24, 25, 1956

The Journal *will have news of the 1954 meeting in coming issues*

THE ASME BOILER CODE

In the July 1952 issue of *Mechanical Engineering*, the ASME commenced publication in serial form, of a history of events leading up to the present ASME Boiler Code, from the first development of boilers in the 18th Century. This history, continued through some ten issues, was prepared by Arthur M. Green, Jr., of Princeton University.

As a preface to the regular publication in future issues of *The Engineering Journal*, of Boiler Code Regulations, this history is here presented in condensed form. It will appear in several issues of the *Journal*, of which this is the third.

III. Revisions and Special Committees, 1932-1935

1932 Edition

In the 1923 Edition of section VIII, Unfired Pressure Vessels, paragraph U-1 contained a new description of vessels to which it applied, and stated provisions of section I of the Code should be mandatory where no definite rules were to be found in section VIII. Paragraph U-2 provided materials other than those specified might be submitted for consideration wherever available. This provision was also made in paragraph U-71.

The need of an X-ray examination of a joint between a dome flange and the vessel was eliminated where welding was in accordance with the rules applying. Reinforcement of openings in dished heads was to follow new rules of paragraph U-59, which was reworded, enlarged, and contained other paragraphs from the 1931 Edition.

The portion on General Requirements provided for permanent marking of each vessel of plates less than ¼ in. to identify the heat from which it had been rolled. Paragraph U-66 on Stamping was enlarged. Rules for the Fusion Process of Welding was changed in only a few places.

Rules for Forge Welding were changed to allow fire-box quality steel to be welded, and provided that stress relieving be done according to an earlier paragraph U-76. Rules for Brazing increased maximum working stress to 9,900 lb. per sq. in. from 8,550 lb. per sq. in. All material specifications of this section in the 1931 Edition was transferred from section VIII to section VII. The Appendix now contained paragraphs UA-1 to UA-8, and UA-10 to UA-15.

The 1932 Edition of section IV, Low Pressure Heating Boilers, contained only minor changes, and rewordings in paragraphs H-35 and H-66. The material specifications in the 1931 Edition of section IV were transferred to section II, Material Specifications.

The 1932 Edition of section VII, Suggested Rules for Care of Power Boilers, followed that of 1927, except for the change in paragraph CA-5 dealing with Caustic Embrittlement. Data now collected showed so clearly the phenomena called Caustic Embrittlement that a revision was prepared. Intercrystalline cracks were generally attributed to the effect of caustic soda on the lightly stressed metal. Then followed instructions for preventing embrittlement. This section VII contained paragraphs C-1 to C-34i and an Appendix, paragraphs LA-1 to CA-27, with same titles as in the 1927 Edition.

Edition of 1933

Section I, Power Boilers; section II, Material Specifications; the Appendix; and section VI, Rules for Inspection of Materials and Steam Boilers, were published in one volume from addenda issued since last printing. The only change in section VI was the new paragraph I-61, calling for inspection reports on Forms A, B and C. The inspector was to certify Forms A and C, while signature only was needed on Form B. These data were sufficient to check fulfilment of the Code requirements, and to give history and ownership of the vessel.

Section II was brought into agreement with changes made in the latest ASTM Specifications since 1921, and Specification S-25 for Open Hearth Iron Plates which was added had been approved in 1930. The principal changes in the 1933 Edition of section I, Power Boilers, were: permission to use steel pipe of S-18 or steel tubes of S-17 for boiler drums; a table of working stresses in steam piping of various materials of section II, and a new formula for working pressure in steam pipe.

The table for working pressure of copper tubes for boilers was new. Additions and changes were made

in paragraph P-102(i), Nondestructive Tests, covering increase in metal thickness to be X-rayed from 2½ in. to 4¼ in. Gamma rays as well as X-rays were permitted for making radiographs. Identification markers, data needed by inspectors, and requirements for satisfactory welds were covered in detail. In addition, words, clauses or even paragraphs were inserted to make the rules clearer. The 1933 Edition of section VII, Suggested Rules for the Care of Power Boilers, was a reprint of the 1932 Edition.

Edition of 1934

Although an edition of section VIII, Unfired Pressure Vessels, had been issued in 1932, some experiments and studies over several years had been completed by 1934, and an edition of that year was published to make the results available to industry. These were the new Rules for Flat Heads, for Vessels Subject to External Pressure, and for Bolted Flanged Connections.

Other charges dealt with rivet tension in manhole frames and dome flanges; paragraph U-33(b) on Butt Joints; classification of welds by paragraphs U-68, -69 and -70 rather than numbers 1, 2 and 3; extension of interval between the tests of welding operators from six months to one year, when regularly employed on some process of welding; and finally the local stress relief of nozzles or welded attachments.

Paragraph U-68(i), Nondestructive Tests, was reworded. Radiographs by gamma rays were recognized, as well as those by X-rays. Details of the use of the penetrometer were given, and also rules for minimum distance from radiation source to back of weld for different metal thicknesses. New statements were made on the quality of radiographs and data recorded on them.

A new definition of lethal substances was added to footnotes, paragraphs U-69 and U-70. The rules for forge welding, for brazing, and for enameled vessels were not changed. Paragraph U-39, Flat Heads of 1932 was enlarged to a three page section. The first four of nineteen numbered paragraphs of the new Rules for Vessels Subjected to External Pressure referred to materials to be used, the working pressure, the minimum pressure of design and the use of Figure U-20.

Paragraph U-25 and charts U-25 and U-24 explained out-of-roundness. Stiffening rings were discussed. Rules for various items were covered in paragraphs U-133 to U-138. Rules for Bolted Flanged Connections were placed in the Appendix, paragraphs UA-16 to UA-22.

Code of 1935

The 1935 Edition of section I, Power Boilers, contained many changes brought about by replies to enquiries. The minutes of the Boiler Code Committee indicate the great care that was given to the addenda. In paragraph P-102(e) attention was called to the fact that the test for a welded joint specimen was for the purpose of testing the weld and not the plate. Later, two additions were made to the gauges shown on Fig. P-4, Details of Thickness Gauges or Penetrometers.

The formula for flathead thickness was changed by substituting a constant "C" for the constant 0.162. Values of "C" for six different sets of conditions were given. These changes, as well as the large additions on openings in the 1933 Edition, were prepared by Subcommittees on Heads and Openings (same as paragraph U-39 of section VIII). A few changes were made in the division on Safety Valves.

The section on fittings and attachments was changed to bring the Code into agreement with requirements of the ASA tables given in the Appendix as to dimensions and maximum allowable working temperature and pressure. A major addition was made to paragraph P-325, permitting fusion welding of lugs, hangers and brackets when of the same size as those which could have been riveted if made of Code Materials, and when attached as shown in paragraphs P-101 to P-111 inclusive.

Section II, Material Specifications (1935) had been altered by using the last editions of a number of ASTM Specifications, and by the addition of five new specifications. These were S-26 to S-31 inclusive. Of the 31 specifications, 24 were identical with ASTM Specifications, one in close agreement, two based on ASTM, and four with no counterpart among the specifications adopted by the ASTM.

The 1935 Edition of section III, Boilers of Locomotives, was identical with those of 1927 and 1931, except for acceptability of other steels for fabrication in paragraphs L-3, L-3 and L-5, and of enlarging paragraph L-53 on Rivet Holes. Fusion welding of barrels was not incorporated, although the use of it was recognized, as in the 1927 Code and earlier.

The principal changes in the 1935 Edition of section IV, Low Pressure Heating Boilers, were in paragraphs H-64 and H-117, Low Water Fuel Cutoff. These were now entitled "Automatic Low Water Fuel Cut Off and/or Water Feeding Device". Section I, Steel Plate Boilers, paragraphs H-1 to H-63 of this Code, were altered. In paragraph H-28 a paragraph was added on the minimum size of firedoor openings.

An addition to paragraphs H-84 to H-118 contained a large addition to H-92, providing for expansion tanks and giving a table of sizes. The same changes were made in this section as those for corresponding sections of section I, Steel Plate Boilers.

The 1935 Edition of section V, Miniature Boilers, differed from the 1931 Edition in that an Appendix, paragraphs MA-1 to MA-4, was added. This Appendix was the same as paragraph U-69(b) of section VII of 1935, after eliminating from it the first three and the last paragraphs. Three paragraphs were added to paragraph M-4, describing the materials which could be welded, testing of welding operators, and conformance of welded joints to requirements of the Power Boiler Code or the Appendix paragraphs MA-1 to MA-4.

Although an Edition of section VIII, Unfired Pressure Vessels, had been issued in 1934, the addenda since justified a 1935 edition. This would permit adding Rules of Electric Resistance Welding, now completed as a result of hearings and enquiries. Paragraph U-68(i), Nondestructive Tests, was changed to provide that the thicker finished weld beyond the limit of the X-ray must be stress-relieved on completion.

Credit for material added for corrosion in figuring strength was eliminated, and permission to use the symbol signified the manufacturers agreement that the vessel was built in accordance with the Code. In the enlarged paragraph U-72, Preparation for Welding, flame cutting for plates was permitted if carbon content did not exceed 0.35 per cent. To the section on Flat Heads, enlarged in 1934, three new categories fixing the value of constant "C" were included, and four additional figures were added to Fig. U-2.

The new Rules for Electric Resistance Butt Welding included five numbered paragraphs, paragraph U-110 called for the metal of the vessel parts to be welded to be of the quality of the steel plates for forge welding in S-2. Paragraph

U-111 required that maximum allowable working stress should be 8,000 lb. per sq. in., and the weld should be annealed. Paragraph U-112 provided for progressive continuous welding over the entire length. Paragraph U-113 provided that working stress must be reduced to values shown in U-4 when temperatures exceeded 700°F.

The Appendix contained the Standard Practice of Making Hydrostatic Tests, and sample methods of Computation of Openings in Shells of the 1934 Edition. Rules for Bolted Hanged Connections were enlarged, and Maximum Design Stress was altered slightly. The new Manufacturers' Partial Data Report was added. These eight sections and Appendix made such a large volume that future editions have been issued in separate sections.

Butt Welding

During this period, paragraphs U-110 to U-114, Rules for Electric Resistance Butt Welding, were added to the 1935 Edition of section VIII in March 1935. These could be applied to the various methods brought before the Committee. They covered the principles which might be used by any of these methods to produce welds that would warrant recognition by the ASME Boiler Code.

Radiographs

The first Rules for Fusion Welding and Classifications 1, 2 and 3 led in 1932 to the formation of a One Class Welding Association, made up of those manufacturing vessels for unlimited use requiring X-ray examination of the welds. A written statement was presented in January, 1932, from the Fisher Body Corporation, describing X-ray examinations and tests of welds on the tests specimen called for by the Code, to determine strength and to test the welder. Investigations suggested the need of amplified provision for stress-relieving, with time limits. These indicated that for a one inch plate the shorter time of cooling resulted in greater strength but less elasticity.

A communication from the Henry Vogt Machine Company on improvements to the requirements for radiographs by gamma rays and better stress-relieving, was referred in June, 1932, to the Special Committee on Standardization of X-ray Films. In October, 1932, this Committee reported it had adopted the suggested names of "gammagraphs" for films from gamma rays, and "exographs" for those from X-rays in paragraph P-102(i), while the general term "radiograph" would be used for either.

The Committee had concluded that the only way of adjudging acceptability or rejection of porous welds was by direct comparison with standard radiographs, showing various degrees of porosity. Reproductions of these on films would be made by the Boiler Code Committee for sale to manufacturers and inspectors. The X-ray Committee recommended maximum distance from film to nearest surface of weld seam should be one inch.

The Subcommittee on X-ray Examinations, in October 1932, approved the nondestructive test methods, and provided for gamma rays, increased plate thickness, and the use of thickness gauges also for acceptable and non-acceptable porosity by the use of standard films.

The Committee concluded the only method was to secure X-ray films from manufacturers of fusion welded vessels, and that the Boiler Code Committee and its X-ray Subcommittee should fix those it deemed acceptable and not acceptable. The report closed with the revision of paragraph P-102(i) which was included in the 1933 Edition of this section of the Code.

In February, 1933, the Committee approved the recommendation of its Subcommittee on Welding, that the time of making the radiograph should be at the discretion of the manufacturer. When the weld was satisfactory the joint could be stress-relieved.

The Class One Welding Association advised the API-ASME Code Committee in February, 1934, that sensitive X-ray paper had not yet proved itself capable of replacing X-ray films for the examination of welds. The Committee also justified the minimum distances of 36 inches and 38 inches from the radiation source to weld for wall thicknesses of 3 in. and 4 in. respectively, unless shorter films were used.

Objections to the use of gamma rays were not approved, as gammagraphs must be used to examine very heavy sections. Four standard films were selected by the Special Committee in October, 1934, in collaboration with the Class One Welding Association.

Changes were made in paragraphs P-102(i) and U-68(i) in March, 1934, for the 1935 edition of all Codes, making minor changes in 1933 paragraphs, and defining the position of the penetrometer, etc. In September, 1935, the Special Committee on X-ray Requirements reported the successful use of a 400 kw. X-ray tube with the Buckey Grid, for examination of welds for heavy plates. Its use was approved.

Sets of radiographs showing acceptable and unacceptable welds issued by the Boiler Code Committee led to the rejection of welds by inspectors, who believed they were not sufficiently stringent. Some users of petroleum equipment under the API-ASME Code expressed a similar opinion. The Special Committee on X-ray Requirements was requested to hold a joint meeting with the Joint API-ASME Committee on Unfired Pressure Vessels and the American Welding Association, to correct these insufficiencies.

Hammer Test

As a result of a hammer test required by paragraph U-68, made in May, 1935, by the Standard Oil Development Company, there were indications of stress lines radiating from the point of application. The Company held that where welds had been X-rayed it was not necessary to subject the vessel to the hammer test. There was some difference of opinion among members of the Subcommittee on Welding and the AWS Conference Committee.

In October, 1935, approval of the retention of the hammer test was reported by the Class One Welding Association, and this was reported by the Class One Welding Association and the Subcommittee on Welding. Although the AWS Conference Committee approved the retention, the AWS disapproved it, and the matter of elimination of the test for U-68 vessels was referred to the Conference Committee.

Stress Relief

In September, 1935, the subject of stress-relieving was referred to a special committee appointed to consider revisions of section VIII of the Code. At various meetings evidence furnished was considered not sufficient to justify the changes proposed for paragraph U-69, and other changes had been disapproved. Since agreement could not be reached it was decided the requirements of the Code would remain unchanged.

Welding Operators

In accordance with Boiler Code Committee action in October, 1934, the 1935 editions of the Codes used the designation "welding operators" to replace that of "welders" in the earlier editions. The qualifications of welding operators had been given in the Codes following those

of 1931, and their training was the responsibilities of industry.

The International Brotherhood of Boiler Makers suggested that universities and technical schools receive samples of the work of welding operators for approval and certification. The Boiler Code Committee replied to this suggestion, quoting the manufacturer's responsibility and pointing out there was nothing in the Code providing for certification of operators by other agencies.

To an objection presented in 1932 by the Struthers Wells Company regarding requirements of qualification tests at six month intervals, the Committee replied it had been recognized this might require revision, and the subject would be considered later. The Committee then provided in paragraph U-69 of 1935 that "when the operator is regularly employed on work embracing the same type and process of welding . . . the tests may be effective for a period of one year."

Base Metal and Filler Metal

The filling or weld metal of the weld rods, filling rods, electrodes, or other metal used to join two sections of the base metal, was described in section IV in general terms as to its smoothness, cleanness, smooth flowing quality and its suitability to produce good welds. No requirements for weld metal were given in the 1935 Edition of section VIII. A probable reason for this omission was that the Committee believed adequate requirements for the finished product were sufficient. Earlier editions of section VIII provided in paragraph U-67 that welding wire might be bare, coated or covered. Paragraph U-111 in section VIII stated that any brand that in practice gave good results might be used.

The repeated stress test of the B and W Company at Barberton in 1925 had shown the superiority of arc welds from coated electrodes. It appears the industry became aware of this superiority about 1930. The Lincoln Electric Company brought to the Committee's attention in April, 1934, a shielded carbon electrode for arc welding. The Committee advised the Company that any welding process might be used that came within the limits of the term "fusion welding" of paragraph U-67, and that would produce welds that would pass the test requirements of paragraphs U-68, U-69 and U-70.

The ASTM advised the Executive Committee in March, 1935, that Committee A-I of the ASTM had been studying specifications for iron and steel welding rods, wire, electrodes and similar material for fusion welding. As increased welding required unnecessary variations, a joint discussion by various organizations was suggested. The Executive Committee announced that it saw no need for this; that the Filler Metal Committee of the AWS would hold a meeting in April to discuss this problem. The Boiler Code Committee approved this opinion.

Flame Cutting

In discussions during March, 1934, on the preparation of plate edges for the welding of Class I welded pressure vessels, it was brought out that if gas-cut welding edges were reasonably smooth and regular, welding thereon should be acceptable without planing, milling or chipping, although no definite action was taken at the time.

Fusion Welding for Repairs to Insured Vessels

In June, 1932, the National Bureau of Casualty and Surety Underwriters presented a tentative set of rules based on the 1931 Edition of the Unfired Pressure Vessel Code, to the Executive Committee of the National Board of Boiler and Pressure Vessel Inspectors for discussion, in an attempt to develop a reasonable set of rules. This was presented at the Boiler Code Committee meeting in September, 1932, and referred to the Executive Committee and the Subcommittee on Welding.

The final form of the requirements was reported in December, 1932, and the Board later reported on an amended form to meet objection. In March, 1933, the Committee voted that the requirements as presented were consistent with Code requirements, and should give safe results. After two years of use they were revised in April, 1935, to bring them in agreement with later editions of the Code, and to include additions suggested by their use.

Responsibility for Welding in Two Different Shops

Some boiler manufacturers, according to a communication received in May, 1933, who had no complete equipment, desired to furnish the highest class welded structures and to secure such structures from shops which could produce such drums for their boilers. The question of which shop should apply the stamp was in doubt.

A special committee reported in June, 1933, that any part should be stamped by the fabricator, and the inspector making final inspection would be responsible for its meeting the Code requirements. This was adopted and added to paragraphs P-332 and U-65. In September, 1933, and in March, 1934, new wording and further changes were found necessary. The final form of paragraph P-332 was adopted in September, 1934, and approved by the National Board of Boiler and Pressure Vessel Inspectors.

Miscellaneous Welding on Boilers

In February, 1932, proof tests of two fusion welded boiler tube headers were referred to the Subcommittee on Welding, the Conference Committee of AWS and the Executive Committee. Opinion was asked whether the headers so constructed would meet Code requirements. The question arose as to whether the Committee was ready to express an opinion on headers embodying this class of welding.

The AWS Conference Committee believed that if all Code requirements of design were met, corner welds could be used with safe results, and recommended the allowable shearing stress at 65 per cent of s, or paragraph U-20. It was finally suggested that the question be referred to the Subcommittee on Welding and the AWS Conference Committee for a year's study. In April, 1932, it was decided to submit all future special requests for new uses of welded joints, other than those in paragraphs P-101 to P-111, to these Committees for study.

Joint API-ASME Code

In January, 1934, the tenth draft of the API-ASME Code was presented to the Boiler Code Committee with accepted changes to earlier proofs, with request for review. Some members of the Conference Committee of State and Municipal Boiler Inspectors did not favour two sets of rules; one in section VIII, and the other as a Joint Committee report for public use.

A special committee was appointed to make suitable recommendations, which reported it was advisable for the ASME Council to approve publication of the rules for criticism and comment. In February, 1934, the Boiler Code Committee sent a letter to the Joint API-ASME Committee, mentioning 39 changes. These suggestions were followed, but not all. They represented a cross-section of the views of the API and ASME, each conceding certain features so that agreement

might be reached. It was decided no formal action should be taken by the Boiler Code Committee.

The API-ASME Code was published in September, 1934. The exemption of the preambles of section VIII, "Vessels for Inflammable Liquids or Gases at Temperatures over 300°F.", was brought before the Boiler Code Committee from the Joint API-ASME Committee. A special committee was appointed to draw up a suitable wording for this exemption. At a meeting in February, 1935, of the Boiler Code Committee, members of the special committee advised postponement of any change of the exemption, pending possible coordination of the two Codes in a single Code.

A special committee to revise section VIII, to embody the best features of ASME and API-ASME Codes, and to use API-ASME rules for all vessels other than those covered by paragraph U-70, was approved. The need for revision arose because many industries other than the petroleum industry, realizing the cost of vessels was less when built under the new Code than under section VIII, had been ordering under that Code, which did not establish qualifications for inspectors.

Tensile Strength of Rivets

The tensile strength of rivets used in connecting domes was brought before the Committee by the American Petroleum Corporation in April, 1932. From publications from the University of Illinois and the American Institute of Steel Construction, it appeared that 8,000 lb. per sq. in. in direct tension might be used with safety, pending further test data.

A special committee was appointed to formulate a revision of paragraph P-193(a). A report from this Committee in February, 1933, gave permissible stress for rivets in domes of not over 7,200 lb. per sq. in., with a factor of safety of 5, because of many factors that must be considered. This was referred to the Subcommittee on Boilers of Locomotives and the Special Committee on Reinforcement of Openings, both of which in March, 1933, approved the recommendation of 7,200 lb. per sq. in. for rivets in dome rings.

Vessels Under External Pressure

The ASME Special Research Committee on Strength of Vessels under External Pressure reported on proposed rules resulting from their research, which had been requested by the Boiler Code Committee. They had first reviewed all existing formulas proposed for such vessels.

Those for determining strength were in many cases too complex to be included in a Code for use of the average boiler fabricator, so the Committee attempted to simplify the application by easily understood rules and charts. The Rules were reported by the Committee in December, 1933, and were accepted for publication and became paragraphs U-120 to U-138 of section VIII of the Code.

Objections and Protests

Frequent revisions were objected to in December, 1932, by State boiler inspection departments, because of their printed rules which became antiquated, and from builders who had to change designs. A special committee was appointed to advise the Boiler Code Committee on ways, means and scope of its work.

In February, 1933, a protest from the Ohio Board of Boiler Rules against the number of revisions was announced. It was the Board's opinion that the Committee's policy should not be to consider through interpretations or revisions, questions of construction for special designs not covered by the Code. Fabricators of vessels should construct in accordance with the Code instead of revising the Code to suit.

The Special Ways and Means Committee was appointed in January, 1933, and reported in September, recommending that addenda and interpretations be continued as the needs of the industry dictated, but that a special effort should be made to restrict them to a minimum to meet actual needs. The method of conducting meetings should be changed and the conduct made more formal. An order of procedure was given. Form letters were also given dealing with the greatest amount of Committee correspondence.

U.S. Navy Machinery Specifications

The Bureau of Engineering, U.S. Navy, had submitted tentative changes to its Specifications for Machinery used for purchase of Propulsion Machinery, asking for criticism. The changes and additions were referred to the Subcommittee on Welding and the AWS Conference Committee. Criticism was reported in March, 1933, of such a nature that a conference of representatives of the Bureau, the Boiler Code Committee, and the AWS was recommended, and this took place at Annapolis in April, 1933.

A paper was presented on a new instrument, the arconograph, which analyzed electric arc welding by recording voltage across the arc during welding on a chart. Discussion followed and a demonstration was made. Defects indicated by the arconograph were found on breaking one of the weld specimens.

Rules for Flange Connections and Flatheads

The tentative report of the Subcommittee on Special Design, giving Rules for Bolted Flanged Connections and proposed Revisions for Flatheads, was formulated by a special joint committee with representatives from the ASA Sectional Committee on Pipe Flanges, the API and the Subcommittee on Special Design. This was presented in February, 1934.

The letter of transmittal was accompanied by five pages of text and tables which finally became paragraphs UA-16 to UA-22, while Proposed Rules for Bolted Flanged Connections and Revisions of Rules for Flatheads and Covers were applied to paragraphs P-198 and U-39.

Boilers

It was voted by the Executive Committee in January, 1932, to recommend to the Chief Boiler Inspectors of New Jersey and New York, acceptance of mercury boilers to be installed at Schenectady and at Newark, as a special case.

A communication was received by the Executive Committee before the January, 1935 meeting, from the Machinery and Agricultural Implements Division of the Department of Commerce, transmitting a copy of a letter from the Assistant Trade Commissioner of the U.S. Embassy in London, England. This letter made enquiry relative to inspection under ASME Code requirements of British made boilers for export to the United States.

The Executive Committee of the National Board of Boiler and Pressure Vessel Inspectors believed an inspector in England could be qualified by passing an examination by members of the National Board in some state that had adopted the Code. The Committee referred the opinion of the Executive Committee of the National Board to the Executive Committee of the Boiler Code Committee.

The latter Committee replied in February, 1935, pointing out two methods of inspection, one by the passing of an examination by a foreigner, the other having a qualified inspector of the U.S.A. inspect

the boiler construction in Britain. It was suggested an international trade law might include reciprocal inspection agreements.

The Subcommittee on Material Specifications, during this period, arranged for the introduction of many revisions so the specifications would agree with the latest form of earlier ASTM Specifications, and proposed the adoption of six additional, S-26 to S-31. In January, 1932, this Subcommittee reported that the Code did not require the presence of an inspector in a steel mill, but only the mill report and specified properties. Foreign sheets and solid drums meeting these requirements could be used in Code structures.

In June, 1932, the Committee confirmed this ruling for foreign boiler material. It also recommended that boiler tubes made by the Johnson Electric Welding Method be acceptable under S-17 and S-18, and that no further action be taken at that time regarding electric-resistance welded pipe, as the ASTM Specification A-135-31T would require a number of revisions. A special committee was appointed to consider the allowable stress on the fusion welded pipe, which had been reported.

Acceptability of Other Materials

The Subcommittee on Materials recommended in September, 1932, that electric furnace steel be considered acceptable under the Code in specifications requiring open hearth steel. This was cared for by alteration of ASTM Specifications to the "Process" clause.

In February, 1932, the Boiler Code Committee was asked to consider "Everdur" as a material for a fusion welded pressure vessel for 300 lb. per sq. in. The properties of the material given in the reply to this case permitting its use indicated the requirements to be met. In April, 1934, this material was permitted for the shell of low pressure heating boilers.

The Petroleum Iron Works Company asked an opinion on "Cromansil" as a material for use in fusion welded pressure vessels, which under paragraph U-71(c) might be considered for new material. Its weldability was questioned, and a special committee was appointed to prepare a statement of facts before consideration by the Boiler Code Committee. The report of February 1933 recommended that a specification be requested from the appropriate Committee of ASTM or with its co-operation.

On April 21, 1933, it was reported the Lukens Steel Company was conducting tests at Lehigh University on riveted joints of plates of cromansil alloy steel. It was stated that manufacturers of cromansil had objected to a lengthy breathing test.

The Subcommittee in January, 1934, presented a specification for this steel alloy with chromium manganese and silicon. The material had not been considered by it as a material for welding. They saw no reason why it should be questioned for unfired pressure vessels or power boilers with riveted joints, as it had much greater strength. It had been in actual use for three or four years. Its suitability for riveted construction should be submitted by the makers to recognized metallurgists.

In December, 1935, a report was made that the cromansil alloy-steel had been subjected to 250,000 alternations from 0 to 1½ times the working pressure, to prove its satisfactory qualities. In November, 1934, the maximum shearing strength of Grade A cromansil was made 60,000 lb. per sq. in. in single shear, and 120,000 lb. per sq. in. in double shear, with a crushing strength of 120,000 lb. per sq. in.

Fatigue Tests on Steels

In February, 1935, tensile strengths of high tensile strength carbon-steel plates were fixed at 70,000 lb. per sq. in. for S-26, S-27 Grade A, 65,000 lb. per sq. in., and Grade B 70,000 lb. per sq. in. Strength of cromansil S-28 was fixed at 75,000 lb. per sq. in. for Grade A and 85,000 lb. per sq. in. for Grade B. For materials of S-26 and S-27, crushing strength was given as 95,000 lb. per sq. in., same as firebox steel of S-1.

Permissible use of molybdenum steel for boiler drums and pressure vessels was brought before the Committee in June, 1934. This steel was proposed for boiler drums or vessels, welded in accordance with paragraph U-68 (Class 1). This was referred to the Subcommittee on Material Specifications. The chairman pointed out it had no information on the suitability for welding, and proof tests should be furnished.

In October, 1934, the Subcommittee reported that they believed breathing tests were not always necessary to prove adaptability of a new alloy to breathing tests; that checks on specimens cut from welded joints perpendicular to the weld could be combined with fatigue tests, which would test the weld metal and the plate. A discussion showed agreement on the elimination of the breathing tests, at least for low alloy metals.

Herculoy, a copper alloy of Revere Copper and Brass, Inc., was presented as a permissible metal for unfired pressure vessels, in accordance with Case 715 permitting the use of Everdur. Herculoy was allowed under paragraph U-69, with restrictions given in the reply of May 25, 1934. Monel metal for nipples in blow-off connections was sanctioned in January, 1934, by an addition to paragraph P-9.

Permission for the use of high strength copper-nickel alloy or that of the 18-8 chrome nickel alloy steel was requested in May, 1934 for a seamless pressure vessel. This was referred to the Executive Committee in conference with the National Board of Boiler and Pressure Vessel Inspectors. On examination of the design, the construction of this low temperature vessel was approved (Case 780) in June, 1934.

In September, 1934, a draft specification for Monel Metal and 18-8 Chrome-Nickel Alloy Steel was submitted to the Subcommittee on Material Specifications, with inquiry as to whether it would be suitable for the particular service being considered by the Boiler Code Committee. The Subcommittee explained in October why these specifications could not be used. The Committee voted to use them in making the necessary qualifying replies to the cases asking for these materials under paragraph U-12. Replies to Cases 792 and 793 were issued pending results of the joint action of the Committee and the ASTM.

Steel meeting the Specification S-1 but containing up to 2½ per cent of nickel, to obtain a tensile range of 70,000 to 80,000 lb. per sq. in. and yield strength of 0-6TS, was approved for stamping with Code symbol for small high pressure heating boilers on diesel locomotives.

Specification S-29 (ASTM B55-33) for Seamless 76-30 Brass Condenser Tubes and Ferrule Stock, and S-30 for Seamless Muntz-Metal Condenser Tubes were added to section II, Material Specifications, in February, 1935. A change in paragraph P-12 was requested in April, 1935, to permit the use of a lower grade malleable iron than that in S-15. After discussion the Committee voted to make no changes.

A special committee was appointed in April, 1935, to consider whether provision should be made in the Unfired Pressure Vessel Code for the use of cast iron in

such vessels. The Committee in October, 1935, accepted the progress report of the Subcommittee on Material Specifications, that on nickel clad steel plates the same objections as to differences in coefficients of expansion did not hold, adding certain qualifications thereto.

American Marine Standards Committee

In February, 1932, the Committee appointed by the Hon. R. P. Lamont, Secretary of Commerce, two years before to co-ordinate Marine Boiler Rules, submitted its report to the Supervising Inspector General of the Steamboat Inspection Service, D. N. Hoover. The Service had decided to publish Suggested Rules for Marine Boilers and Pressure Vessels as an appendix. For this purpose a committee of AWS had co-operated, and its Board of Directors had approved the rules in January, 1932. Fusion Welding Rules of sections 1 and VIII of the ASME Code had been used as a basis, with modifications.

In April, 1932, a proposal to consolidate the Steamboat Inspection Service and the Bureau of Navigation, was reported. The new Bureau would be known as the Bureau of Navigation and Steamboat Inspection Service. Senate Bill S-1129 was reported to the Committee in April, 1933, relating to construction and inspection of boilers, unfired pressure vessels and appurtenances thereof.

A new Board of Supervising Inspectors would be empowered to make rules and regulations covering design, construction and inspection. Boiler Code Committee support of the Bill was sought. Action by the Committee or by the American Engineering Council was referred to the Executive Committee, with power.

As Mr. Hoover had asked for comments on the rules by March 1, 1934, the matter of suggestions was considered by the Committee in February, 1934. In sending the suggestions, a set of resolutions was included covering approval of Rules I and II of General Rules and Regulations, with congratulations to Mr. Hoover on success in the passage of a Bill by Congress, together with endorsement of the proposed changes and thanks to General Hoover and James Wilson for their co-operation and help.

General Rules

The amended Rules I and II, General Rules and Regulations, were called First Supplement to General Rules and Regulations, January 1, 1935. These were adopted pursuant to authority conferred by the Act of June 13, 1933, amending Rules I and II. The foreword contained pages I to XI, with 164 pages of text. Rule I on Specifications covered 44 pages and Rule II, 120 pages.

The Material Specifications were mostly marked "in substantial agreement with" some ASTM Specifications. In Rule II many of the diagrams and formulas were based on ASTM Codes. Section XX on Fusion Welding was based on those prepared by the ASME Boiler Code Committee with the co-operation of the AWS.

Advisory Board of Standards and Codes

In December, 1934, the ASME Council set up an Advisory Board of Standards and Codes with representatives from ASME Council, and each of the following: Boiler Code, Standardization, Power Test Codes, and Safety. Authority had been delegated to the Board by the Council to approve actions of the Boiler Code Committee. Actions of the Boiler Code Committee were entered into the Minutes of the Council, and the Committee still remained a creature of the Council.

California Activities

In January, 1932, the proposed revision of the Air Tank Safety Orders were received from the Boiler Section, Industrial Accident Commission, State of California. It was the desire of this Commission to adopt the 1931 Code for Unfired Pressure Vessels for its Safety Orders, but local conditions and the pressure of local industries made it necessary to follow the suggestions of its Revisions Committee.

This matter was referred to the Executive Committee. In March, 1932, a letter was sent by the Boiler Code Committee to the Commission, commenting on 35 of their paragraphs. The Commission's reply was referred to the same group of the Boiler Code Committee. The reply by the Committee was reviewed in May, 1932, and was approved for transmission by the Committee.

Correspondence between the Committee and the Commission regarding inserted heads, single welded on the outside only, led to much study. The Committee authorized a letter to the Commission asking for full design and data on certain tanks which had failed, especially the attachment of the heads, noting that the ruptured vessels showed construction so foreign to the spirit of the Unfired Pressure Vessel Code that failure did not indicate that present Code requirements were incorrect.

The construction used was not sanctioned by the Code. No failure in a vessel built in accordance with Fig. U-17 of the 1932 Code and of paragraphs U-73 and U-75 had been reported to the Committee. Further information was requested. The Commission later referred to proposed revision of paragraphs U-69 and U-70.

In October, 1933, a conference was held with Mr. F. A. Page, Supervising Engineer of the Commission, by two members of the Committee. This resulted in revising Fig. U-17 of the 1932 Code (Fig. U-18 of the 1935 Code) to make the distance 2(t) that from point of tangency as shown in Fig. U-18, with a minimum of ½ in.

Following this settlement, failure of a casing-head gasoline storage tank was reported. The Commission was requested to supervise installation and operation of unfired pressure vessels, particularly those of industries handling inflammable material. Mr. Page requested recommendations of the Committee in consideration of proper rules. In February, 1934, it was reported that Mr. Page had been advised by his Chief that it would be better to follow the ASME Code. There were no further references to the California activities in 1934 and 1935.

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The Plastic Theory of Structural Design

by

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There is considerable and growing interest in "limit" or "plastic" design methods as applied to structures and much has been written about them, some of it unfortunately not too clear to the uninitiated. This paper seems to us to give a singularly simple outline of the bases of plastic design, perhaps partly because the authors enjoyed personal contact with Professor J. F. Baker, one of the leaders in the work which led to arousing interest in the theory.

Engineers are well aware of the large sums which must be spent to provide the new buildings required by Canada's expanding economy, and great ingenuity is being exhibited in solving the problem of providing economical structures. Designers are alert to the advantages of new structural materials, such as the light alloys, laminated timber, plastics and glass, while prestressed concrete is also receiving considerable attention from the building industry. However, conventional construction in mild steel has a combination of desirable features—lightness, adaptability, ease of erection and stiffness, for example—which cannot be attributed to any one of the new materials mentioned. There is little likelihood that the steel framed building will be entirely replaced by other forms especially as their construction is being made easier and more efficient with the increased use of welding.

With costs still rising, we must make certain that steel framed buildings are being designed and erected in the most economical way. We must ask the questions, "Is the steel being used efficiently ? Does the design theory used correctly predict the action of the material when it is incorporated in a structure ?" This article is an attempt to present the underlying ideas of the plastic theory of design, to inform engineers about the present development of the theory and to show examples of current British design.

European engineers have been concerned for many years with the actual behaviour of steel structures and have carried out much experimental work, both in laboratories and on full-scale structures. In England in 1936, for example, the Steel Structures Research Committee reported tests on various structures, including a new hotel building and a block of residential apartments. Loads equal to the design loads were applied and complete pictures of the stresses in the structures were determined by means of strain measurements. It is no exaggeration to say that these real stresses bore practically no relation to the design stresses.

A direct result of these tests was a proposed SSRC design procedure which, while permitted by the latest (1949) revision of British Standard (B.S.) 449, is cumbersome and little used. An indirect result was that Professor J. F. Baker, who had been concerned with the SSRC tests, decided to approach the problem of

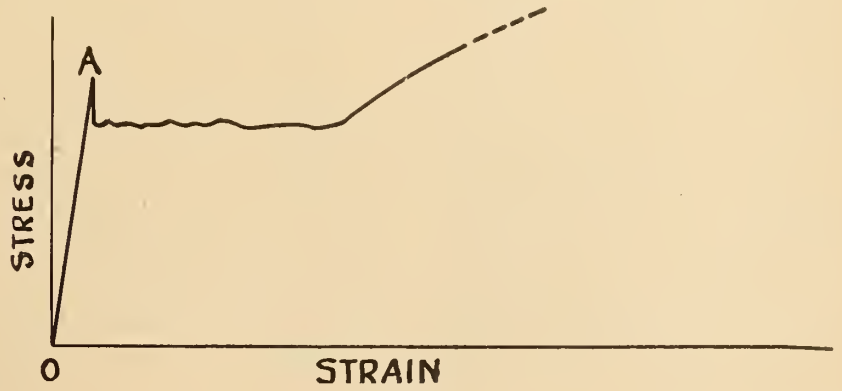

Fig. 1.

structural design in steel from the point of view of ultimate load capacity and plastic theory. Working first at Bristol and later at Cambridge, he and his colleagues have brought the theory to a point where it is now incorporated in B.S. 449 and in the British Code of Practice. Two representative buildings designed by the theory are illustrated in this article. The use of the plastic theory instead of the orthodox elastic method has two marked advantages; considerable savings in material may be achieved, and the design itself is more rational and uses the material more efficiently.

Using the word "structure" in its widest sense, the engineer is concerned that any structure he designs does not fail in use; for example, a shaft must not fracture and a boiler must not burst. In the structural field, a building must not collapse. This way of looking at the design problem is inherent in the plastic method—*the building is designed to collapse under some specified amount of overload.*

Compare this with the elastic method of design. In the conventional design one assumes that, when any one portion of the structure is subjected to stresses equal to the yield stress, the structure is no longer serviceable. In fact, as the simple examples below show, after the yield stress has been reached at one location, a structure may have a considerable reserve of carrying capacity and the applied loads will have to be increased considerably before collapse occurs.

The magnitude of this extra margin of capacity, inherent in elastic design but always ignored, varies from structure to structure depending on proportions and on the number of redundancies. If this extra capacity to carry load were a constant proportion of the elastic "strength" of all structures, then the elastic theory could be used to predict the real strength of structures and would provide a rational design method. However, the margin of capacity, lying between first yielding and final collapse, does vary, and so design based on the elastic theory is irrational because the real "factor of safety"—the ratio of ultimate load capacity to design load—of structures designed by the elastic theory is *not* a constant for all types. Conventional methods of design apply *a factor of safety on the yield stress of the material used*; the plastic method of design applies *a load factor against collapse of the structure.*

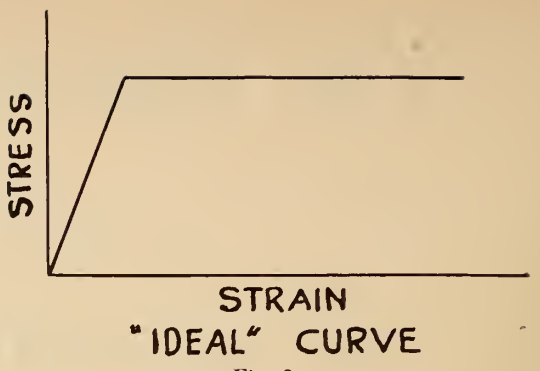

Fig. 2.

This way of looking at the design problem assumes, of course, that the structure will not fail due to brittle fracture. At present, it seems that the only way of guarding against brittle fracture is to use a material the transition temperature of which is lower than the expected service temperature; both elastic and plastic designs are liable to failure if the wrong material is used.

It may be well at this stage to review briefly the elastic method of design and some of its implications. Figure 1 shows the stress-strain curve for mild steel; the linear portion OA is the only part of the curve used in conventional design. However, every building code in use today has a clause specifying a minimum ductility for structural steel, usually 20 per cent or more

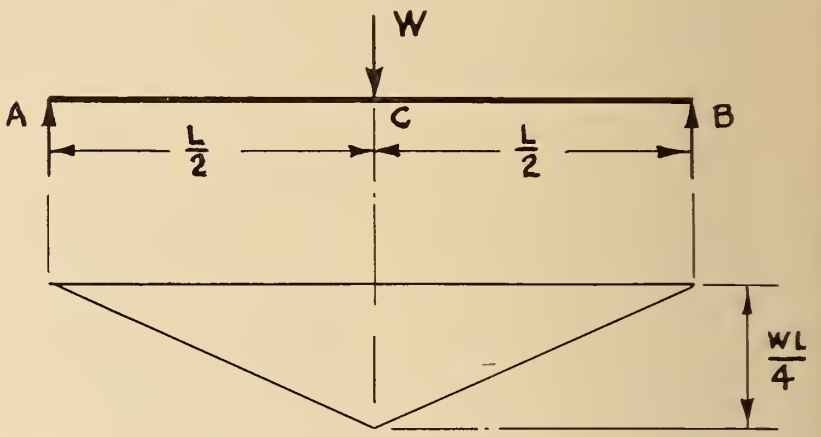

Fig. 3.

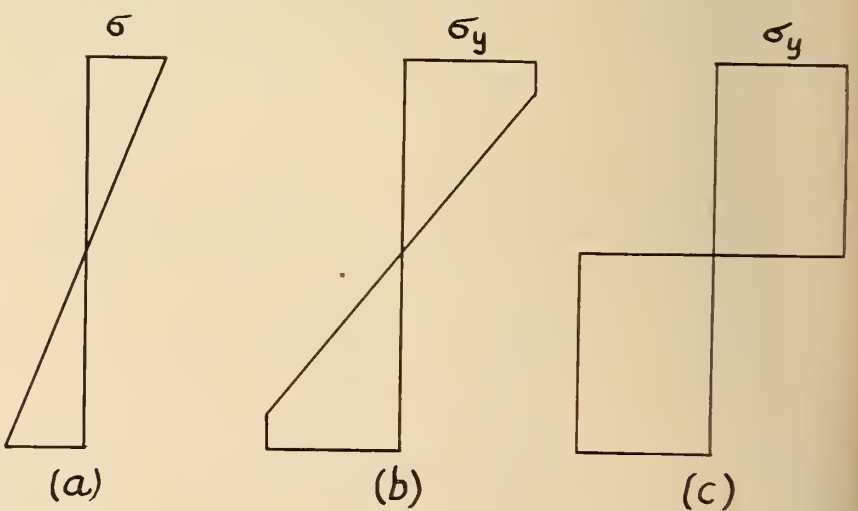

Fig. 4.

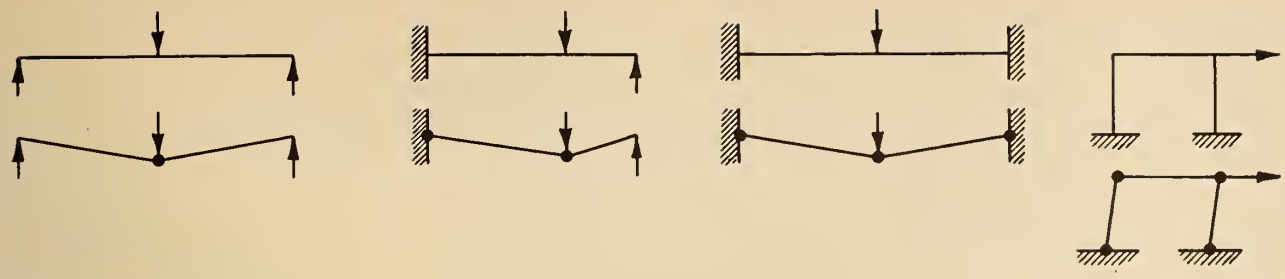

Fig. 5.

elongation at fracture is required. Why should this be, if no regard is paid to the behaviour of the steel once the elastic limit is passed?

Consider a hole in a plate subjected to tensile forces. Elastic theory predicts that the maximum tensile stress at the edge of the hole is three times the average stress in the plate. Yet no building code requires a stress concentration to be taken into account in the design of riveted structures. The experienced designer knows that such a requirement is unnecessary, since the material yields in regions of high stress and forces other portions of the member to carry more load. Such a man would certainly be worried if he had to apply a test proposed by Professor Baker, "Take your steel structure, which you claim is subjected to elastic stresses only, and replace it by a cast-iron structure of equal strength, but no ductility." In fact, although designers pay lip-service to elastic theory, they do rely on the ductility of the material.

All this is, if not well known, at least suspected by the engineer. And however irrational his rules are, experience gained in using the normal building codes have convinced him that his structures will stand. He has, however, no measure of *how safe* such buildings are. How much overload can they take? Is this overload capacity in the same proportion for all structures? Or how wasteful is the design and how can it be improved? The fact that plastic design starts from a consideration of collapse conditions enables the engineer to fix his overload margin from the beginning by choosing whatever load factor he thinks fit. In addition, it will be appreciated from the examples below that plastic design is in fact *simpler* in execution than elastic design. For the first time, a real attempt can be made to study the effect of redistribution of material in a steel frame, for example between beams and columns, in order to achieve a minimum weight design.

The basic concept in plastic design is that of the *plastic hinge*. Suppose the actual stress-strain curve for mild steel (Fig. 1) is idealised to that shown in Figure 2, where the flat portion is assumed to extend indefinitely. This idealisation will be discussed later. Consider a simply-supported beam carrying a central concentrated load, as in Figure 3. The stress distribution at the centre of the beam, where the moment is $\frac{1}{4}$WL, is given by normal elastic theory as Figure 4(a). As the load W is increased, the extreme fibre stress will eventually reach the yield value, σ_y. Further increase in load will cause no further increase in the stress in the outer fibres, which will deform plastically. The extra bending moment must be carried by an increase of stress in the inner fibres, as shown in Figure 4(b). The load W can be increased until the stress distribution in Figure 4(c) is attained; at this stage the whole cross-section of the beam is plastic at the section under the load. The moment corresponding to this distribution is called the *fully-plastic moment*, and the section where such a moment occurs is the *plastic hinge*, since indefinite rotation can now take place without increase in moment. At this stage, the beam is incapable of carrying further load and will collapse; the plastic hinge has transformed the statically determinate beam into a *mechanism*.

If the actual stress-strain curve for normal structural mild steel is used instead of the idealized curve, it is found that strain-hardening commences in the outer fibres when the bending moment is within 1 per cent of the fully-plastic value. This strain-hardening causes an increase in the value of the moment that a section can support; the ideal

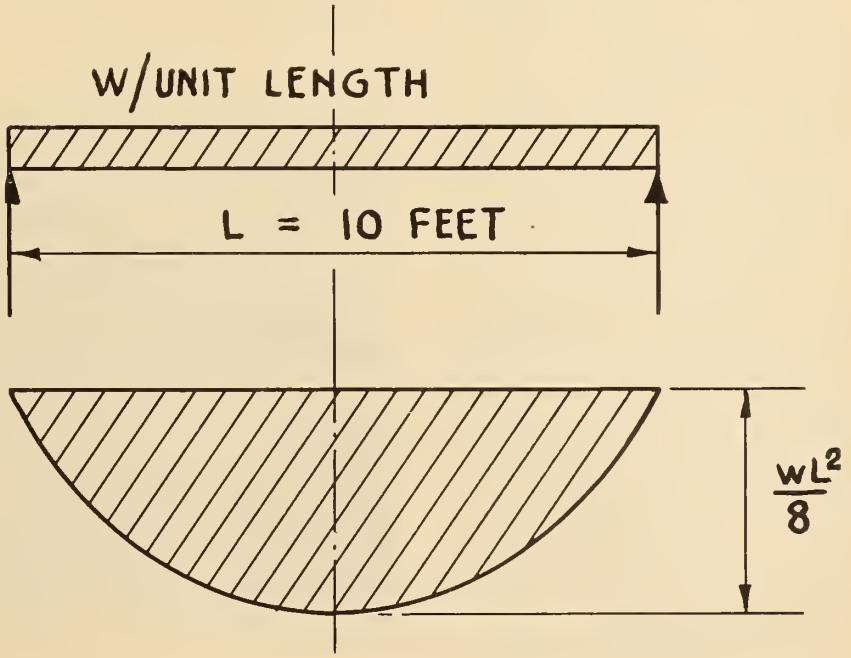

Fig. 6.

plastic hinge is an assumption very close to actual behaviour, and *on the safe side.*

The formation of plastic hinges is essential for the collapse of a steel structure, and sufficient hinges must be developed to turn the structure into a mechanism. By referring to Figure 5, the following general rule for simple structures can be seen: *If the number of redundancies of a structure is n, then the number of hinges required to convert the structure into a mechanism is* $(n + 1)$.

It is this rule that makes plastic design relatively simple. If the bending moment is known at $(n+1)$ locations in an n-times redundant structure, i.e., known at $(n+1)$ plastic hinges, then the structure is in effect statically determinate, because the complete bending moment and shear force distributions can be worked out. In addition, since we have $(n+1)$ equations to determine n unknown redundancies, we know one more fact about the structure — the load the structure will support, i.e., the collapse load.

When a loaded structure forms a collapse mechanism, the members of the structure begin to move, and the loads acting on the structure move also. A balance may be struck between the work done by the moving loads and the work absorbed in the plastic hinges, these two quantities being equal. The loads do not accelerate, and so the problem is one of statics, not dynamics.

Let us formulate the fundamental tenets of the plastic theory a little more precisely:

1. The bending moments in a structure can nowhere exceed the local values of the fully-plastic moment. A section at which the fully-plastic moment is developed is called a "plastic hinge," with the property that rotation can take place there at constant moment.

2. A structure at collapse must be transformed into a mechanism by the formation of plastic hinges.

3. A structure at collapse must be in static equilibrium.

Various theorems useful in plastic design can be proved rigorously from the above propositions; in particular, it can be proved that the collapse load of a given structure is unique, and that a solution satisfying all three of the propositions gives this value of the collapse load. Powerful approximate methods have also been developed by means of which it is possible to calculate the collapse load of a structure within arbitrarily close limits.

Before considering some examples of the use of plastic theory one other point must be discussed, namely, the *redistribution of moments* in a redundant structure. Consider a fixed-ended beam (see Example 2 below) carrying a uniformly-distributed load. Elastic theory gives the end bending moment as twice the central moment so that, as the

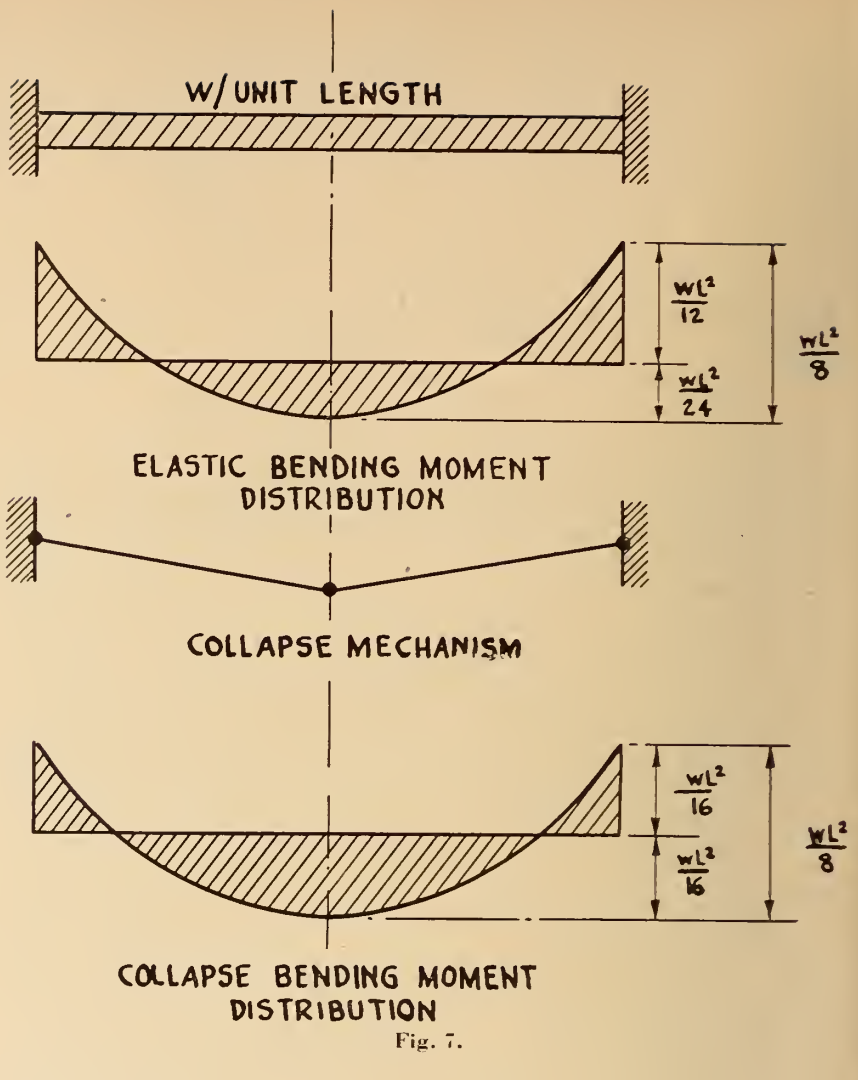

Fig. 7.

Fig. 8. Warehouse Building, Imperial Chemical Industries (Paints Division), Slough. Weight of frames, 15 tons. Weight of similar frames, orthodox elastic design, 25 tons.

load is increased, plastic hinges will form first at the ends of the beam. However, the beam is not yet a mechanism and can sustain further increments of load. The moments at the ends cannot increase any further so that, as the load is increased, the central section will become more highly stressed until finally a plastic hinge is developed there. This stage represents the limit of loading since three hinges in a straight line form an elementary mechanism. In carrying out an actual design it is not, of course, necessary to follow the complete loading history of the structure in this way. The plastic hinges can be inserted from the start and the problem solved by writing the equilibrium equations or by writing the work equation—work done by external loads equals work done by the rotations of the hinges. It is this redistribution of bending moments consequent to the formation of plastic hinges that provides a structure with a large reserve of carrying capacity; plastic theory assesses this reserve and incorporates it in the design.

It should also be noted that the deformations of a steel frame do *not* increase in an undesirable manner until the formation of the *last* plastic hinge, i.e., the plastic hinge required to transform the structure into a mechanism.

Problems involving structural stability, e.g., columns, and webs of plate girders, are being investigated but these investigationshave not progressed far enough to produce a design method suitable for use in the design office. As a result, columns must still be designed by the existing empirical (and *irrational*) methods.

The principle of superposition characteristic of the elastic theory is not applicable in the plastic range, but the Neal-Symonds method (Ref. 7) quickly resolves the question of order of application of loads. It should also be noted that repeated plastic deformations must be avoided. Thus there are two conditions which must be satisfied in a structure subjected to fatigue loading. In the ordinary way the structure should be proportioned by the plastic design method to carry the maximum possible load; then the structure must be designed so that variations in working load will cause no further plastic deformations.

Design Examples

Example 1 (Figure 6): Comparison of load factor and safety factor for a simply-supported beam carrying a uniformly-distributed load over a 10 ft. span.

12 WF 27 beam:

Elastic section modulus, S, $=34.1$ in.^{3}

Plastic modulus, Z, $=38.0$ in.^{3}

Yield stress, σ_y, $=33$ ksi.

Design to AISC or NBC standards limits flexural stress to 20 ksi.

Hence the permissible w is given by

$$\frac{w(10^2)}{8} \cdot 12 = 20 \times 34.1$$

or $$w = 4.55 \text{ k/ft.}$$

with a safety factor on stress of $33/20 = 1.65$.

Consider now the value of w necessary to cause collapse of the beam. This is given by

$$w_c \frac{(10^2)}{8} \cdot 12 = 33 \times 38.0$$

$= 1254$ inch kips, the fully-plastic moment.

Hence $$w_c = 8.36 \text{ k/ft.}$$

The load factor against collapse of this beam carrying 4.55 k ft. is thus $\frac{8.36}{4.55} = 1.84$, *as compared with the stress safety factor of 1.65.*

Example 2 (Figure 7): Comparison of load factor and safety factor for a fixed-ended beam carrying a uniformly-distributed load over a 10-ft. span. Use the same section as in Example 1.

Elastically:

$$\frac{w(10^2)}{12} \cdot 12 = 20 \times 34.1$$

$$w = 6.82 \text{ k/ft.}$$

Plastically:

$$w_c \frac{(10^2)}{16} \cdot 12 = 1245 \text{ inch kips, the fully-plastic moment.}$$

$$w_c = 16.72 \text{ k ft.}$$

The load factor against collapse of this beam carrying 6.82 k ft. is thus 2.45, as compared with the same stress safety factor of 1.65.

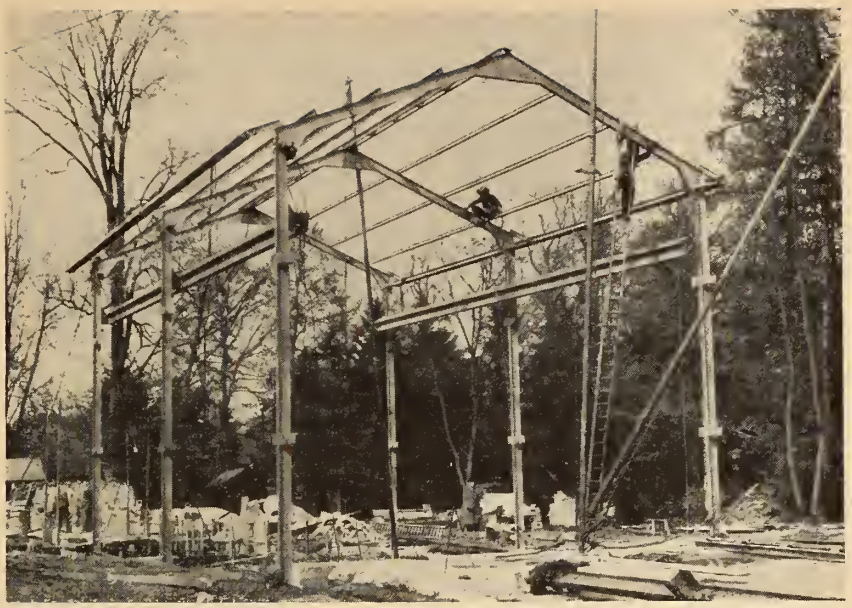

Fig. 9. Fatigue testing Laboratory, British Welding Research Association, Abington. George Coles, F.R.I.B.A., architect. W. S. Atkins & Partners, consulting engineers.

Building Designs

The photographs in Figures 8 and 9 show the type of building, now being erected in England, designed by the plastic theory. With a construction industry organised for welded erection, it should be possible to realize significant erection savings in addition to savings in materials.

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"Progress of Engineering Science" Part 2

From the London Quarterly Review,
October, 1863

ART I.—1. *Lives of British Engineers.* By Samuel Smiles, 3 vols. 8 vo. London, 1862.

2. *Proceedings of the Institute of Civil Engineers*, 1842 to 1863.

3. *Sir W. Armstrong's Address delivered at the Meeting of the British Association at Newcastle*, 1863.

However marvellous the variety, or astonishing the quantity of articles produced by the unceasing activity of the millions of horses or horse-power which the mechanical engineer has created, all their labour would be in vain if it were not for the assistance of the carrying branch of the same profession. Unless every corner of the world were ransacked to bring raw materials to the countries possessing coal and iron, the steam-engines would soon cease their labours; and it is equally indispensable that the manufactured products should be returned to those who cultivate the soil, or gather the mineral products of distant climes. In striving to effect this in the cheapest and most expeditious manner, the civil engineer has executed a series of works more striking at first sight than those of the mechanical engineer, and more pleasing, because more permanent, though perhaps they do not surpass them either in ingenuity or usefulness.

As hinted above, the sea is, and probably always must be, the great highroad of nations. To the mere savage no barrier can appear more impassable than the unstable salt ocean he sees before him; but he soon learns how much more easily a large body is moved in water than on land, and whether to catch fish or to visit neighbouring ports, a log becomes a canoe, a canoe a boat, and a boat soon passes into a ship.

During the three thousand years that have elapsed between the launch of the 'Argo' and that of the 'Great Eastern', men have striven unremittingly to perfect this great problem; and though the progress has been uninterrupted, and wonders have been accomplished, still what has been achieved during the last thirty years makes us wonder how so little was done during the previous three thousand; and if we continue to improve at anything like the same rate, the speed of our steam-vessels will equal that of our railway trains, and a man may easily go round the world in a month.

Till the invention of the compass, long sea voyages were of course impossible, and large vessels were consequently not needed for commercial purposes; but the discovery of the uses of a keel, or something to enable a vessel to hold a wind, even if she could not beat to windward, was almost as important, for propulsion by oars must always have been very expensive and inefficient in large vessels. An immense impulse was also given to the improvement of vessels by the discovery of America, and of the passage round the Cape, and since then the progress has been rapid and steady; but it was not till propulsion by steam cleared the problem of all extraneous considerations of weatherlyness, steadiness, and handiness in manoeuvring, etc., that marine architects fairly grappled with the subject.

In order to explain the problem the shipwright has before him, it may be necessary to state that a vessel, for instance, of 1,500 tons, 36 feet beam, 250 feet long, and with 20 feet draft, displaces 20 tons of water for every foot she moves forward, and the question is what is she to do with this ? If she heaps it up before her as the old bluff-bowed vessels did, she has not only to climb over it, but she has wasted an enormous amount of power in lifting what she might have left lying. As every contractor knows, he is paid the same for wheeling stuff twenty yards forward as for raising it one yard high; and what the naval engineer seeks to do is to spread his displaced water laterally, evenly, and flatly over as large a surface as possible. The progress already made in this direction will be understood if we take for instance the resistance of a square box as our unit. By simply rounding off the corners, the power

October, 1863 — Queen Victoria has recently celebrated the twenty-fifth anniversary of her accession, the American civil war is at its height, Confederation is nearly four years from birth, and the "London Quarterly Review" publishes an article on the "Progress of Engineering Science" by an unknown author.

At first, we thought of trying to digest this article, with frequent quotations, but have come to the conclusion that the flavour of the original would be wholly lost by any interference with its continuity and so have decided to publish it in full in four instalments. We hope our readers may enjoy as much as we have the relaxing rhythm of the writer's Victorian prose, the profundities of his rhetoric, his prophesies — right and wrong — his comments on current engineering projects and his breathless admiration for the engineers of his day.

To turn the author's pounds sterling into 1953 Canadian dollars, multiply by fourteen.

requisite to force the box through the water is diminished by one-third; by introducing such lines as were usual in the best ships thirty years ago, the resistance is lessened by two-thirds. Whereas now, in consequence of the improved lines which are mainly due to the long scientific investigations of Mr. Scott Russell and his coadjutors, the resistance is only one-twelfth of that of the box first mentioned; and this fraction may before long be reduced to one-twentieth or even one-twenty-fourth. The consequence of this is, that twenty years ago engines of 500-horse power barely sufficed to drive a vessel of 1,000 tons burthen ten knots through the water; the same engines would now propel a vessel of 1,500 tons at least fourteen knots; and better results than this are being attained. Already twenty miles an hour has been reached, the Holyhead packets working steadily at that rate; and even an armed dispatch vessel has just left this country for China, which, with all her armament on board, can do as much, and that without any extraordinary exertion. Having reached this speed, we cannot long be content with less. Vessels must cross the Atlantic at the rate of 500 miles a day. It would be expensive to build a vessel to do this today, and it might be at some waste of power that she would accomplish it, but day by day it is becoming less difficult, and before long it will be easy. Had the 'Great Eastern' been built for speed alone, she could easily have accomplished this; but carrying power was her great object, and her calculated speed was 15 miles, which she accomplishes with singular evenness in rough weather as well as smooth. She has run 475 miles in twenty-four hours, but her average speed is about 360, or 15 miles per hour, or about the average speed of the best ocean steamers of the present day. This they accomplish easily without the sacrifice of any of their qualities as sea-going vessels, while retaining the capability of accommodating a large number of passengers, and a considerable amount of cargo for a voyage of 3,000 miles,—the distance (speaking in round numbers) of New York from Liverpool.

But it is not only in speed that such progress has been made, as vessels have increased in size in even a greater ratio. Thirty years ago 1,300 tons was the measurement of our largest Indiamen, and 2,000 tons of a first class line-of-battle ship. We were all astonished some ten years ago when we heard of the 'Duke of Wellington' being launched, of 3,800 tons; and the 'Himalaya,' of 3,600, built since that time,was the largest merchant vessel the world had ever seen. Now our first class iron-plated frigates measure at least 6,000 tons. The 'Great Eastern' is 691 feet long, 83 feet wide, and registers 18,914 tons, though her real capacity is nearer 25,000 tons, and the indicated power of paddle-wheel engines is equal to 3,600 horses, and that of her screw to 4,800, making together 8,400 horse-power. If she has not obtained, commercially, the success that was anticipated, it is not that our engineers did not know how to design and build her, or how to furnish her with the requisite power, but simply that she was born before her time. The world is not yet ready for vessels of her size. Without disrespect to any one, we may say, that until vessels of very large size become more common than they are, and until nautical experience has been enlarged by the use of such ships, there cannot be captains capable, in the highest sense, of commanding, or sailors and engineers sufficiently educated to work, so gigantic a machine. Our harbours are not big enough to receive her, and there is not a single dock in existence which she can enter for repairs. All this may render her a bad speculation, but her building has tended more to set at rest most of the problems of naval architecture than anything that has yet been done. We now know that there are no engineering difficulties in size, and no practical limit except expediency to the amount of power that might be applied. All the problems connected with speed, and the means by which it should be obtained, have been immensely advanced by this great experiment, and we can now safely go back to vessels of 10,000 tons and twenty miles speed, with which we may be contented for the present. Before such size and speed can be economically attained we still want some further improvements in the forms of vessels, but, more than this, we want the power of using high-pressure steam with safety, and of using it expansively to a greater extent than has yet been done at sea, and we want to be able to return the condensed steam to our boilers without waste. The difficulty in effecting these improvements lies more with the engineering crews than the engineers. The latter could effect them all, but the machinery would be so refined that it could not be entrusted to those who have now charge of our vessels: but this is not a difficulty that can long be allowed to stand in the way of so desirable an improvement. The Americans have that class of men, and though principally employed hitherto in their sailing mercantile navy, it has enabled their ships to outsail ours, and to carry cargoes cheaper than we can, from every port where we meet, and has led to a beauty of form and perfection of rigging which our ships cannot compete with.

We, on the other hand, have been so intent on improving our steam-vessels, that sailing ships have been comparatively neglected; but to these also we must now turn our attention. The improved lines have already done a good deal, but the introduction of iron masts and iron yards with wire rigging may probably do more. The immense length which we now know can be given to vessels relatively to their midship-section—which is the principal measure of resistance—will enable four or five masts to be used instead of the stereotyped three; and as there is no practical limit to the squareness of steel or iron yards, a cloud of canvas may be spread low down which will propel a vessel with a speed hitherto undreamt of. So long as ship-builders were limited by the length of the spars they could find in a wood, they were obliged to pile sail on sail to a height where they acquired a leverage doing more harm than good. All this is altered by the introduction of greater proportional length and iron rigging. Such a size of yards and sails as would be necessary to carry out these improvements would be practically impossible when only man-power was used, but since we have learned to use steam through accumulators that difficulty vanishes. A small 10-horse power sailor-engine would in a few hours store up such a mass of power in two or three accumulators in the hold of the vessel as would brace the yards round in a few seconds, and do all the heavy pulling and hauling of the ship. With all these appliances may we not anticipate from the agency of our old, but inconstant, friend the wind a speed nearly, if not quite, equal to that which steamers are now accomplishing? Is not twenty miles an hour a possible speed for even sailing ships?

This increase in the size of ships, and their constantly growing number and importance, have required a corresponding increase in the dimensions of the ports for their reception, and worthily have the engineers

responded to the call; for some of the modern harbour works rank among the largest structures in the world, and, considering the difficulties among which they have been erected, display more skill and ingenuity than any buildings standing on dry land.

The ancients executed works which appeared to themselves very mighty,* but none which will stand comparison with those of modern engineers. The Mediterranean is full of natural harbours, which sufficed for the small shallow vessels of the Greeks or Romans. Even the imperial port at Ostia, which was by far the greatest artificial work of the class undertaken in ancient times, would not be thought much of now-a-days. The Port of Trajan was little more than a hexagonal basin covering some seventy acres of ground, and consequently less in extent than the Victoria Dock at Blackwall; and infinitely less in an engineering point of view, as the Ostian Port was probably hardly more than ten feet deep, had no locks or entrance-gates, and was consequently liable to be silted up by the river, which necessarily had free access to it; and the Claudian Port, forming the sea-entrance, was both in design and extent very like the Duke of Buccleugh's Harbour at Granton. But even then it is probable that the Ducal surpassed the Imperial Harbour as an engineering work as much as ours are inferior to those of Rome in an architectural point of view.

Down to the end of the last century we were content with such estuaries or such natural harbours as Nature had provided us with. It was then thought quite sufficient to line a river's banks with quays, to enclose a natural pond by walls. Occasionally a jetty timidly thrust itself a little way into the ocean, and in our royal yards some handsome graving docks were excavated for the repair of ships.

The first person who boldly confronted the difficulties of the case was De Cessart: he, in 1783, proposed to convert the open roadstead of Cherbourg into a land-locked harbour, by constructing the celebrated breakwater in water forty feet deep at low spring tides, where the rise was nineteen feet, and where the whole structure was exposed to the sweep of the heaviest ocean swell. The means he took to effect his object were ingenious, and theoretically correct; but he miscalculated the power of framing timber cones sufficiently strong for the purpose, and partly from mistakes in placing them, partly in consequence of the failure of funds before the works were sufficiently advanced for the cones to afford each other mutual protection, the original mode of construction was abandoned, and that of a great extent of 'Pierre Perdue'* carried out in its stead. The calculations of De Cessart have, however, been fully justified by the result. The breakwater has now been completed at an expense of 230*l.* per lineal foot, including the sea wall and the forts which crown it, and it answers perfectly the purposes for which it was designed.

It was not till nearly thirty years afterwards (in 1812) that we attempted anything that could at all compare with this, by commencing the Plymouth Breakwater. That at Cherbourg, however, is 12,700 feet long, the one at Plymouth only 5,300. Ours is a-wash with the high tide—the French work is crowned by a wall rising fifteen feet above the highest tides; and notwithstanding its being in so sheltered a position and near the quarries, ours cost 283*l.* per foot against the 230*l.* of the French.

We are at present constructing three very extensive breakwaters on the newest principles, somewhat like the Cherbourg example, but with such variations as the local circumstances suggest. At Portland, where stone is abundant and easily got, the outer arm, 6,000 feet long, is only a rubble mound raised above high-water mark. At Holyhead, after the rubble has been deposited long enough, a great trench is excavated in it, and a sea wall built along its whole extent. At Alderney, where stone is less plentiful and has to be fetched further, the rubble is carried up only to twelve feet below low-water mark, where being below the action of the waves it will stand at an angle of nearly 45°, and then on this foundation a sea wall is built, the platform of which rises considerably above the highest tides. The first of these breakwaters has cost on the average 120*l.* per foot, the second 160*l.*, what the third may cost nobody knows. Owing to mistakes in the original design, they are now throwing in rubble at a depth of 120 feet, and must go beyond that depth if it is ever to answer the purposes for which it was intended.

The French in the meanwhile have invented a new system of pier building, which promises the most satisfactory results. Having ascertained that no wave that rises in the Mediterranean ever disturbs a block weighing from twenty to twenty-five tons, they have formed gigantic bricks of concrete or béton, of that weight, and throwing them at random into the sea along the line of their breakwater, use them to protect either a hearting of rubble or such sea walls as they may require. The new Mole at Algiers consists of a base of rubble 17 feet high and 156 feet wide, on which the béton blocks are thrown into the water till they rise out of the sea thirty-three feet above the rubble, making a total height of fifty feet, and this has cost only 122*l.* per foot. At Marseilles the enclosure of the new harbour of Joliette is composed of a rubble hearting, surmounted by a sea-wall, and protected only to seaward by these blocks, and it only cost 86*l.* per foot. At first sight this French mode of pier building appears weak and unconstructional, but there seems no reason to doubt its durability. Though some of the blocks are slightly weathered, they stand well: and even if one broke up and was carried away, it would cause no breach, and could easily be replaced. Indeed the very roughness of the construction seems an advantage, as it breaks up the waves and as it were screens them, and so prevents their breaking over the sea-wall, which with a smoother foreshore might be the case.

Such a system might perhaps have been advantageously adopted at Dover. There being no rubble to be obtained for a breakwater there nearer than Portland, it was determined to erect a pier of masonry with a hearting of concrete built from the bottom of the sea in fifty feet water by the aid of diving bells. This has now been done to a distance of 1,800 feet from the shore, and it is perhaps the most beautiful specimen of a wall constructed in the sea which has yet been executed: but the process is so slow that it would take fifty or one hundred years to complete the harbour as originally intended, and its cost is 415*l.* per foot forward, which is fatal to the extension of works of this sort.

Another mode of constructing

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* Virgil says (Georg. II)—

'An memorem portus, Lucrinoque addita claustra,
Atque indignatum magnis stridoribus aequor,
Julia quâ ponto longé sonat unda refuso,
Tyrrhenusque fretis immittitur aestus Avernis?'

And Horace (Ep. ad Pisones)—

'Sive receptus
Terrâ Neptunus arces Aquilonibus arcet,
Regis opus—Sterilisve diu palus, aptaque remis,
Vicinas urbes alit, et grave sentit aratrum.'

* Loose blocks thrown into the sea at hazard, not formed into masonry.

piers has recently been engaging the attention of engineers, and promises satisfactory results. It is in fact a revival of the idea of De Cessart of building a breakwater in circular masses on the shore, and floating them to the spot where they are required, only carried out in stone instead of wood. It was attempted at Sheerness in 1812, by Sir William Bentham, with fair success, and has been done on a smaller scale elsewhere. Though it may at first appear paradoxical, there is no more difficulty in building a stone ship, especially if shaped like a circular tower, which is the form wanted, than there is in building an iron one, nor in making it of sufficient strength to float across a harbour, and when sunk in its place and filled with concrete it ought to form as stable a pier and as cheap as any yet executed.

Where the water is shallower or the spot more protected, our engineers have fifty other expedients for making sea walls. But those above quoted are sufficient to prove that where the depth of water does not exceed fifty feet, any amount of space may now be permanently enclosed by breakwaters varying in price from 100*l.* to 200*l.* per lineal foot, and the experience gained during the last twenty or thirty years will certainly tend to bring it nearer the first named than the higher sum.

Although it is a more impressive sight to see man struggling with the ocean, setting limits to its power, and producing calmness and shelter in the midst of the tempest, than to contemplate his operations where he has no such adversaries to subdue, still such breakwaters as those just described are neither the largest nor certainly the most expensive works required for the accommodation of shipping. The construction, for instance, of the docks at Birkenhead will cost, with the appurtenances, six millions of money at least, which is more than would be required to finish all the harbours of refuge we have undertaken on our coasts; and even this sum is a trifle when compared with what has been spent on the docks of London, Liverpool, and other great commercial cities.

In the Mediterranean and other tideless seas, it is sufficient to erect a breakwater or to excavate a port. No locks or gates are required, for the vessels can always lie along the quays at the same level; but in all harbours on the great ocean, the case is widely different. It is scarcely possible to find any place where the water is deep enough for a large vessel to be alongside a quay wall at low water, without touching the bottom; and even then, the inconvenience of the vessel's being at one time from 15 ft. to 20 ft. lower than another is so great in loading or unloading, that, when docks are not provided, the vessels generally lie in the stream or in the middle of the harbour, and then cargoes have to be transhipped into lighters. All this, however, is so inconvenient as to have led early to the introduction of floating-docks. At Bristol it was done by providing a new channel for the river, and cutting off the connexion with the old one at the upper end, and putting locks at the lower end, so as to convert the whole of the channel through the town into one great float.

The want of dock-accommodation was early felt at Liverpool, where the stream is so strong and the situation is so exposed, that vessels can only with difficulty lie at anchor in it. The first dock there was commenced in 1709, the second about fifty years after that; and the gradual steady development of the system, from that time to this, has produced the most magnificent series of dock-works that exists in any part of the world. They extend for nearly five miles (4 m. 1400 yds.) north and south in front of the town; and as the entire site has been gained from the river, the whole has to be protected with massive walls, generally of granite. Within these are twenty-eight great docks, containing an aggregate of 271 acres of water surface, and approached by more than forty locks with gates varying from 40 ft. to 80 ft. in width. There are also fifteen graving docks for the repair of ships, and with the warehouses, sheds, and machinery, an aggregate of works is made up, which, though not perhaps so showy as some of the architectural productions of the Romans or of some modern nations, are, when combined with those of Birkenhead, unrivalled as specimens of solid utilitarian grandeur.

As a single work the great Float at Birkenhead far surpasses anything on the opposite side of the water, or indeed any work of its class that has yet been attempted anywhere. The area of water in this one dock is 121 acres, and it is approached by three great entrances, one of which has a sluicing apparatus, intended to keep the low-water entrance basin free from sediment, and which is constructed on a scale never before attempted; but whether it will attain its proposed object is very much doubted. The principal entrance has gates with a clear opening of 100 ft.; the largest ever constructed, which would admit the "Great Eastern" if divested of her paddle-wheels, and will admit the largest screw-steamer or sailing-ship that the wildest imagination has yet conceived.

It is difficult to convey a correct idea of the magnitude of such a work as this, for even its money value does not tell the story of its difficulty. It may, however, help us if we recollect that St. Paul's Cathedral cost about 800,000*l.*, and this was more than the expense of any of our mediæval cathedrals. The Parliament Houses costs two millions; and if we take the Great Pyramid of Cheops at a shilling a cubic foot, which is about the price at which a contract could be obtained, it would cost a little over four millions. As before hinted this dock will cost six; but as two millions, at least, were wasted in doing and undoing, it is probable that a contractor might be found to undertake this Float or the Great Pyramid at about the same lump sum.

The Docks of London are about equal to those of Liverpool in extent; that is to say, they contain about 270 acres of water-surface, and taking into account the expense of land and the amount of warehouse accommodation belonging to them, they probably cost as much money; but being dug out of the dry land, they presented none of the engineering difficulties encountered on the Mersey, and have none of that cyclopean grandeur of masonry which is so impressive there.

Besides these, most English ports are provided with dock-accommodation to some extent, and they make together an aggregate perhaps equal to that of the two great ports.

On the Continent few commercial ports are so provided. Havre has, perhaps, the largest establishment of the kind; but even this would be considered only second-rate on our side of the Channel.

One of the most expensive parts of a great naval establishment consists of the dry docks for the repair of ships. These are generally excavations lined with massive masonry, and furnished with a pair of gates or a caisson at their outer end, and in commercial ports they are generally made long enough to contain two vessels, one before the other; but at Birkenhead, where everything is stupendous, there is a graving-dock 750 ft. long, 100 ft. wide, and capable, therefore, of containing the "Great Eastern." But its gates are only 50 ft., and it is intended to

contain three vessels abreast and three tiers in length, though how this is to answer economically is as problematical as many other things in that gigantic undertaking. Practically, this class of dock is only available when there is considerable rise and fall of tide—when the vessel being admitted at high-water is left dry, or nearly so, by the ebb when the gates are closed—were it not for this, the expense of pumping out the whole of the water is so great, that it has led to the employment of floating-docks or inclined planes, up which the vessel can be drawn, and various other expedients.

The most ingenious of these contrivances is, perhaps, that invented by Mr. Edwin Clarke. This consists in sinking two rows of cast-iron cylinders at such a distance apart as to admit vessels between them of the size intended to be docked. Each of these acts as a hydraulic pump, and acting together, worked by a small steam-engine, they raise a gridiron which is suspended between them at such a depth in the water as may be requisite to receive the vessel. On this gridiron are successively placed platforms, which are constructed hollow in compartments with valves opening outwards; so that the water which was admitted to sink them, is discharged as they rise, and the saucer—as the platform is technically called—with the vessel upon it can be floated away to any wharf or place convenient for its repair. Six or a dozen vessels can thus be docked by one apparatus in a single day, if there is a sufficient supply of platforms and power enough to raise them. This may not be absolutely the best mode of effecting the desired object, but it seems nearly certain that modern engineering skill will supply some such scientific mode of raising vessels, instead of the primitive contrivance of digging a hole and floating a vessel into it; and, with the plan of working by accumulations, it does not seem that any time or any power ought to be lost by the operation. It is quite true the power required to lift a ship out of the water by this process is the same as is necessary to draw one up the inclined plane of a patent slip; but its advantages are, that it gets rid entirely of the friction of the cradle on the rails, in which so large a proportion of the power is absorbed. It is also a more direct and convenient way of applying power; and the number of vessels that can be docked by it in one day justifies the employment of steam-power, which would be too expensive for a slip which probably may be used only ten or twelve times in a year.

It is, in fact, a very satisfactory solution in this particular case of the great problem of modern mechanics. We cannot get rid of weight and other resistances which are inherent in solid bodies; but we may eliminate friction and other resistances which are not inherent, or at all events these resistances may be reduced to a minimum, as is done in this instance, and we may regulate the time of action in proportion to the available power; and this is pretty nearly all that we can hope to effect by our most elaborate mechanical combinations. √

Artistic Tunnels

The Netherlands Government is now engaged in building a pair of tunnels under the North Sea Canal at Velsen. One, a double-barrelled tube, is for highway traffic and the other carries a double-track railway to replace an existing bridge over the canal. The present highway ferry across the canal will be retained to handle the little traffic which will not be allowed to use the tunnel—hazardous loads, loads too large for the tunnel, pedestrians, cyclists and non-motor vehicles.

The figure shows a cross section of the highway tunnel. The unmarked conduits at the center and sides are for utilities. The usual ventilating equipment will be installed in the two towers on the canal banks. Lighting will be fluorescent; about half of each approach nearest the tunnel mouth will be covered with concrete louvres so as to give a gradual transition from outside daylight to the level of illumination in the tunnel and vice versa.

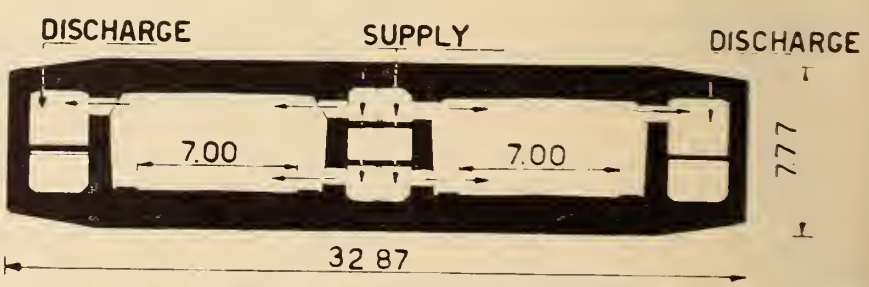
The railway tunnel is a single tube. It will rely on the piston action of the trains for ventilation; not much is needed with electric traction. Its grades are flatter than those of the highway tunnel, consequently it is longer, 10,557 feet as against 5,394 feet.

Construction of the tunnels is being carried out by cut and cover. About half of each is being built in the dry south of the south bank of the canal. When these sections are completed, the width of the canal will be doubled by excavating over them, shipping will be diverted to this bypass and the north halves of the tunnels will be built in a coffer dam in the present canal. The canal widening is not being done especially for this project; it is part of a general widening scheme over the entire length of the canal from the North Sea to Amsterdam.

At just about the level of the tops of the tunnels there is a clay stratum. Above this, ground water is brackish; below, it is fresh. This stratum will be restored after construction so as to prevent salty pollution of the fresh aquifer.

Care is being taken to make passage through the highway tunnel as pleasant and accident free as possible. The interior walls will be painted light green "because this color has a soothing effect. The (ceiling) will be peacock blue, which will give the impression of driving under a night sky." Stars and planets have been omitted.

Both tunnels will involve about 3,250,000 cubic yards of excavation and 450,000 cubic yards of concrete. Construction on the highway tunnel was begun in 1941, but was halted by the war. Subsequently, when work was recommenced in 1952, the railway tunnel was added to the scheme and the highway tunnel enlarged from one tube to two, so the work already done was demolished. If the contractor makes as good progress as is expected, both tunnels will be open in late 1958 or early 1959. √



North Sea Canal Tunnel, Velsen. All lengths are shown in metres: 1 metre (100 cm.) = 3.28 ft. or 1.09 yds.

Prestressed Concrete Buildings

by

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Prestressed concrete has been much in the limelight of late. Most of our readers will have a vague idea that it is replacing more conventional materials, but few will realize to what extent.

This paper emphasizes the construction methods used in building the roof structures of three large warehouses and an arena and auditorium, with little mention of theory of design. Prestressed concrete construction poses its own problems, which have here been ingeniously solved.

The author, who presented this paper at the Halifax annual meeting in May, 1953, concludes with a few paragraphs of timely advice, which should be pondered by all who are concerned with the development of this new material.

Under present economic conditions, engineers and builders are being continuously challenged to find new methods of construction which will not only improve conventional design and construction, but will also result in greater economy by more rational use of the materials and labour available. This challenge, or rather need, is universally acknowledged, and is probably the major reason for the extraordinary progress of an essential new material, prestressed concrete, thanks to its theoretical conception and to the multitude of its practical applications in every field of civil engineering, present and potential.

Modern industrial development, in particular, creates a pressing demand for buildings with wide column spacing and long spans, either to accommodate heavy mechanical equipment and facilitate processing and storage, or to increase the flexibility of space available. These requirements are admirably met by the use of prestressed concrete.

The elimination of practically all tensile stresses, and therefore cracks, and the creation of a homogeneous elastic solid for all conditions of practical loading, considerably improves the quality of a structure and the economy of the material used effectively throughout. The possibility, nay the necessity, of using high tensile-strength steel and high strength concrete, results in a reduction in the volume of steel and concrete needed in prestressed concrete flexural members and hence leads to lower loads on columns and foundations. The principal diagonal tension due to shear is considerably reduced by the applied prestress and the carrying capacity of a prestressed concrete beam is not reduced by its own deadload.

These inherent advantages permit bridging long spans with comparatively slim and economical members. They also lead to new and efficient methods of assembling unit elements, and therefore stimulate prefabrication, with its advantages of speed of erection, minimum interference by climatic conditions and introduction of labour-saving methods. These advantages apply to statically determinate as well as to statically indeterminate structures.

For some time the use of prestressed concrete in the construction of buildings on the North American continent has been limited. Although the technical advantages of the material are universally recognized, and sufficiently proven by numerous applications in Europe, engineers and contractors on this continent seem to be doubtful whether this new method of construction is competitive, economically justified and compatible with the existing labour market. The following descriptions of prestressed concrete alternatives for several buildings in Canada may constitute a convincing answer to these doubts.

These prestressed concrete alternatives, designed and constructed recently in co-operation with the consulting engineers and general contractors engaged on the contracts, were chosen on the basis of their economic or structural merits in competition with either conventional reinforced concrete or with structural steel.

Central Ordnance Depot, Cobourg, Ont.

The four warehouses actually completed at this Central Ordnance Depot make use of prestressed concrete girders to carry their roofs, which cover a total area of more than 420,000 sq. ft. and are, it is believed, the largest prestressed concrete roof structures so far erected in North America and perhaps one of the largest in the world.

Initially designed to be constructed as continuous poured-in-place reinforced concrete structures, the prestressed concrete alternative design had to conform entirely to the dimensions and structural arrangement previously approved by the client, without consideration as to the simplicity of its design or the elimination of dangerous field work to be carried out in the worst construction seasons — late fall, winter and early spring.

The column lay-out and principal cross-sections of one of the warehouses, shown in Fig. 1, illustrates the arrangement of the prestressed concrete design. The main building is 200 feet wide, with columns at 50 ft. centres. Each frame, at 25 ft. spacing, consists of two 100-ft. continuous girders, adequately tied to the reinforced concrete columns.

Figure 2 shows the details of one continuous beam, consisting of two 50-ft. spans, and the ducts and centrelines of the three cables used to prestress it.

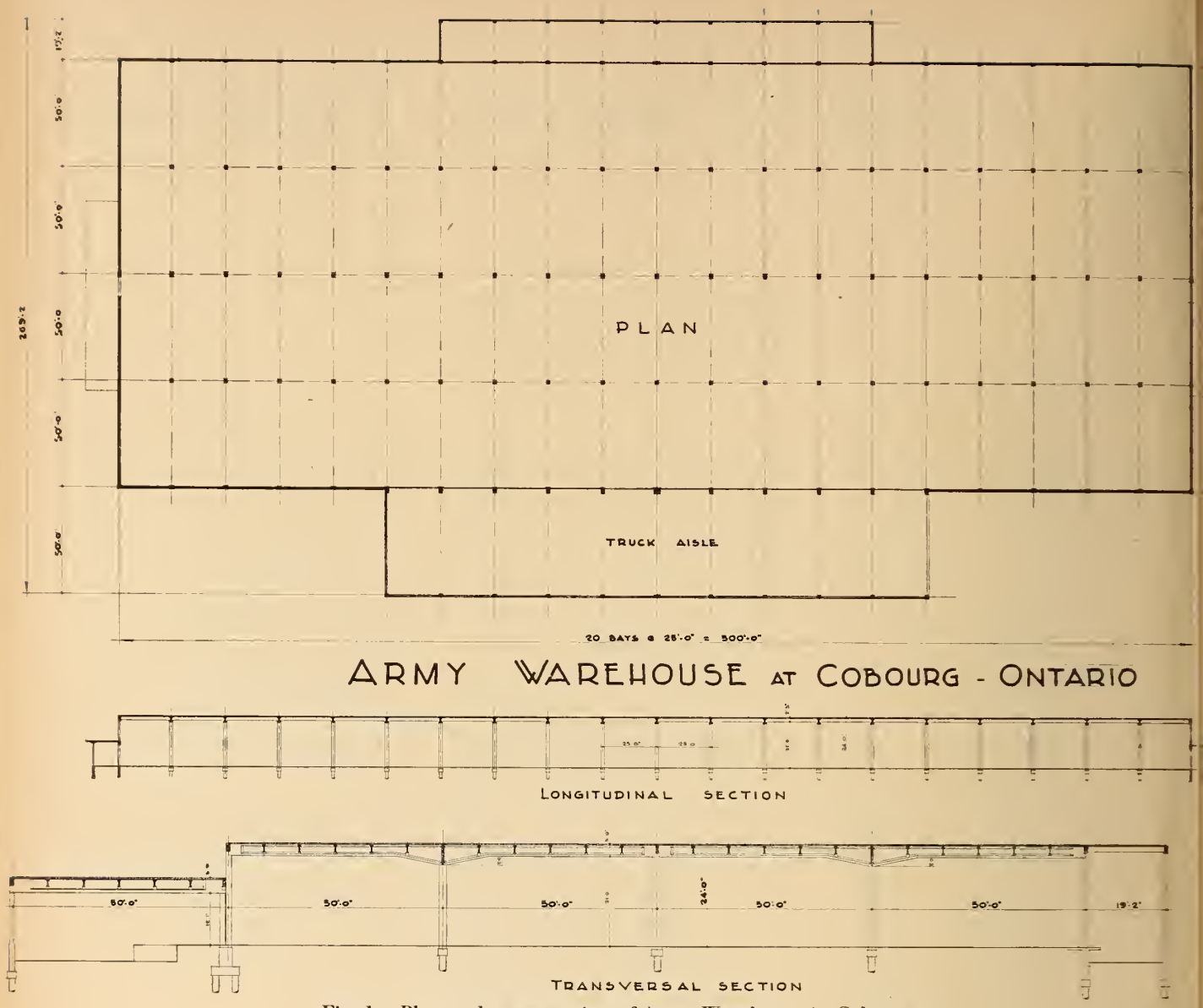


Fig. 1. Plan and cross-section of Army Warehouse in Cobourg.

The I-shaped cross-section is 3 ft. deep through the major part of each span, increasing to 5 ft. at the haunched end. The top and bottom flanges are both 18 in. wide, while the web is 8 in. thick to permit forming the haunched end slot needed for construction purposes.

The truck aisle portion is treated independently of the main structure and consists of a 50-ft., simply supported, prestressed concrete beam and its two column supports. The I-shaped cross-section here is 3 ft. 9 in. deep, the top and bottom flanges are respectively 30 in. and 18 in. wide, and the web 6.5 in. thick. (Fig. 3). Both beams are designed to carry a total load of 2,500 lb/lin. ft.

Purlin brackets at 8 ft. 4 in. centres are provided on both beams to support 25-ft. reinforced concrete purlins which, in turn, carry the light weight concrete roof slabs. Rectangular purlins 9 in. x 23 in. frame into the continuous prestressed concrete beams at the column heads to provide longitudinal rigidity. All other purlins are simply supported on the beam brackets, and are of a light T-shaped cross-section, with a depth of 23 in., a width at the top flange of 9 in. and a web thickness of 3 in. (Fig. 3).

There are 150 hundred-foot continuous prestressed concrete beams for the main buildings, 36 fifty-foot simply supported beams for the truck aisles, 2,021 precast purlins and 508 poured-in place reinforced concrete columns.

Since there were a large number of identical units, full advantage could be gained by organizing the job and the gangs on assembly line principles. A central ground area was equipped to manufacture the purlins and the prestressed concrete girders in 50-ft. units, providing good conditions at low cost, both for production and for the control of inexperienced local labour.

Two concrete casting beds were provided, each for 16 haunched end beams and two truck aisle beams. Travelling gantries were installed to facilitate their concreting and moving (Fig. 4). The bases for the long haunched end members were elevated about 2 ft. from the ground to allow for the haunched end, while the bases for the truck aisle beams were on the ground. In each case, the bases were constructed of lumber, and were stationary throughout the entire production period. There were four concrete casting beds for

the purlins, each accommodating 16 purlins, thus permitting beams and purlins to be constructed concurrently. Twelve sets of beam forms were constructed, permitting a production of six beams per day. These forms were constructed of lumber and ¾ in. thick plywood; they were reused 25 times. To form the cable ducts through the beams, extractable rubber cores were used, which were withdrawn a few hours after concreting.

Mild steel reinforcing bars were necessary only at the purlin brackets (the intermediate stirrups being used only for temperature reinforcing) and at the shallow end of the beam. Here reinforcing steel is required to distribute the highly concentrated loads developed by the anchorages of the prestressed wire.

The 1¾-in. slump concrete used for the prestressed beams was designed to give a crushing strength of 5,000 p.s.i., this desired strength being usually obtained after three days by using eight bags of XXX cement/cu. yd. of concrete. All concrete was placed with the assistance of the overhead gantry, and fully compacted by both external and internal vibrators to ensure a thoroughly dense concrete, particular attention being paid to the placing. During cold weather the beams were completely covered with insulating board immediately following concreting, and the desired curing temperature was maintained by steam heating. Stripping of the forms took place generally 24 hours after concreting.

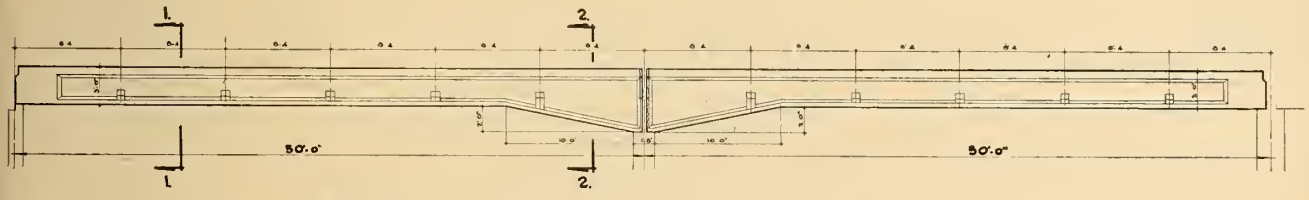
The truck aisle beams, being simply supported, were tensioned in one operation prior to being moved from their bases, and were grouted before being erected. To obtain the necessary prestress of 367,000 lb., 48 high tensile wires, each of 0.276-in. diameter, were used in a slightly parabolic cable.

The 100-ft. continuous beams, however, were manufactured in three stages:

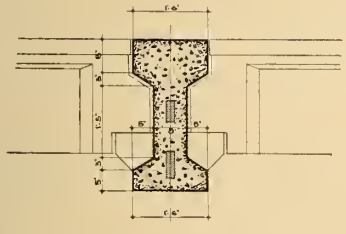
(1) The 50-ft. elements were partially prestressed while on the casting beds by means of a straight cable consisting of eight wires only, each being of 0.276-in. diameter. In spite of the rough treatment these beams received during their transport, this initial prestress was sufficient for handling and erection.

(2) After erection on their supports and the placing of the rectangular purlins, the 4-in. gap between haunched ends, sufficiently wide to allow the column dowels to protrude into the haunches, was grouted with non-shrinking, quick-setting grout.

(3) Two 24-wire cables were then threaded into the members, the stressing of which caused them to become a continuous beam. These cables were stressed in a horizontal plane. The lower cable was then jacked up to obtain in each cross-section the designed line of action of the total prestress force of 428,000 lb. needed to create the continuous beam. Two 1-in. diameter pins were placed in the web of the beam to hold the wires in their desired positions (Fig. 2). The vertical gap at the haunched ends facilitated the threading of the cables and the jacking-up described. The cable ducts and the vertical gap were



ELEVATION OF PRESTRESSED CONTINUOUS BEAM



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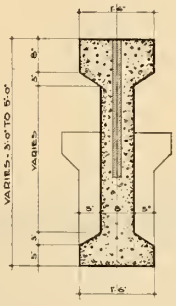

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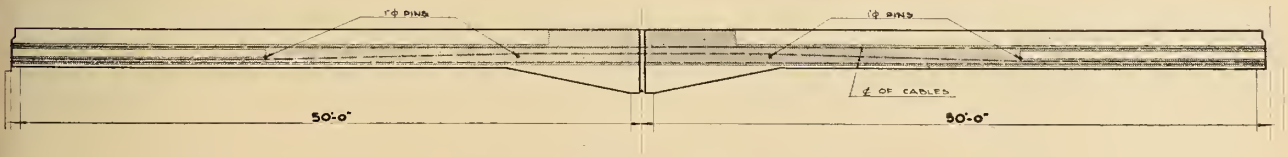


DETAIL OF HOLES FOR CABLES

Fig. 2. Army Warehouse at Cobourg, Ontario.

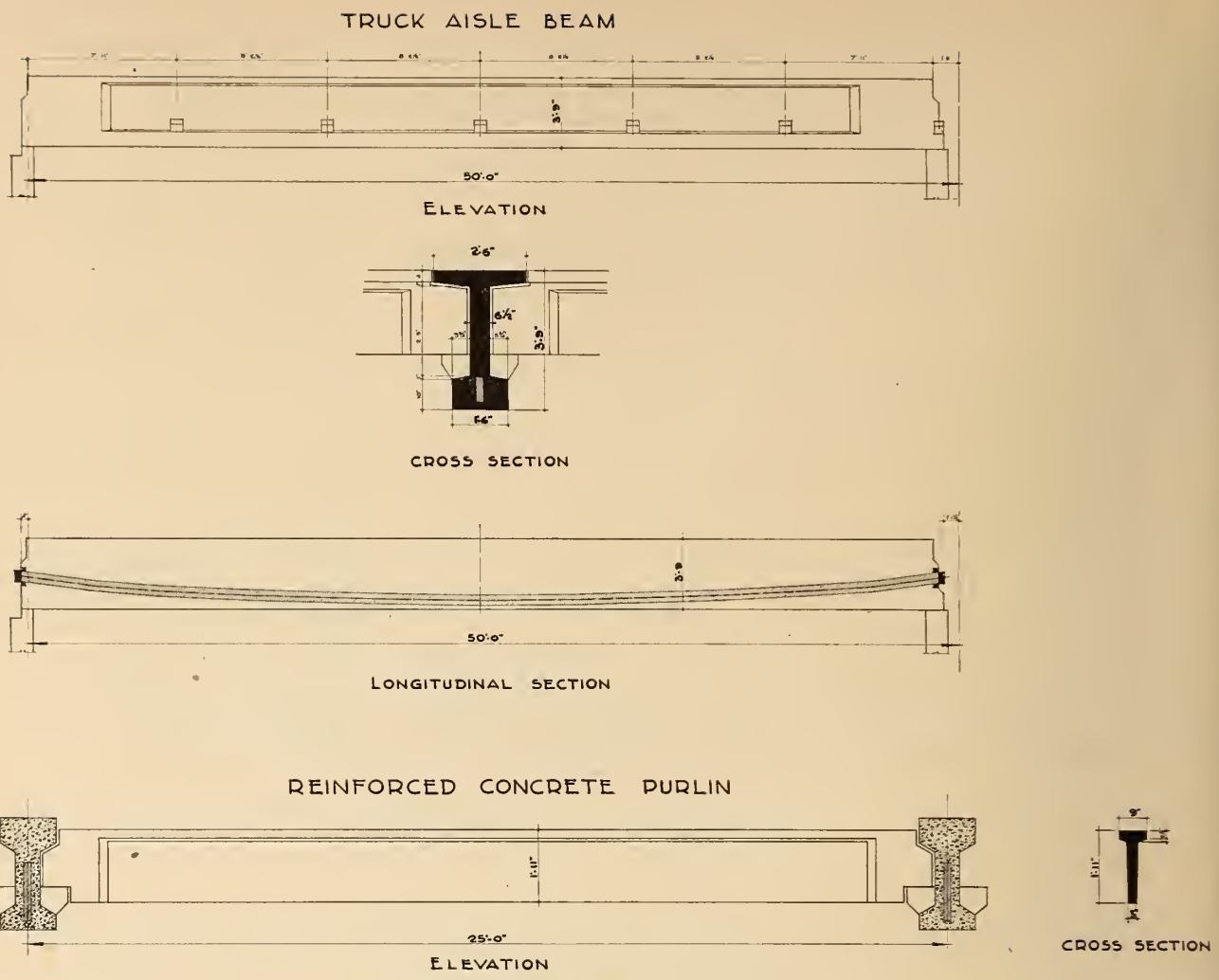


Fig. 3. Army Warehouse at Cobourg, Ontario.

then filled with grout to protect the wires from corrosion and to obtain an additional bond to the beam. Necessary inspection holes were provided along the cable ducts, both to control grouting and to act as air bleeds.

The wires in both beams were tensioned in pairs using the normal Blaton-Magnel anchorage (Fig. 5). This consists of sandwich plates and wedges, each sandwich plate maintaining eight wires under tension. The sandwich plates transmit their loads through cast steel distribu-

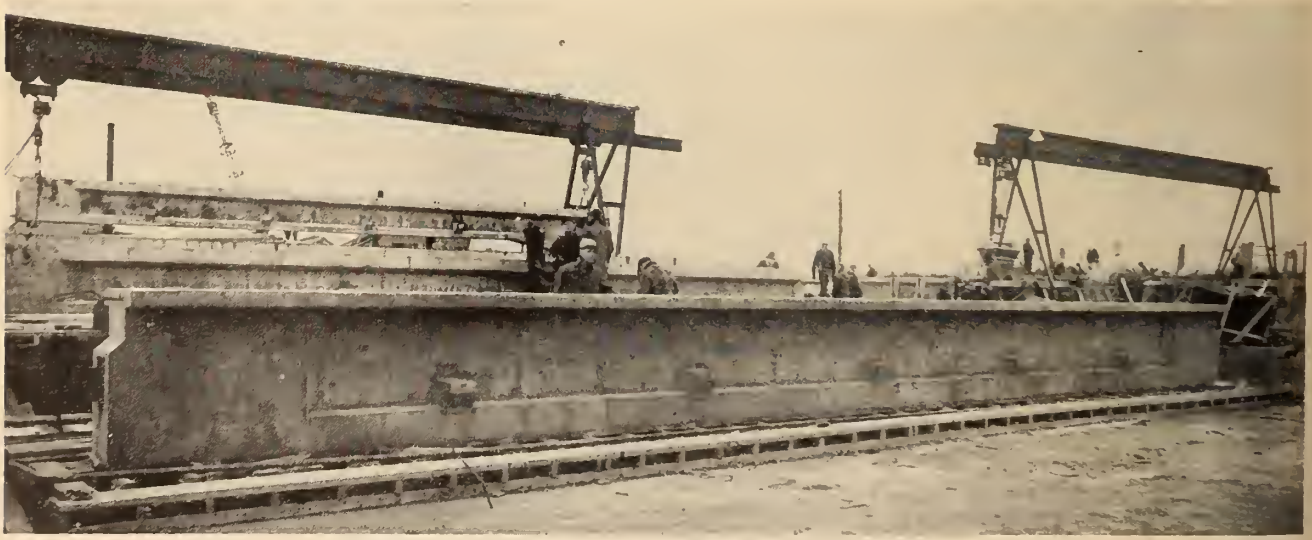


Fig. 4. A truck aisle beam; gantries in background.

tion plates (Fig. 5) which are necessary to keep the stresses on the concrete within permissible limits. The initial stress induced in the wires was 128,000 p.s.i., controlled by the predetermined imposed elongation and checked by hydraulic gauge readings.

The beams were stockpiled with the overhead gantry. They were transported to their erection points on a trailer towed by a bulldozer. A strong-back was used to lift the beams, thus permitting erection by a single crane (Fig. 6).

The production and erection of the prestressed concrete beams was carried out concurrently with and independently of the construction of the columns by the general contractor, reducing the construction period to a minimum. Following the erection of the prestressed concrete roof structure, all that was left of the roof frame for the general contractor to construct was poured-in-place reinforced concrete spandrel beams. Dowels were left in the shallow ends of the beams and their corresponding column heads to form ties when these spandrel beams were concreted.

In spite of the bad site conditions, it took only six to eight weeks to complete the structural framework of one warehouse.

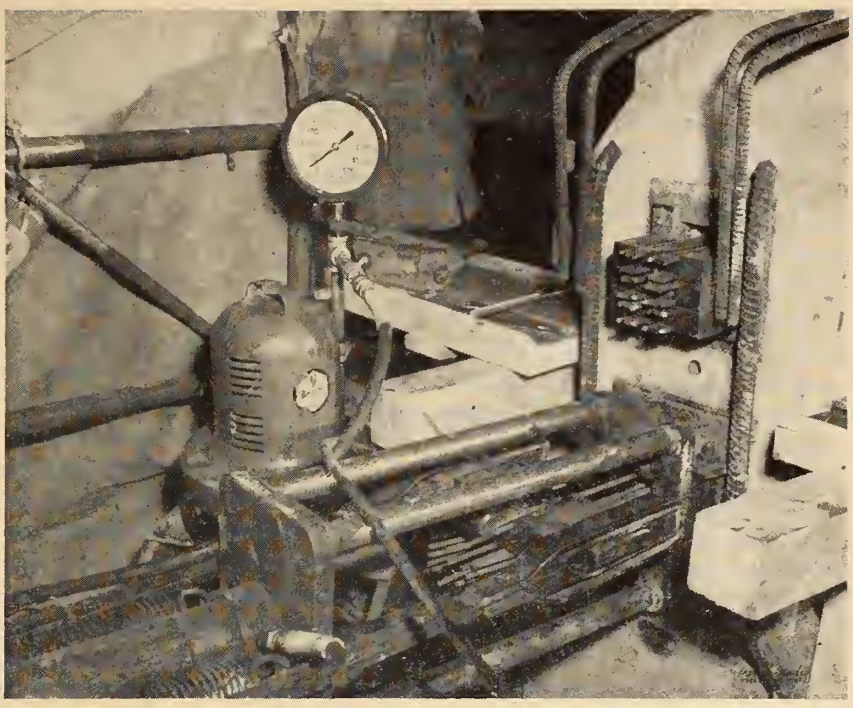


Fig. 5. Tensioning wires; note cast steel distribution plate on end of beam.

Regional Ordnance Depot, Winnipeg, Man.

The prestressed concrete construction of the warehouses at the Regional Ordnance Depot at Winnipeg, Man., further illustrates the economical advantages of this material in comparison with conventional reinforced concrete. Although almost the same in layout and column spacing as the warehouses in Cobourg, the prestressed concrete design submitted proposed a design of simply supported prestressed concrete girders to support the entire roof, which covers a total area of 200,000 sq. ft.

Since possible winter construction was anticipated, it was imperative to simplify the field work, particularly if it were to be subject to winter conditions, severe in Manitoba. On the other hand, unlike the Cobourg job, where all the prestressed concrete work was carried out at the site, it was the intention in Winnipeg to manufacture the prestressed concrete beams in a plant more than 10 miles from the job. Consequently, it was desirable to finish the beams in the plant and to reduce the field work merely to erection.

The column layout and principal cross-sections of one of the warehouses, shown in Fig. 7, illustrates the prestressed concrete design and the details of the beams.

Four 50-ft., simply supported prestressed concrete beams adequately tied to the reinforced concrete columns constituted the 200-ft. frame across the building.

The I-shaped cross-section is 4 ft. deep, the top and bottom flanges are 30 in. and 16 in. wide, respectively, and the web thickness, which was 4½ in. in the centre increased to 6½ in. at the third points, where lateral web stiffeners were provided. The beams were designed to carry a total load of 2,500 lb. per lin. ft. To provide longitudinal rigidity and to tie the whole roof structure together, dowels were left in the web stiffeners, in the ends of the beams and in the corresponding column-heads to be grouted after erection. For both warehouses, a total of 144 fifty-foot beams were required.

Generally, a similar, but more efficient, procedure than that employed at Cobourg, was adopted for the manufacture of the beams in a plant.

Contrary to the practice adopted on other contracts, where XXX cement was used, it was decided to use normal portland cement, because of the high cost of XXX cement in Winnipeg and because the required strength of the concrete after four days was only 3,250 p.s.i.,

Fig. 6. Erecting one of the 50-ft. main girders.

easily obtainable with normal portland cement. Ready mixed concrete was supplied by the plant at which the beams were manufactured.

To obtain the necessary prestress, a single parabolic cable of only 36 wires, each of 0.276-in. diameter, was required to create a total force of 275,000 lb. The tensioning and anchorage of wires were done in the normal Blaton-Magnel manner.

The favourable working conditions provided by the plant enabled the manufacture of the 144 prestressed concrete beams to be carried out in a period of only six weeks.

St. Thomas Memorial Center, St. Thomas, Ont.

Entirely different in conception and execution, the St. Thomas Arena is a better example of the numerous advantages of prestressed concrete.

Figs. 8 and 9 show the general layout and typical cross sections of the project. The building called for a clear roof span of 133 ft. The structure as shown consists of ten 135-ft. 11-in prestressed concrete beams, spaced at 20-ft. 8-in. centres and supported by 20 pairs of columns 27 ft. 6 in. high. Twelve wind-brace columns at the ends of the structure and 143 purlins complete the structural frame of the arena, to which is added an auditorium, the roof of which consists of five prestressed concrete beams, 40 ft. long, and 20 reinforced concrete purlins.

The beams, indicated in Fig. 10, are believed to be the longest prestressed concrete beams used in any building in North America. They are of I-section, the depth varying parabolically from 8 ft. 4 in. at the centre to 4 ft. 6 in. at the ends, this representing a span/depth ratio varying from 1/16 to 1/30. A camber of 6 in. was provided in the bottom flange of the beam; the upper and lower flanges were 42 in. and 26 in. wide, respectively; the web was only 5 in. thick. Lateral web stiffeners were provided every 9 ft. 4 in., which also served as supports for 20-ft. purlins, which in turn carried a lumber roof deck.

Structurally, each bent, consisting of a beam and its supports, was designed as a frame, the columns being fixed at their bases and hinged at their tops. The supports at each end of the beam were in pairs, each column being 28 in. by 15 in. in section up to within 3 ft. of the beam soffit level. These columns were forked at the heads (Fig. 11) to provide a seat for a special reinforced concrete cross member required to transmit the load of the prestressed beam to its support, the top of the forked section being flush with the top of the prestressed beams.

The entire project was carried out during the winter months. To construct the columns, a portable steel scaffold was erected around three sides of one pair of columns. The reinforcing steel and the forms were placed in position with a crane. Concreting was carried out in three lifts and consolidated with internal vibrators. During cold weather,

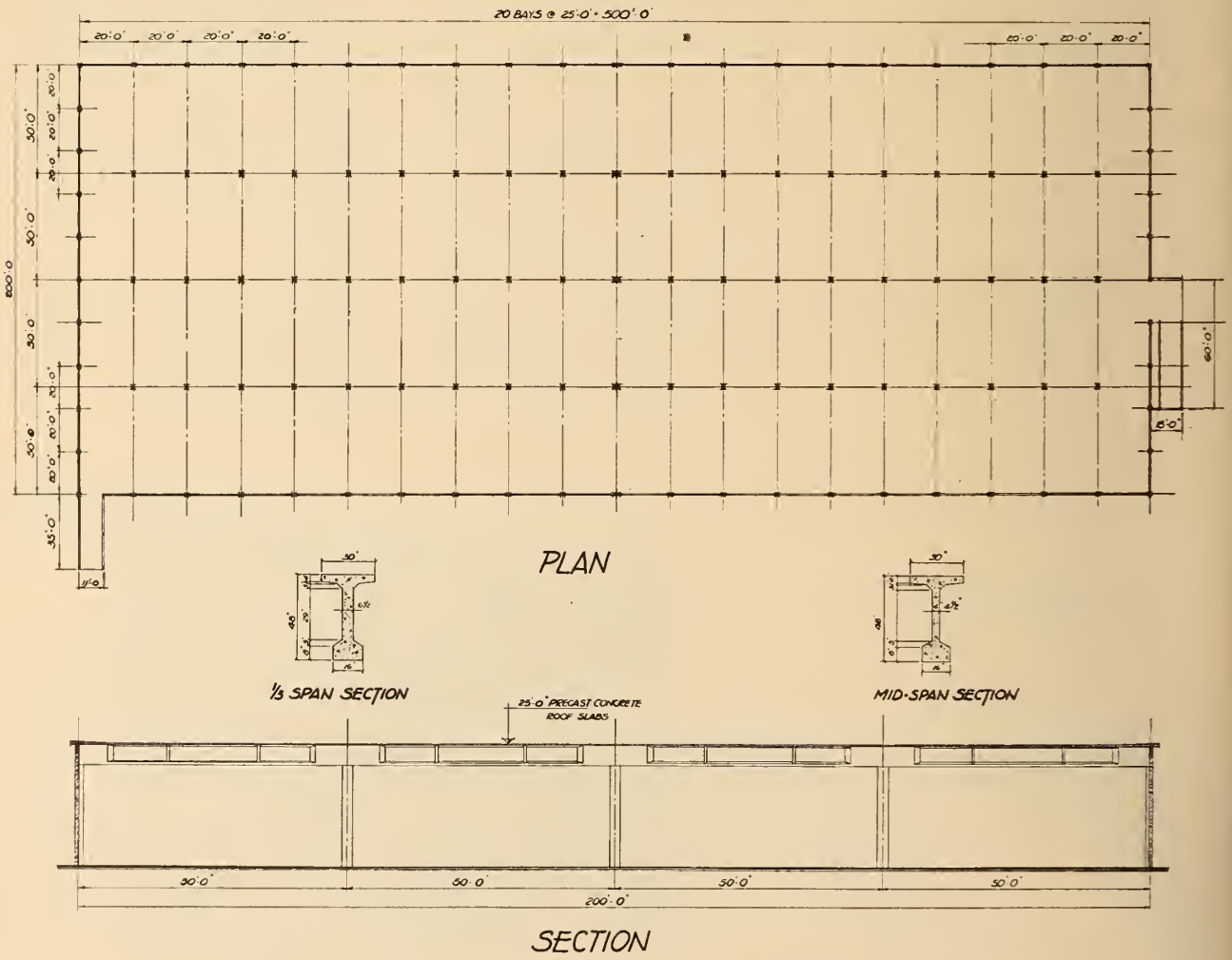


Fig. 7. Regional Ordnance Depot, Winnipeg, Manitoba.

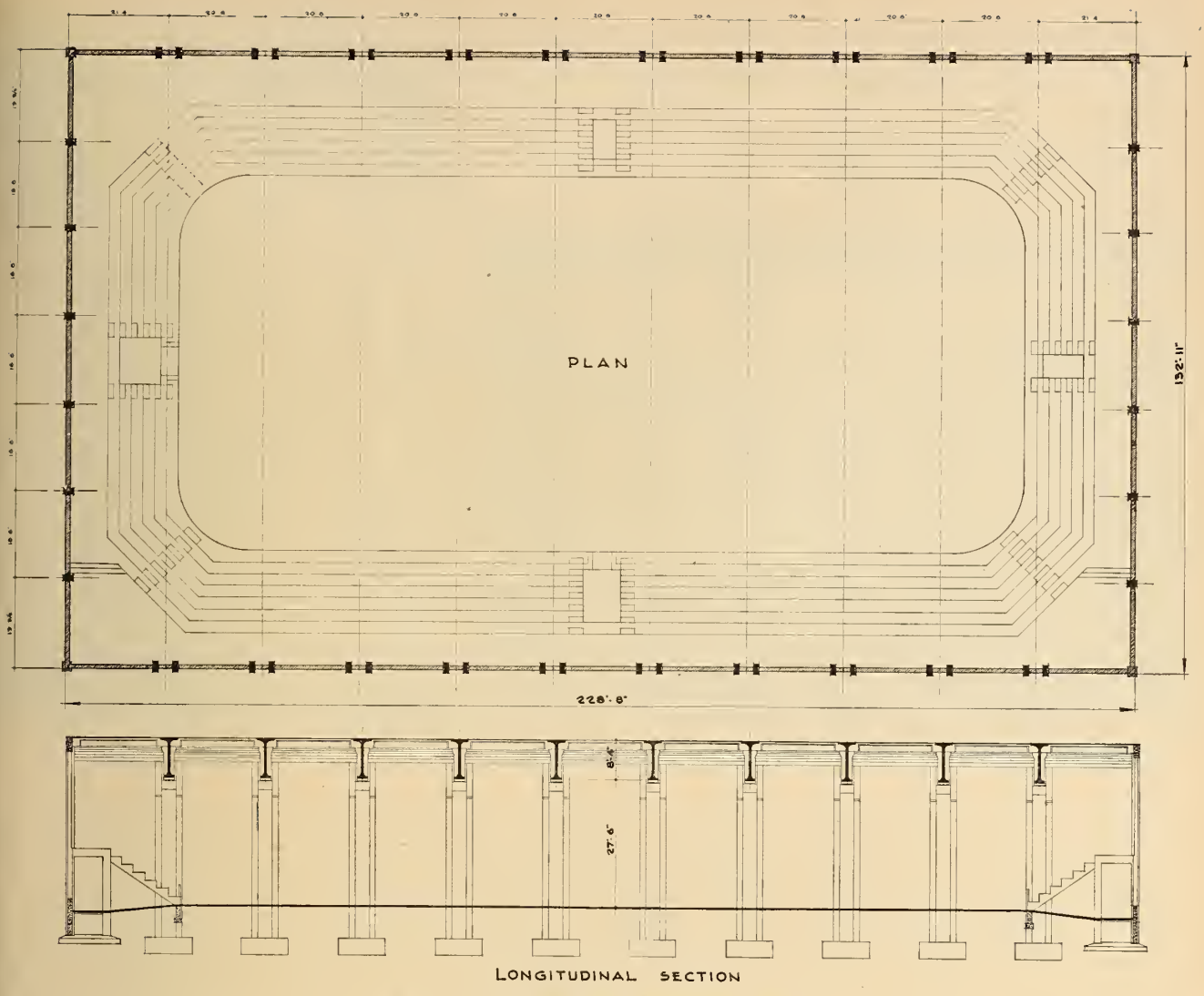


Fig. 8. St. Thomas Elgin Memorial Centre.

tarpaulins were fixed around the scaffold, forming a tent, and the desired temperature was maintained by salamanders.

Concrete with a designed strength of 3,750 p.s.i. was adopted, using six bags of XXX cement per cubic yard. Forms were stripped on the day following pouring, and were hooked inside the steel scaffold. The whole structure was then moved by crane to the site of the next pair of col-

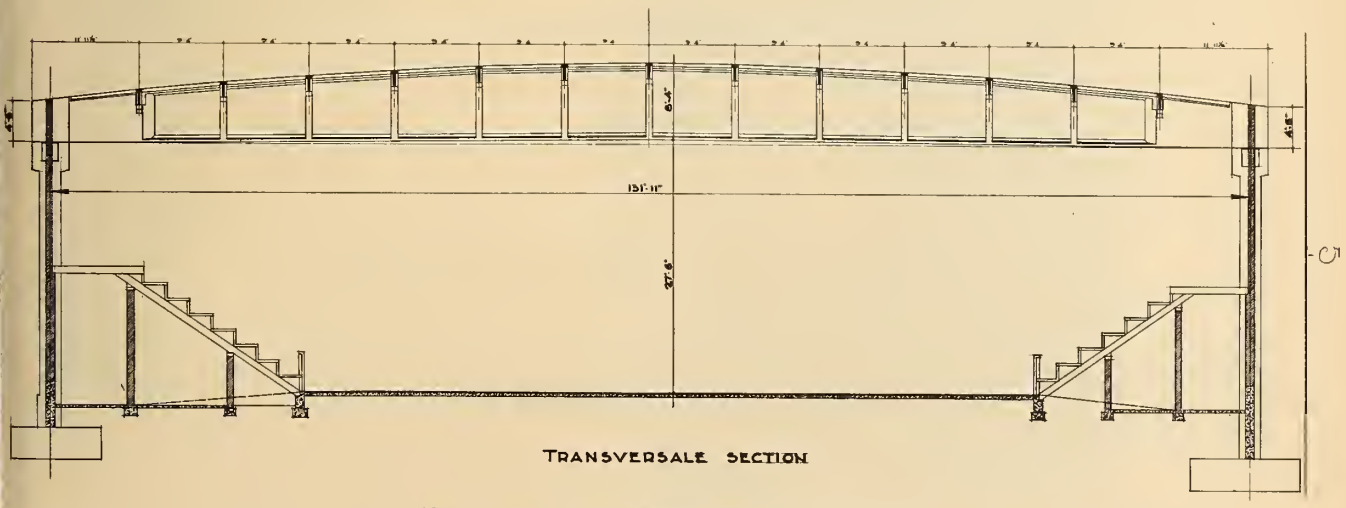


Fig. 9. St. Thomas Elgin Memorial Centre.

umns. Although only one form was used for the construction of the 20 pairs of columns, in no case was any repair or patching to the concrete necessary.

The prestressed concrete beams were constructed on the ground, on a concrete base, the ends being between their respective pairs of column supports (Fig. 12). A 5,000-p.s.i. concrete using 7.5 bags of XXX cement cu.yd. was utilized, and was placed with a 2-in. slump, being fully compacted by both external and internal vibrators. Each beam required a total of 37½ cu. yd. of concrete. The comparatively small amount of reinforcing steel needed in the prestressed beams was prefabricated and placed in units. The forms were constructed of wood covered with 20-gauge sheet steel to permit maximum reuse and to ensure a perfect surface finish.

During cold weather the beams were covered with tarpaulins, under which radiators were placed at regular intervals, with sufficient "free" steam bled from them to give the desired humidity for curing. Stripping of forms was generally carried out within 48 hours, during which curing period a temperature of 70 to 75 degrees F. was maintained.

The prestressed concrete beams were designed to carry a total load of 2,600 lb. per linear foot.

To obtain the necessary prestress, 128 high tensile wires, each of 0.276-in. diameter, were required to carry a total force of 978,000 lb. Two 64-wire cables were placed on each side of the web and tensioned in a horizontal plane. They were then jacked down to a reverse parabola in comparison with the top of the beam (Fig. 12). Vertical slots in the stiffeners were provided to allow threading and jacking down of the wires. The wires were tensioned in pairs and anchored in the normal Blaton-Magnel manner, following a prearranged schedule to prevent buckling of the beam while tensioning. During tensioning, a release of the soffit of the beam from its base, except at the ends, was obtained; the extent of the rise at mid-span, both before and after jacking down the wires, was checked against the design data. After jacking down the wires, they were held in position by precast concrete fillers of the same section as the slots in the web stiffeners. After completion of the tensioning operation, all wires were grouted to protect them from corrosion and to ensure an additional bond to the beam. The total weight of each beam when ready for erection was 90 tons.

The device used to lift a beam of such weight consisted of a structural steel framework fixed to each column. Under each end of the beam a short I-beam was placed, supported by a compressed-air driven screw jack, which in turn was carried by a second I-beam pinned to the lifting device (Fig. 13). Each jack was bolted between the two I-beams; when fully extended to 12 in., the top beam was pinned in position and the jack was reversed. This lifted the lower I-beam, which was in turn pinned in position, and the operation repeated until the beam was about 3 in. higher than its ultimate position, to allow placing of the concrete cross member. This

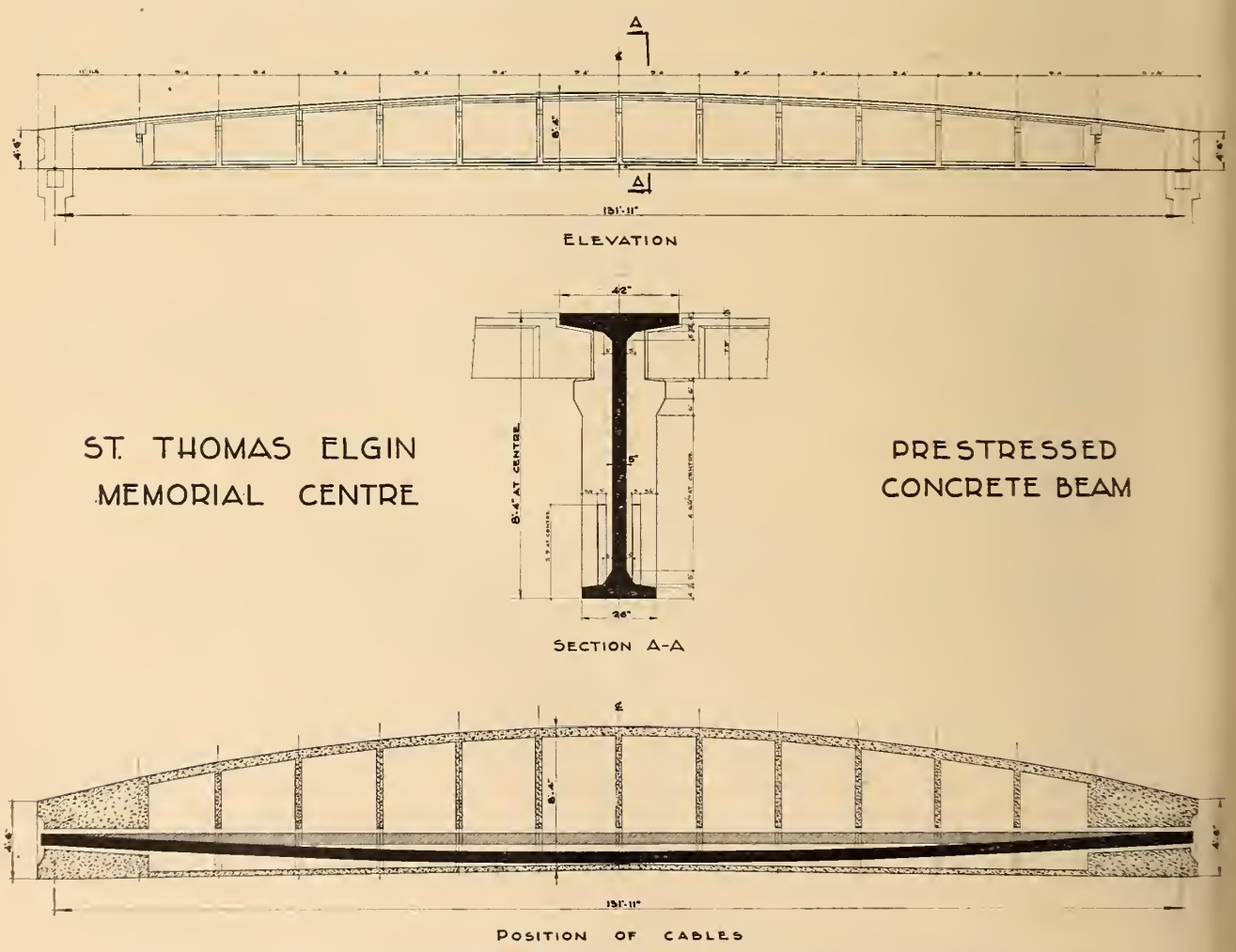


Fig. 10. St. Thomas Arena: Prestressed Concrete beam elevation section and position of cable.

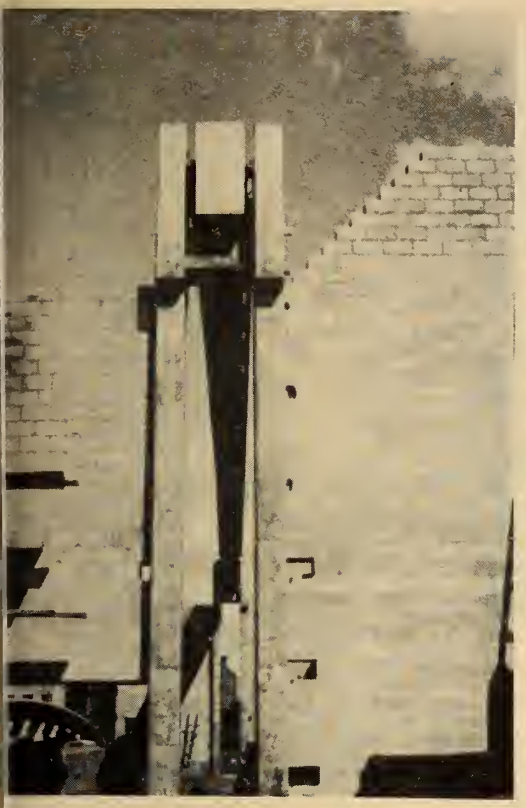
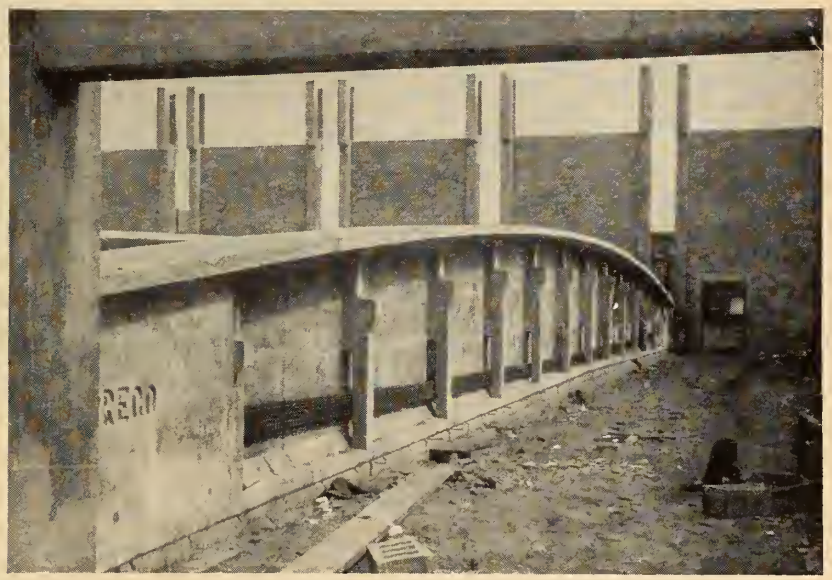


Fig. 11. A pair of columns showing the end of a beam resting on the cross member, which in turn, rests in the column forks.

Fig. 12. Ungrouted beam ready to raise; its end lies between a pair of columns; the prestress cables lie along the web at the bottom.



member, 5 ft. 6 in. long, 2 ft. deep, and 1 ft. 10 in. wide, which spanned between the pair of columns at the forks, was rolled into position, and the prestressed concrete beam was lowered onto it. A short length of steel rail was cast into the top of this cross beam, with a keyway at each end, which, combined with a steel plate cast into the soffit of the prestressed beam, formed the hinge.

Thus, the lifting of 90-ton beams to a height of approximately 32 ft. became an extremely simple and, at every stage, a controllable and safe operation completed in about five hours. (Fig. 14).

The erection of the reinforced concrete purlins by crane was carried out concurrently with this operation. These purlins were similar to those at Cobourg, being of a T-shaped cross-section 21 in. deep, with a top flange of 7 in. and 3-in. web.

R.C.N. Armament Depot, Longueuil, Que.

Another example of the structural possibilities of prestressed concrete in competition with steel is the warehouse under construction at the R.C.N. Armament Depot, Longueuil, Que., and covering an area of more than 110,000 sq. ft.

The warehouse is composed of two independent adjacent buildings, each 120 ft. wide and respectively 44 ft. and 28 ft. high. In both buildings, reinforced concrete columns at 60- and 25-ft. centres support the prestressed concrete roof, as well as reinforced concrete runways carrying overhead cranes of 30-ton capacity in the high structure and 10-ton capacity in the lower one.

Each double bent, consisting of two 60-ft. 9-in. prestressed concrete beams, and its supports was designed as a frame, the columns being

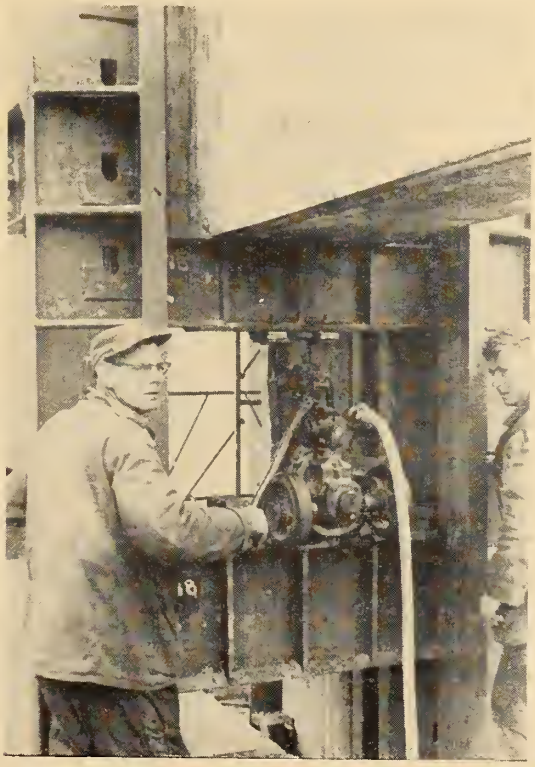


Fig. 13. Beam lifting gear, showing air-driven screw jack.

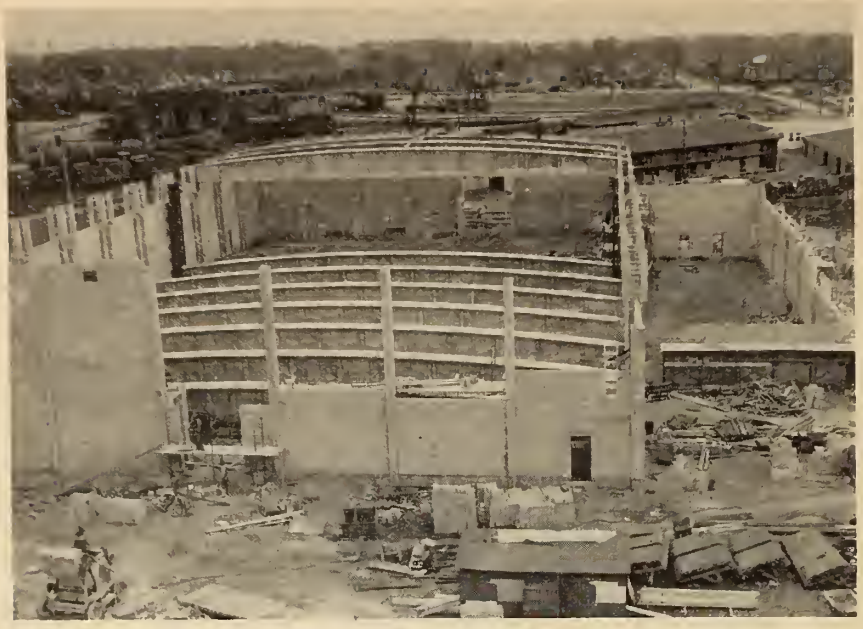


Fig. 14. General view of arena during construction.

fixed at their bases and hinged at their tops. In addition to acting as a roof girder, the prestressed concrete beam will also act as a tie beam to insure an adequate distribution of the horizontal thrusts in the whole frame.

The I-shaped cross-section is 4 ft. deep, the top and bottom flanges respectively 28 in. and 20 in. wide and the web 6½ in. thick. Purlin brackets at 8-ft. 7-in. centres are provided to support 25-ft. T-shaped reinforced concrete purlins, which in turn will carry the light-weight concrete roof slabs. The prestressed concrete beam was designed to carry a total load of 2,500 lb. per linear foot.

To obtain the necessary prestress, a single parabolic cable of 56 wires each of 0.276-in. diameter will create a total force of 428,000 lb. The tensioning and anchorage of the wires will be done in the normal Blaton-Magnel manner.

Besides the precast roof structure, consisting of 74 prestressed concrete beams, 559 reinforced concrete purlins and approximately 110,000 sq. ft. of light-weight concrete slabs, precast long span wall panels will be used to form the high walls of the warehouse.

All prefabrication will be carried out concurrently with and independently of the construction of the columns and runway beams by the general contractor.

Conclusions

The foregoing description of four prestressed concrete buildings proves the competitive reality in Canada of this new method of construction. The experience gained will no doubt, accelerate the use of prestressed concrete here wherever long spans, repetition of units or speed of construction are involved. Combined with thorough experimentation and, above all, with a designer who is well aware of the importance of the many practical problems confronted, prestressed concrete will certainly be widely used in future.

It has to be remembered, however, that the applied force needed to develop the required precompression is large and that the stresses thus induced in both concrete and steel will necessarily cause important deformations. The use of prestressed concrete, therefore, in either statically determinate or statically indeterminate structures, is possible only under the supervision of competent engineers having a thorough knowledge of the characteristics of the material used and with the help of adequate equipment and trained key-men.

But this is far from being a handicap. On the contrary, the fact that excellent workmanship and supervision are required constitutes the best guarantee of the quality of the construction job and will allow architects and engineers to design their structures without fear of defective execution.

The prestressed concrete of what is believed to be the first prestressed concrete buildings in Canada was designed and carried out by the Precompressed Concrete Engineering Co. Ltd., in co-operation with the architects and engineers and general contractors engaged on these projects and who deserve full credit for their willingness to assume the responsibility of sponsoring this relatively new method of construction in the interest of engineering progress.

Acknowledgments

Architects — Fred Green, St. Thomas, Ont.; Gratton D. Thompson, Montreal.

Consulting Engineers: C. C. Parker & Associates, Hamilton; Margison & Babcock, Toronto; Pierre M. D'Allemagne, Montreal.

Defence Construction Ltd. — R. G. Johnson and R. F. Shaw.

Army Headquarters — Colonel L. G. C. Liley.

General Contractors — Richard and B. A. Ryan, Ltd., Montreal; Peter Leitch Construction Ltd., Winnipeg; Pigott Construction Co. Ltd., Toronto; Walter G. Hunt Co. Ltd., Montreal.

E.I.C. Annual Meetings

MAY 12, 13, 14, 1954

CHATEAU FRONTENAC, QUEBEC, QUE.

MAY 11, 12, 13, 1955

ROYAL YORK HOTEL, TORONTO, ONT.

FROM MONTH TO MONTH

Notes of the Institute and Other Societies, Comments and Correspondence, Elections and Transfers

Greetings to the Students

This issue of *The Engineering Journal* is being sent in large numbers to the undergraduate engineering society in each degree granting university in Canada. Such procedure was recommended by the students themselves at the students' conference held during the annual meeting of the Institute in Halifax last year.

The object in making these complimentary copies available to those classes selected by the undergraduate society is to bring the Institute to the attention of the future generation of engineers. It is hoped that each man will read his copy carefully so that through it he may gain some further ideas about the profession itself and some knowledge of the character, the activities and the place of the Institute in his professional life.

The enrolment of students in the membership of the Institute is essential to the Institute's life. The great bulk of all the members on today's list were enrolled when they were undergraduates.

It is Council's belief that the Institute is of great importance to the student and that it is unique in the opportunities it has to render a service to him and to assist him in his own professional development.

It is realized that through members of the faculty and members of the senior classes the younger students will learn much about the organization but it is hoped that this wide distribution of the *Journal* will give them a much better insight into the organization and that as a consequence they will wish to become members to receive the many benefits available to them and in their turn to make the benefits available to succeeding generations.

Students who wish to join the Institute may obtain applications from the officers of the engineering society or from the faculty. The Council of the Institute would be encouraged greatly if an increasing number of students would respond in this way.

Honours at University of Alberta

On the occasion of the recent opening of the new engineering building at the University of Alberta, four honorary degrees of Doctor of Laws were granted to three engineers and one scientist.

The first engineer was Ibrahim Follansbee Morrison, M.E.I.C., who for forty years was on the teaching staff of the University. He organized and taught the first courses offered in Canada in the field of soil mechanics. He is the author of many books and technical papers, several of the latter having been published in *The Engineering Journal*.

Dr. G. A. Gaherty, M.E.I.C., president of the Calgary Power Company and the Montreal Engineering Company, was the second engineer to be honoured. He is so well known in Institute circles that no biographical sketch is required. His services in the development of Canadian industry and in service to the public are recognized in the award. He is referred to in the citation as "a most distinguished public servant and professional engineer". His friends everywhere will acknowledge the fitness of such a description.

The third engineer was William Gladstone Jewitt, who as a mining engineer had an important part in the exploration of other natural resources of the West, and in the development of the Consolidated Mining & Smelting Company of which he is now manager of mines and assistant general manager.

The scientist was Joseph Grant Spratt, president of the Anglo-Canadian Oil Company and presi-

Our Cover

The new subway of the Toronto Transportation Commission will go into regular operation in the spring of 1954. It is hoped to have several papers presented before our next annual general meeting describing its various features.

The cover picture illustrates the track work and lighting on the curve from Union Station Terminal leading into Yonge Street.—*Photo courtesy Toronto Transportation Commission.*

dent of the Trans-Mountain Pipe Line Company. Almost from its beginning he has been associated with the petroleum and national gas resources of the province from the industrial angle. He is a graduate in geology of the University of Manitoba.

"For Purposes of Clarification"

The Institute's By-law 81 provides that from time to time the by-laws may be reworded and rearranged "for purposes of clarification and simplification". Certain procedures are stipulated as measures of safety, before these changes can become effective. One of these is that the changes shall be published in the *Journal*. Herewith are proposals already approved by the president and vice-president Tait who were appointed by Council for the purpose, but which have yet to be approved by a majority of the branch executives, and the councillors by letter ballot.

Not long ago the membership gave substantial approval of seven changes in the by-laws. These in turn require that other by-laws be changed in order to bring them all into agreement. The need of these changes is quickly apparent but still they have to be approved along the lines stipulated in Section 81.

A few other types of changes are proposed also. The meaning of some by-laws has been ambiguous, and in other cases are susceptible to different interpretations. Council has developed practices to meet all these cases, and accordingly some changes are proposed now to clear up the wording and to bring it into line with the established practice. Certain other proposals are made simply to correct printers' errors.

Section 9

Spell "Junior" with a capital.

Section 17 — Certificates

(Present wording)

A certificate shall be issued to all members on election which shall be the property of the Institute. This certificate shall be returned by any member who has resigned, or whose name has been removed from the list of members, on his receipt of notice of such removal or of council's acceptance of his resignation.

The present wording is impossible of accomplishment, and has never been followed by Council. The present practice is described by this proposed rewording — "A certificate in a form approved by Council shall be available to all corporate members".

Section 22 — Journal Subscription

(Present wording)

In addition to the annual fees provided in Section 21, a subscription of *two dollars* per annum for the Journal of The Institute shall be paid by members of all classes, with the following exceptions:—Honorary Members, Life Members, and Members who have compounded their fees, who shall receive the Journal gratis, and Students who shall pay one dollar per annum. Branch Affiliates may receive the Journal on payment of an annual subscription of *two dollars*. The annual subscription to the Journal for non-members of the Institute shall be *six dollars*. All subscriptions shall be payable on the first day of January in each year.

The present wording indicates that members who have prepared or compounded their fees "shall receive the *Journal* gratis". Actually they have already paid for it in advance. It is proposed to strike out the words quoted above.

Note "A" — Because of the recently approved amendment by which all Juniors become Corporate Members, it becomes necessary to remove the word "Corporate" in many by-laws and spell the word "Member" with a capital. In this way the original intent of the by-laws is preserved.

Section 26 — Exemptions

(Present wording)

The council may for sufficient cause temporarily excuse from payment of annual fees any member, who from ill health, advanced age, or other good reason assigned, is unable to pay such fees, and the council may remit the whole or part of fees in arrears.

The council shall confer Life Membership upon each corporate member who has paid fees as such for thirty-five years, or who shall have reached the age of seventy years after having paid fees as a corporate member for thirty years, and from the following January first such Life Member shall enjoy full membership privileges without payment of further annual fees.

Change as explained in Note "A".

Section 28 — Compounding of Fees

(Present wording)

A corporate member in good standing may compound all his future annual fees and *Journal* subscription by a single payment in accordance with the following schedule:—

Upon election as a corporate member	$350.00
5 years after such election	315.00
10 years after such election	280.00
15 years after such election	240.00
20 years after such election	195.00
25 years after such election	140.00
30 years after such election	75.00

For intermediate years direct interpolation will apply.

In the event of discontinuance of membership for any cause whatsoever there shall be no refund of fees that have been compounded.

Payment received for compounding of fees shall be kept in a separate fund during the period of membership of the compounder, and only the interest used for the current expenses of the Institute and the rebates to the branches.

The above schedule shall be made retroactive to February 6th, 1946.

Change as per — Note "A". The new figures for the commuted amount are on the same basis as the old ones i.e. 3% compound discount but are for the new scale of fees and *Journal* subscription. They are as follows:

Upon election as a corporate member	$485.00
5 years after such election	445.00
10 years after such election	395.00
15 years after such election	335.00
20 years after such election	270.00
25 years after such election	195.00
30 years after such election	105.00

The last sentence sould read "The above schedule shall be made retroactive to August, 1953".

Section 29 — Officers

(Present wording)

The officers of the Institute shall be a president, six vice-presidents, one councillor from each branch having less than two hundred corporate members, two councillors from each branch having two hundred and less than four hundred corporate members, three councillors from each branch having four hundred corporate members, and an additional councillor from each branch for each two hundred corporate members over four hundred, and one councillor from each society or association with which the Institute has a co-operative agreement as described in Section 78 or 82 of the by-laws, as such councillors are appointed, and the treasurer of the Institute.

Changes as per Note "A".

Section 31 — Vacancies

(Present wording)

A vacancy in the office of president shall be filled by the senior vice-president. Seniority shall be determined by priority of elections as a vice-president, and failing that, by priority of admission to corporate membership.

A vacancy in the office of vice-president shall be filled until the following annual election by the senior councillor from the zone in which the vacancy occurs. Seniority shall be determined by priority of election as a councillor and, failing that, by priority of admission to corporate membership.

A vacancy in the office of councillor shall be filled until the following annual election by a corporate member chosen by the council from a list of nominees submitted by the executive of the branch concerned.

A vacancy in the office of councillor appointed by a society or an association with which the Institute has a co-operative agreement as described in Sections 78 or 82 of the by-laws, shall be filled by the said society or association.

Instead of stating "by priority of admission to Corporate Membership" it should be "by number of years of Corporate Membership". The present wording takes no account of the fact that a man may

have dropped his membership for a period of time.

Section 34 — The General Secretary
(Present wording)

The general secretary shall be a corporate member of the Institute. He shall be appointed by the council and shall hold office subject to removal by an affirmative vote of a majority of the members of the council.

He shall be the executive official of the Institute under the direction of the president and the council.

He shall attend all meetings of the Institute and of the council; he shall present the business therefor and record the proceedings thereof.

He shall see that all moneys due to the Institute are carefully collected, and deposited with the funds of the Institute.

He shall personally certify the accuracy of all bills or vouchers on which money is to be paid and present them to the finance committee for their approval. He, or in the case of his absence or inability to act, the treasurer, together with any one member of the finance committee shall have authority on behalf of the Institute, to draw, accept, sign, make and agree to pay all or any bills of exchange, promissory notes, cheques and orders for the payment of money.

He shall be responsible for the editing of the publications of the Institute.

He shall have charge of the books and accounts of the Institute.

He shall conduct the correspondence of the Institute and keep full records of the same.

He shall be in responsible charge, under the president and the council, of all the property of the Institute.

He shall, with the approval of the council, employ such help as may be necessary and shall be responsible for the work of all employees of the Institute.

He shall perform such other duties as may be assigned to him by the council.

His time shall be devoted solely to the affairs of the Institute.

He shall give a bond for the faithful performance of his duties, in a sum to be fixed by the council, at the expense of the Institute.

Change as per Note "A".

Section 35 — The Treasurer
(Present wording)

The treasurer shall be a corporate member of the Institute. He shall be appointed by the council and shall hold office subject to removal by an affirmative vote of a majority of the council.

He shall attend meetings of council and shall prepare and present annually to the council in time for the annual general meetings a financial statement, as of the 31st December, of the affairs of the Institute. He shall furnish from time to time such other reports as may be prescribed.

He shall, with the general secretary, invest the funds of the Institute as may be ordered by the council.

Change as per Note "A".

Section 42 — Officers' Ballot
(Present wording)

A ballot form, prepared in accordance with the list and additional nominations (if any) shall be mailed to corporate members at least thirty days before the annual general meeting, and shall state the name and residence of each nominee, his class of membership and the zone or branch district in which he resides. The names of the nominees for each office shall be arranged alphabetically by zones and branches.

Voters may strike out names from this officers' ballot and may substitute other names therefor but the number of votes cast for each office must not exceed the number to be elected to such office. In voting for councillors, each voter shall vote for the councillor to be elected from his own branch. Directions in accordance with the above provisions shall be printed conspicuously on the officers' ballot and any vote which does not comply with them shall be rejected.

The first paragraph should be altered to agree with the recent amendment of Section so that it would read "A ballot form, prepared in accordance with the list and additional nominations (if any) shall be mailed to corporate members at least thirty days before the annual general meeting (except as noted in the last clause of this section) and shall state the name and residence, etc."

Section 43 — Canvass of Officers' Ballot (Present wording)

Officers' ballots must be delivered to the general secretary before twelve o'clock noon of the first day of the annual general meeting when the polls shall be closed and the ballot shall be canvassed publicly by scrutineers appointed either by the meeting or with its consent by the presiding officer.

This ballot is unworkable under the amended by-laws. It now becomes necessary to appoint the scrutineers before the annual meeting. Therefore it should be changed to read "scrutineers appointed either by Council or by the president".

Section 48 — Papers Committee
(Present wording)

The papers committee shall be composed of representative members selected, as far as possible, from the several branches. The committee shall advise and assist in obtaining papers for the meetings of the Institute and its branches.

Papers which have been published previously, which advocate personal interests, which are prepared carelessly, which controvert established facts or are purely speculative or foreign to the objects of the Institute, shall not be accepted for publication.

As now worded this by-law gives the committee some of the same duties as are assigned to the Publications Committee. The Paper Committee has never functioned in this way, and the proposal is to clarify the situation by making the by-law read "The Papers Committee when requested shall advise and assist in obtaining papers for the meetings of the Institute and the branches". The last paragraph to be struck out.

Section 57 — Meetings of Standing Committees (Present wording)

Standing committees, except the papers committee, shall meet at the call of their chairman at such times as may be found necessary to transact properly the business before them.

Three members shall constitute a quorum.

The present wording is ambiguous and to clarify it, it is proposed to strike out the words "except the Papers Committee".

Section 60 — Branch Membership
(present wording)

The membership of a branch shall consist of the members of the Institute of all classes residing within an area known as the branch district and so allocated that such members are members of the branch most convenient geographically. Branch districts shall be so apportioned that all members of all classes resident within the Dominion shall be members of a branch. The boundaries of the branch districts shall be determined by the council.

A non-resident member shall have the right to designate himself a member of any branch he may chose, failing which designation he shall be attached, for Institute voting purposes only, to the Montreal branch.

Correct typographical error — change the word "chose" to "choose".

Section 64 — Branch By-Laws
(Present wording)

Branches shall adopt by-laws governing the election of officers, the holding of meetings, and other matters of local jurisdiction. As far as possible, there shall be uniformity in the by-laws of all branches of the Institute. The draft of such by-laws, and of amendments or additions thereto, shall be submitted to the council for approval, and shall then be submitted by letter ballot to the vote of the corporate members and Juniors of the branch for final adoption.

As Juniors are now Corporate Members, strike out the words "and Juniors" in the last line.

Section 66 — Branch Revenue
(Present wording)

Each branch shall receive a portion of the annual fees, current and arrears, received by the Institute from the members of that branch during each year, determined as follows:—

30% to each branch having a corporate membership of less than one hundred.

25% to each branch having a corporate membership of one hundred and less than two hundred.

20% to each branch having a corporate membership of two hundred or more, provided always that the amount of rebate shall not be reduced by reason of an increase in membership and consequent reduction in rate.

For the purpose of these percentages the branch membership as of the last day of December in each year shall govern for the following year.

Substitute the word "Membership" for "Corporate Membership". If Juniors are included in the count most branches would get a reduced revenue.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Petroleum Engineering	Chemical Engineering	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
Memorial	1st	45															45
	2nd	32															32
	3rd	9															9
Total		86															86
Dalhousie	1st	74															74
	2nd	51															51
	3rd	23															23
Total		148															148
St. Mary's	1st	48															48
	2nd	21															21
	3rd	20															20
Total		89															89
St. Francis Xavier	1st	74															74
	2nd	86															86
	3rd	41															41
Total		201															201
N.S. Tech. College	4th					10	30	31					42	6	6		125
	5th					6	25	13					17	4	2		67
Total						16	55	44					59	10	8		192
Acadia	1st	60															60
	2nd	35															35
	3rd	13															13
Total		108															108
Mount Alison	1st	60															60
	2nd	80															80
	3rd	29															29
Total		169															169
New Brunswick	1st					3	46	20					19		1		89
	2nd					5	42	25					19		6		97
	3rd						18	9					12				39
	4th						24	14					13				51
	5th						18	9					5				32
Total						8	148	77					68		7		308
Laval	1st	95															95
	2nd	88															88
	3rd					10	36	16				4	7	8	4		85
	4th					7	37	13				3		1	4		65
	5th					7	25	14				4		2	1		53
Total		183				24	98	43				11	7	11	9		386
Ecole Polytechnique	1st	186															186
	2nd	165															165
	3rd	107															107
	4th						52			44		11		3			110
	5th						33			25		4		4			66
Total		458					85			69		15		7			634
McGill	1st	304															304
	2nd	300															300
	3rd					30	57	42					66	15	5	23	238
	4th					33	55	43					73	6	6	12	228
	5th					20	47	42					60	8	8	8	193
Total		604				83	159	127					199	29	19	43	1263
Ottawa	1st	20				5	7	5					2	1			40
	2nd	4				7	8	14				1	4		2		40
	3rd						4	3					1	2			10
Total		24				12	19	22				1	7	3	2		90
Carleton College	1st	41															41
	2nd	29															29
Total		70															70
Queen's	1st	247															247
	2nd	234															234
	3rd					37	25	36				8	24	6	7	7	150
	4th					28	38	26				5	42	5	11	7	162
Total		481				65	63	62				13	66	11	18	14	793
Toronto	1st		22			109	92	84	48			36	94	22	17	42	566
	2nd		12			77	75	69	47			12	89	10	10	35	436
	3rd		12			61	75	47	43			10	54	8	6	30	346
	4th		2			56	52	52	36			4	62	6	5	15	290
Total			48			303	294	252	174			62	299	46	38	122	1638

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES — Continued

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Petroleum Engineering	Chemical Engineering	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
Manitoba	1st	226	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	226
	2nd	123	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	.....	.....	.....	3	138
	3rd	.....	.....	.....	.....	.....	27	26	.....	.....	.....	2	41	.....	.....	3	99
	4th	.....	.....	.....	.....	.....	31	21	.....	.....	.....	2	31	.....	.....	3	88
Total	.....	349	.....	.....	.....	.....	58	47	.....	.....	.....	16	72	.....	.....	9	551
Saskatchewan	1st	250	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	250
	2nd	135	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	.....	.....	.....	17	170
	3rd	.....	.....	2	.....	10	25	15	.....	.....	.....	15	26	.....	.....	3	96
	4th	.....	.....	1	.....	12	22	2	.....	.....	.....	8	22	.....	.....	2	69
Total	.....	385	.....	3	.....	40	47	17	.....	.....	.....	23	48	.....	.....	22	585
Alberta	1st	265	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	265
	2nd	.....	.....	.....	17	47	56	31	.....	.....	.....	.....	2	.....	15	.....	168
	3rd	.....	.....	.....	16	12	40	17	.....	.....	.....	.....	.....	.....	7	2	94
	4th	.....	.....	.....	12	22	37	18	.....	.....	.....	1	.....	.....	3	.....	93
Total	.....	265	.....	.....	45	81	133	66	.....	.....	.....	1	2	.....	25	2	620
British Columbia	1st	290	.....	.....	.....	.....	.....	.....	.....	.....	7	.....	.....	.....	.....	.....	297
	2nd	166	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	168
	3rd	.....	.....	.....	.....	12	27	25	.....	.....	5	7	39	8	9	10	142
	4th	.....	.....	.....	.....	12	22	31	.....	.....	6	10	32	5	4	10	132
Total	.....	456	.....	.....	.....	24	49	56	.....	.....	20	17	71	13	13	20	739
Canadian Services Colleges																	
Royal Roads	1st	67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	67
	2nd	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	58
Total	.....	125	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	125
Royal Military College	1st	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66
	2nd	63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63
	3rd	.....	.....	.....	.....	12	24	14	.....	.....	.....	.....	28	.....	.....	.....	78
	4th	.....	.....	.....	.....	6	10	14	.....	.....	.....	.....	15	.....	.....	.....	45
Total	.....	129	.....	.....	.....	18	34	28	.....	.....	.....	.....	43	.....	.....	.....	252
Grand Total	.....	4330	48	3	45	674	1242	841	174	69	20	159	941	130	139	232	9047
Prospective 1954 Graduates	.....	.....	2	1	12	163	350	228	36	25	6	38	271	34	34	45	1245

Student registration for 1953-54 in Engineering courses at Canadian Universities as compiled by The Engineering Institute is shown in the above tabulation.

Total registration is again higher than for the preceding year by approximately 1,000 students, after making allowance for certain discrepancies in our 1952-53 figures which came to light after the December 1952 *Journal* was printed.

First year registrations for the current term have been approximately 3,100 which represents an increase of just under 10 per cent over 1952 and of 60 per cent over the 1950 low of 1,874. Incidentally, it is of interest to note that the first year registration at the two larger schools—McGill and Toronto is lower than last year while that at practically all the others is higher.

The total number registered in the 1954 graduating class is 1,245. The graduating class is likely to be the smallest for some years to come since the Junior class registration is about 165 higher this year than it was a year ago and succeeding classes will be larger still. Even so the number of graduates is likely to remain below 1,300 annually until 1956 when a considerable number of the large freshman class of last year will be due to graduate.

Some noticeable trends in the selection of courses have been observed in this year's figures. For example, there has been a noticeable drop percentagewise in Engineering and Business Administration as well as Forest Engineering, while overall registration is higher by an appreciable margin in Geology, Mineralogy and Metallurgical Engineering.

W. F. G. Swann to Give Wallberg Lecture

The University of Toronto has announced that Dr. W. F. G. Swann, director, Bartol Research Foundation, will deliver the Seventh Wallberg Lecture on Monday, January 18, 1954.

Dr. Swann is an English-born physicist whose notable contributions have mostly been made during his stay of many years in the United States. He has directed the Bartol Research Foundation since its beginning in 1927.

Dr. Swann is not a stranger to engineering audiences as visitors to the Centennial of Engineering, held in Chicago, well know. He has chosen as his title, "Engineering in our Epoch."

The Wallberg Lecture will be held in Convocation Hall, at 8.15 p.m., and the public is invited.

Not "Made in Canada"

Canadian publishers of periodicals are facing a serious situation brought on by a peculiar competition from United States publishers. Many Canadian advertisers, without whom there would be no publications, are curtailing their advertising in Canadian publications and are using instead American publications camouflaged as "Canadian". Any wide expansion of the practice might well put out of business every periodical in Canada owned and published by a Canadian publisher. It is a matter of serious import to all Canadians, but particularly to those who have a hope that eventually Canada will become a nation, free from economic domination by any other country.

Like most other Canadian periodicals with a national circulation, *The Engineering Journal* has suffered from this development. Some of the most valued advertisers, who have made extensive investments in the *Journal* have switched to the product of American publishers. No one can question their privilege to spend their advertising appropriations wherever they please but there is the possibility that the high pressure methods which are used at least in some instances may make these media appear better than they will prove to be eventually. Canadian publishers think so, and are taking steps to prove it. In most instances Canadian publications can prove that dollar for dollar they offer the best values for advertisers who wish to reach the Canadian public.

No one can blame the Americans for trying to get some of the Canadian advertising revenue to help them out of a situation which, without that revenue, is an unhappy one for them. In order to reduce their financial losses on Canadian circulation, they must have Canadian advertisers. The situation is this:

Advertisers pay for the cost of publishing almost every periodical. For example, if it had not been for the advertisers, the members of the Institute last year would have had to pay over $8.50 for *The Engineering Journal*. The advantage of increased circulation, which of course increases the costs, is that advertising rates may be increased thereby. The trouble with certain American publications is that their Canadian circulation is increasing, but their American advertisers will not pay increased rates for Canadian circulation. Thus it is that the Americans find their publishing costs rising due to having to print and mail more copies in Canada but their advertising revenue does not rise correspondingly.

And so some bright person has thought up the "Canadian Edition" whose advertising pages could be sold to Canadian advertisers. They are asking firms whose sources of revenue are wholly or largely Canadian, to spend their Canadian-made dollars with American publishers rather than Canadians. The Canadians are expected to provide the dollars that make it possible for the American publisher to expand his already great invasion of the Canadian reader's mind. It does not seem to make sense. Here is exploitation of the Canadian market at the expense of truly Canadian organizations. It is a serious matter worthy of the attention of all Canadians, both readers and advertisers.

It is ironic that many of the firms using "Canadian Editions" are the same ones who are urging upon the government that protective tariffs be increased. It seems unreasonable that they should ask that American merchandise be kept out by tariffs while at the same time they are buying increasing space in American publications, in place of Canadian.

"Canadian Editions" of American periodicals not only are a threat to Canadian publishers through their advertising columns, but they are a further threat from the subscription and reader point of view. They are not "Canadian" even by the greatest stretch of the imagination. The whole set-up is purely and simply a veneer through which they hope to get Canadian dollars to reimburse them for their Canadian circulation—and the tragedy of it is that they appear to be succeeding. Canadian readers and Canadian advertisers are surely making it difficult for Canadian publishers, perhaps without realizing it.

Canadian Engineering Graduates in Britain

Thirty-seven Canadian engineering graduates left London recently to begin a two-year post-graduate course at universities, technical colleges and leading engineering firms in various parts of Britain. This is the third group of Canadian graduates to arrive in Britain under the Athlone Fellowship Scheme, which was instituted in 1951 to give recently graduated engineers from Canada an opportunity of learning more about British engineering and technical methods. Four of the graduates are going to Cambridge University, five to the Imperial College of Science and Technology, London, and others are going to

A group of Athlone Fellows in Britain.

such firms as De Havilland, English-Electric, Imperial Chemical Industries, Metropolitan-Vickers, and Rolls-Royce.

Speaking at a brief course entitled "Introducing Britain", held in London for the Fellows, Sir Edward Hodgson, K.B.E., C.B., vice-chairman of the Athlone Fellowship Management Committee, welcomed the Canadians to Britain and explained that the object of the scheme was twofold. It was firstly a long-term investment programme to spread the knowledge more widely in Canada of what British engineering could do and export, at the same time benefiting the holders of Fellowships in enabling them to pursue further their studies in their particular fields of engineering. Secondly, the scheme was of great cultural value to the two countries through the resulting first-hand exchange of ideas and opinions and of the opportunity it provided for Canadians to see something of the British way of life.

The origin of the Athlone scholarship dates back to the visits to Canada of the Gilpin Engineering Mission in 1948 and of the then President of the Board of Trade in 1949, and their recommendations that some scheme should be set up to attract Canadian engineering graduates to Britain with the long-term aim of expansion of British capital goods exports to Canada. After extensive preparations, a scheme was evolved. A managing committee was set up under the chairmanship of Sir Arthur Fleming with representatives of the Federation of British Industries, the universities, the trade unions and Government departments concerned. This committee administers the scheme, which is financed by the Board of Trade. The fellowships were named "The Athlone Fellowships" after the former Governor-General of Canada.

Thirty-eight fellowships to cover cost of transport, fees and maintenance are awarded annually. twenty-eight to graduates immediately after graduation and ten to graduates who have already spent some time in industry. Fellows may choose where to take their course of study from a number of approved industrial organizations, universities, colleges and research establishments.

Courtesy United Kingdom Information Office.

Progress Report

The inaugural meeting of the Prestressed Concrete Development Group of Canada was held at Hart House, University of Toronto, on September 10, 1953. The meeting was arranged by an Inviting Committee under the chairmanship of Prof. M. W. Huggins of the Department of Civil Engineering of the University of Toronto, and the meeting was attended by about 100 engineers and architects from all parts of Canada.

At this meeting, an Organizing Committee was formed under the chairmanship of Mr. E. P. Muntz, consulting engineer, with the following members:

E. P. Muntz, Chairman, consulting engineer, The Hydro-Electric Power Commission of Ontario, 620 University Ave., Toronto. KI.5078, EM.8-6767.

Leo E. Venchiarutti, architect, 2941 Bathurst St., Toronto. RE.4377.

Dr. T. O. Lazarides, consulting engineer, 79 Scollard Street, Toronto. KI.9986.

Dr. P. L. Pratley, consulting engineer, 909 Drummond Building, St. Catherine St., W., Montreal. MA.1020.

M. W. Huggins, assoc. professor, Dept. of Civil Engineering, University of Toronto. MI.6611, Lo.251.

F. P. Rolph, Pentagon Construction Co., Ltd., 1225 Bishop St., Montreal. UN.6-8611.

J. D. Allan, sales manager, Const. Materials Div., Steel Co. of Canada, Hamilton. 8-2511.

P. Benn, general manager, Precompressed Corporation of Canada, 5012 Western Avenue, Montreal. EM.8-1193 (Toronto), HU.8-3089 (Toronto).

R. M. Doull, general manager, Canada Gunite Co. Limited, 7325 Decarie Blvd., Montreal. AT.1177.

B. A. Hesketh, managing director, Hesmont Concrete Limited, 5035 Western Avenue, Montreal. EL.1118.

H. King, engineer, Cooksville Company Limited, 1055 Yonge Street, Toronto. MI.8466.

Dr. R. L. Hearn, general manager and chief engineer, The Hydro-Electric Power Commission of Ontario, 620 University Ave., Toronto. EM.8-6767.

I. Brouillet, consulting engineer, 515 Demontigny St. E., Montreal. MA.8371.

V. S. Murray, president, Murray Associates Limited, 130 Queen's Quay, Toronto. EM.4-4362.

D. O. Robinson, Secretary, chief engineer, Dept. of Sales, Canada Cement Co. Limited, 1103 Bank of Montreal Bldg., Toronto. EM.3-2476.

The Organizing Committee has had two meetings, both in Toronto, on September 18 and October 1. Two sub-committees have been appointed, the first to draft a tentative practice for the use of prestressed concrete under the chairmanship of Dr. T. O. Lazarides.

The members are: Messrs. Allan, Brouillet, Huggins, Doull, and Pratley.

The second sub-committee to have been appointed is under the chairmanship of Mr. H. King, and the function of this sub-committee will be to draft objectives and rules for the Group.

The members of this sub-committee are: Messrs. Murray and Robinson.

The chairman of the Organizing Committee, Mr. Muntz, is *ex-officio* a member of all sub-committees.

It may be reported that the two sub-committees referred to and the Organizing Committee have made significant progress in their work, and the Chairman, Mr. Muntz, is anxious to get from all interested parties their opinions and ideas about the tasks entrusted to the sub-committees.

The next meeting of the Organizing Committee has been set for November 5 in Montreal, and it is expected that a further progress report will be prepared at a later date.

Correspondence

The General Secretary,
Engineering Institute of Canada.

I have much pleasure in according to the members of your Institution an invitation on behalf of the Institution of Engineers (India) on the occasion of our Thirty-fourth Annual General Meeting to be held in Calcutta from February 13 to February 17, 1954.

It is hoped to distribute the printed programme in December or so, but I should be grateful if you would publicize the dates of the Meeting to members of your Institution well in advance.

Any member of your Institution able to attend the Meeting will indeed be very welcome to do so on the same terms and conditions as members of this Institution.

B. Seshadri
Assistant Secretary

The president and Mayor Whitton reminisce about the coronation. Left to right, Mrs. L. Austin Wright, L. Austin Wright, W. E. Wakefield, Mrs. Wakefield, Mrs. Jack Dobbin, Ross L. Dobbin, Her Worship Mayor Charlotte Whitton, and Dr. J. J. Green, Branch chairman.

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Head table, left to right: Gordon Sutherland, branch secretary-treasurer; Mrs. K. M. Cameron, Mrs. W. E. Wakefield; L. Austin Wright, general-secretary; Mrs. Jack Dobbin; Ross L. Dobbin, the president; Dr. J. J. Green, Mrs. Wright, W. E. Wakefield, Mrs. Green; Dr. K. M. Cameron, past-president; Mrs. Sutherland. In the foreground: Mr. and Mrs. Walter Saunders and Mr. Guy Ballard.

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A general view of one end of the room.

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Photos by D. E. Phinney of the National Research Council.

Tribute to An Engineer

Thirty-five years to the day after the passage of the first scheduled train through the Canadian National Railways' Mount Royal tunnel in Montreal, a tablet to the memory of the engineer who conceived the scheme was unveiled in the Central Station at the city end of the tunnel.

That engineer was the late Henry K. Wicksteed, who became a member of our predecessor, the Canadian Society of Civil Engineers, in 1887. Mr. Wicksteed was born in the city of Quebec and graduated from McGill University in 1874. After eleven years with the Canadian Pacific Railway in the west, he became chief engineer of the Brantford, Waterloo and Lake Erie Railway, and then served the Grand Trunk Railway from 1889 to 1900, when he joined the Canadian Northern Railway, finally retiring in 1921.

The Canadian Northern was expanding and an entry into central Montreal was a necessity if it were to hope to compete for passenger business with the two old established lines, the C.P.R. and the G.T.R. Mr. Wicksteed, it is said, never visited a strange city without making himself familiar with its

Unveiling a tablet in Central Station, Montreal, in memory of the late Henry K. Wicksteed, M.E.I.C. Left to right: Miss W. Wicksteed, His Worship Camillien Houde and Donald Gordon.

railway entrances and terminals, so it was quite natural that he should devote a good deal of thought to the Canadian Northern's problem.

By 1904 he had become convinced that the solution lay in a tunnel under Mount Royal, with a station south of Dorchester Street, although this meant the acquisition of much well-developed property for the station.

By 1911 the Montreal Tunnel and Terminal Co., Ltd., later the Mount Royal Tunnel and Terminal Co., Ltd., had been incorporated by the railway and surveys had been begun. The site of the Town of Mount Royal was acquired and work on the tunnel began in June, 1912. The tunnel was holed through in December, 1913. The first station was a temporary stub-end terminal, serving the tunnel lines only, replaced after the formation of the Canadian National Railways and the bringing of the former Grand Trunk lines into the site.

The commemorative tablet reads, in both English and French:

> "Erected by the Canadian National Railways, this tablet honors the memory of Henry K. Wicksteed, 1850-1927, whose foresight as early as 1904 brought about the construction of a tunnel through Mount Royal, 1912-1918, and the erection of the original terminal on this site."

It was unveiled on October 21, 1953, by Miss Winnifred Wicksteed, Mr. Wicksteed's eldest daughter.

In asking Mayor Houde of Montreal to present the unveiling ribbon to Miss Wicksteed, Mr. Donald Gordon, C.M.G., president of the Canadian National Railways, said in effect that it was both a pleasure and a duty to pay tribute to an engineer of Mr. Wicksteed's great ability and even greater prescience.

The Institute was represented at this ceremony by Dr. J. B. Stirling, past president, who expressed the engineering profession's appreciation of this generous memorial to an outstanding career. He remarked that this tablet gave credit where credit is due; all too frequently such tablets exalt the reputation of some politician whose only virtue is that he happened to be in office when a particular work was completed. Thus it came about that names like Keefer, Fleming and Gzowski were practically unknown to the public, though their bearers were among the builders of the nation.

Others present were members of Mr. Wicksteed's family and Messrs. M. W. Maxwell M.E.I.C., J. S. Busfield, M.E.I.C., who worked on the tunnel, and conductors, trainmen and others associated with its beginnings.

Queen's University Convocation

Assembled for the convocation at Queen's University, Kingston, marking the diamond jubilee of the faculty of applied science, were: (reading from left to right) first row: R. D. Bradfield, instrument maker, faculty of applied science, Queen's University, recipient of the honorary degree of master of science; I. F. Kinnard, engineering manager, Meter and Instrument Division, General Electric Company, West Lynn, Mass., awarded the honorary degree of doctor of science; H. S. Van Patter, vice-president, Dominion Engineering Limited, Montreal, awarded the honorary degree of doctor of laws; Chancellor C. A. Dunning, Queen's University; D. O. Notman, general manager, Electro-Chemicals Department, E.I. du Pont de Nemours, Wilmington, Del., awarded the honorary degree of doctor of laws; W. A. Marrison, Bell Telephone Laboratories, Inc., awarded the honorary degree of doctor of science; W. A. Mackintosh, principal, Queen's University.

Second row: G. H. Ettinger, dean of medicine; D. S. Ellis, dean of applied science; J. A. Corry, vice-principal; R. O. Earl, dean of arts; S. M. Gilmour, principal, Queen's Theological College; J. M. Macdonnell, chairman, board of trustees.

Third row: Miss Jean I. Royce, registrar, Queen's; R. L. Dobbin, president of the Engineering Institute; A. Vibert Douglas, dean of women, Queen's.

New Officers for ASCE

Daniel V. Terrell, dean of the College of Engineering, and director of the Engineering Experiment Station at the University of Kentucky, was inducted as the 85th president of the American Society of Civil Engineers on October 21, at the Society's annual convention in New York.

Dean Terrell, whose long service to ASCE includes terms as director and vice-president, has spent his entire career in his native state, Kentucky. He graduated from the University of Kentucky and, joining the staff in 1913, he was instrumental in the consolidation of the college of engineering. The civil engineering department was under his direction for 25 years, as professor of civil engineering and head of the department. In 1946 he was appointed to his present position.

Dean Terrell has executed many special engagements for the state. Since 1942 he has been director of the State Highway Research Laboratory. He was active in the early good roads movement in Kentucky, and later supported the program for greater industrial development through research and more effective use of the state's natural resources. He also assisted in the postwar planning activities. His advice has been sought on many occasions in the field of federal service and in addition to his work for ASCE, Dean Terrell has held office in other professional associations.

Two newly elected vice-presidents of the Society were also inducted at the annual convention—Enoch R. Needles, consulting engineer, Howard, Needles, Tammen and Bergendoff, New York; and Mason G. Lockwood, Houston, Texas, of the consulting engineering firm, Lockwood and Andrews. New directors who will serve for three year terms are William S. La Londe, Jr., chairman of the Department of Civil Engineering at Newark College of Engineering, Newark; Oliver W. Hartwell, of the Water Resources Division of the U.S. Geological Survey, at Trenton, N.J.; Thomas C. Shedd, professor of structural engineering at the University of Illinois, Urbana, Ill.; Samuel B. Morris, general manager of the Department of Water and Power of the city of Los Angeles; Ernest W. Carlton, a member of the engineering faculty of the Missouri School of Mines, Rolla, Mo., and professor of structural engineering in charge of graduate study; and Raymond F. Dawson, professor of civil engineering at the University of Texas, Austin.

The president and general secretary attend the annual meeting of the American Society of Civil Engineers at New York. Left to right, Wm. N. Carey, executive secretary of ASCE; W. L. Huber, president of ASCE, Ross L. Dobbin, president of the E.I.C., and L. Austin Wright, general secretary of the E.I.C.

ASME Elects Officers for 1953-54

Dr. Lewis K. Sillcox, M.E.I.C., of Watertown, N.Y., vice-chairman of the board of the New York Air Brake Company, who was nominated in June as president of the American Society of Mechanical Engineers, took office on December 2 during the annual meeting of the Society in New York.

The new president, who has been a member of the Engineering Institute of Canada since 1926, has spent his entire career in the railroad industry, where he has contributed greatly to the development of improved methods of railway power application and control of railway trains. He has also sponsored the design of the aircraft hydraulic pump now in use on many military and commercial aircraft.

Born in Germantown, Pa., he studied at l'Ecole Polytechnique, Brussels, Belgium, graduating in 1903. He was later to receive honorary degrees in science from Clarkson College of Technology, in engineering from Cumberland University and Purdue University, and in law from Syracuse University.

His early railway experience was gained in New York, after which he spent four years in Canada associated with the Canadian Northern Railway. Returning to the United States he worked for the Illinois Central Railway and the Chicago, Milwaukee and St. Paul Railway, and in 1927 joined the New York Air Brake Company as first vice-

president. He has been a director of the Company since 1948.

Dr. Sillcox has been the recipient of the ASME Gold Medal for distinguished service in engineering science, as well as the Gold Medal of the Institution of Locomotive Engineers of Great Britain, and the Salzberg Memorial Award of Syracuse University. He has held office in and fulfilled voluntary service for ASME and other professional associations. Nine universities have called upon him as lecturer on subjects relating to railway practice and applied mechanics. He is honorary curator of transportation of the Baker Library of Harvard University, and a trustee of Clarkson College.

Dr. L. K. Sillcox, M.E.I.C.

Five officers, nominated as regional vice-presidents of ASME, also took office at the December meeting. They are: Willis F. Thompson, vice-president of Westcott and Mapes, Inc., architects and engineers, New Haven, Conn.; William G. McLean, associate professor and head of the department of mechanics, Lafayette College, Easton, Pa.; Thomas Chandler, head of the general engineering-service division of the research and development department, Carbide and Carbon Chemicals Corporation, South Charleston, W. Va.; Vernon A. Peterson, district manager for the Elliott Company, at Los Angeles, Calif.; Clifford H. Shumaker, chairman of the department of industrial engineering, Southern Methodist University, Dallas, Tex.

Frank L. Bradley, vice-president of the Garfield Warehouse and Transportation Company and Robert B. Lea, co-ordinator of exports, The Sperry Corporation, are newly elected directors-at-large of ASME.

ECPD Meeting

At the ECPD meeting, New York, October 16, 1953. Head table, left to right: Dean S. C. Hollister, Cornell University; General the Honourable A. G. L. McNaughton, the speaker; Dr. L. F. Grant, the chairman; Dean Thorndike Saville, New York University; Dean L. E. Grinter, University of Florida; Gregory Dexter, New York.

The Canadian representation. Back row: J. R. Kaye, Halifax; L. Austin Wright, general secretary; W. S. Wilson, Toronto; G. B. Moxon, Montreal. Front row: E. V. Buchanan, London; R. L. Dobbin, Peterborough; General the Honourable A. G. L. McNaughton, Ottawa; L. F. Grant, Toronto.

Engineering in Canada

Reprint of The Royal Bank of Canada Monthly Letter, October 1953

Engineers are more appreciated than they used to be. It is through their efforts that the comforts have been provided which set today's standard of material living so high above that of past centuries.

The engineering profession has particularly wide opportunities and obligations in Canada, where sound healthy expansion is based upon an abundant supply of natural resources. Science and engineering take these resources and develop them for the benefit of our people. At the same time engineers work for conservation of resources—the maintenance of soil, the perpetuation of water supply, the preservation of forests—so as to provide for a continuance of supply over coming centuries.

What exactly is engineering? It has been called the art which makes pure science useful. This is a far cry from the definition of "engineer" given by Samuel Johnson in his *Dictionary of the English Language* published in 1755: "One who manages engines, or directs the artillery of an army."

It is often difficult to draw sharp lines between the many different practices so as to define where engineering begins and ends. The title of "engineer" is a coveted one, and rightly so as long as it implies a long and difficult course of education and training.

In Canada engineering is regarded generally as a learned profession. The engineer analyses needs and then designs and supervises the building of things to meet them: railroads, bridges, radios, airplanes, automobiles, rockets, dams, power plants, engines, factories, pipe lines, atomic energy and thousands of other things.

Perhaps the shortest all-inclusive definition is given by a distinguished contemporary engineer: "Engineering is the art of the economic application of science to social purposes."

A person who is only a technician is, in the words of Sir Richard Livingstone: "a man who understands everything about his job except its ultimate purpose and its place in the order of the universe." The engineer, however, must follow problems through from origin to results, and find solutions. He must take account of the social effects of what he produces. He is exercised to see that the cost is not more than the benefit is worth.

Need for Engineers

Canada's need for engineers is expanding constantly, says Dr. L. Austin Wright, General Secretary of the Engineering Institute of Canada. Not only does industry keep increasing its needs, and the armed services their demands, but opportunity is opening new doors. Many small industries that never before used engineers are finding that they can get better results, and can meet competition more successfully, when they employ engineers.

What a change this is from the situation thirty years ago! Dr. Wright's predecessor in the Engineering Institute of Canada told the Montreal branch in 1923 that the profession "is overcrowded, and becoming more so every year." He went so far as to advise youths to seek other outlets for their energies.

These thirty years have brought about a revolution, and today graduating engineers are eagerly sought. One company numbers 350 graduate engineers among its 8,500 employees.

There are many openings in the government service. More than fifty percent of the professional staff of the National Research Council and the Atomic Energy Control Board are engineers, and somewhere about 75 per cent of their budget is spent on applied science or engineering development work. When you move over into government departments which are charged with the practical application of discoveries made through research, the importance of engineers is seen again: there are more than 500 technically trained engineers in the Department of Mines and Technical Surveys; more than 250 architects and engineers in the Department of Public Works; and, of course, proportionate numbers in the departments of Transport and Resources and Development.

Engineers are holding preferred positions in administrative, legal, research and sales staffs of industries. A recent survey in the U.S.A. revealed that 45 per cent of all administrative posts in industry were held by engineers.

Certainly, a young man's chances of making dreams come true were never better than now, if his dreams have to do with designing or building great structures, electronic wonders, rockets to probe the universe, or machines to produce things people want. But basic qualities are needed. Because a man is fond of digging in his garden, he mustn't on that account think himself the equal of a skilled gardener. No dub at measuring and calculating should expect outstanding success as an engineer; nor should the youth who is uninterested in physics, in chemistry, and in finding out the answer to "why?" and "how?" He must be willing to submit to a rigorous course of education, and to work hard at putting into practice what he learns of theory.

Conditions in Canada

While the opportunity for young men in engineering is undoubted, there is not the same shortage of men in all parts of the country or in all branches of the profession. The demand is mostly, says Dr. Wright, in specialized fields—noticeably in electronics.

Writing about the situation a year ago, the Chief of the Executive and Professional Division of the National Employment Office said that in 1952 the eleven Canadian schools of engineering graduated 1,750 engineers while at the same time he had demands for more than 2,350 graduates. He estimated that Canada's annual requirement for some years will be 2,000 graduates in engineering. The Rt. Hon. C. D. Howe, Minister of Defence Production, himself an engineer, told a University of Toronto audience last year: "I can foresee no possibility of engineering graduates ever exceeding the demand, in this expanding country of ours."

Not many engineers are leaving Canada. A report from the bureau of statistics showed only ten per cent of our university graduates in engineering going to the United States, and most of them were seeking post-graduate study. To offset this, there are from two to three times as many engineers coming into Canada from the United States. To this information Dr. Wright adds: "I don't believe that today the United States' salaries are an irresistible temptation to Canadian engineers. As a matter of fact there is an increasing number of inquiries from American students who propose working in Canada."

Confirmation of this is given by the result of a poll of placement officers at four Canadian universities. In their opinion, starting salaries which are offered graduates at bachelor level compare favourably, though they say that engineers

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with a doctorate degree are frequently able to secure better offers in the United States.

Saturday Night commented on a National Research Council advertisement in 1950 offering $5,000 to $6,000 a year for a "highly qualified physicist or mechanical engineer" to be head of "a group of physicists and engineers in applied research and engineering development related to design of atomic energy plants and plant equipment." The periodical said editorially: "If the National Research Council gets a 'highly qualified physicist or mechanical engineer' for this post on these terms it will be simply because some such person loves his country and his science too much to carry his abilities to a better market."

Production and Culture

Both in achievements and opportunites, engineering in Canada has had its ups and downs, but there is hardly a curve of engineering growth which does not turn sharply upward after 1900 and increase its gradient in the nineteen-forties.

Power plants and highways, mining and communication, chemicals and machines—all have set and passed new standards of quality and quantity. Their achievements have been the fruit of creative thinking based on original concepts, blueprinted and carried out by engineers applying fundamental physical laws with incredible ingenuity.

It may be said that the most important single factor in our national economy in the past thirty years has been the rising influence of engineering. To go further back, the rise of our culture has been coincidental with the rise of science and technology. Because of the production advantage given by engineered factories, the worker exchanges a fraction of his waking hours for hitherto undreamed-of freedom in all other areas of life.

Cultural activities must have such a solid base as that given a nation by its engineers and technologists. In the book *Engineering and Society* by Young, Innis and Doles, it is said: "Whatever gives a continuing and dependable basis of economic security stimulates humanistic interests and occupations. And so the technologist and the engineer in their practical pursuits are extending the opportunities to those who wish to rise above the tedium of daily toil." This book, published by the University of Toronto Press in 1946, is a unique attempt to give young engineers some knowledge of the important fields linking engineering, history, economics and geography.

The promise of technology is always fabulous, and our problem with reference to it is not to guess what the future holds for us but to answer the question: "what do we want technology to do for us?"

Engineering is Creative

Wherever one touches engineering one finds creativeness. An engineer may be engaged in exploratory research, uncovering new fields, setting new goals, separating good creations from useless, and drawing patterns for further work. Or the engineer may exercise his special talent in fundamental and basic research, in data-gathering and manipulation, in providing facts upon which thousands of others will work. Or he may devote his knowledge and experience to design and development, working out for everyday use the theoretical concepts of others.

To be successful in whatever field he chooses, the engineer must think logically, visualize clearly, and evaluate in terms of reality. He needs to reject the thought that so-and-so is final, that such-and-such a process is perfect. He will realize that many facts of nature are still unknown to us. Charles F. Kettering, at the time Director of General Motors Research Laboratories, listed 25 unanswered questions, and said in an aside that the list might be extended to 25,000. Among the questions which engineers still have to answer are: what is friction? how do fuels burn in an engine cylinder? what is magnetism? what is electricity? what is fatigue of metals? what is the nature of the atom, the molecule and the electron? what is energy? what is a lubricant, and how does it work?

These and other questions either clamour for attention or whisper insistently around the fringe of engineers' minds. The fact that they remain unanswered does not mean that engineering cannot go on: engineers built stone arch bridges for at least two thousand years before they knew for certain what made them stand up.

There are traces, even in the most primitive engineering efforts, of the scientific spirit and a search for underlying principles, though engineers in general will agree with Lord Kelvin's dictum: "the life and soul of science is its practical application."

With us, in these western countries, the concept of science carries with it the idea of a power transforming material life for the good of mankind. We see it expressing its discoveries in techniques, in arts and in crafts. The engineer applies his experience to a theory with a practical objective, and the test of his product is that it works. It satisfies some of man's material wants and needs within the economic and social framework of the times.

Kinds of Engineering

These two engineering functions —theory and practice—display themselves in many diverse areas of human endeavour, and each one attracts men and women of diverse personalities. No matter what his particular bent, the man with an engineering-type mind can find a niche fitting him perfectly.

There are five major engineering categories: mechanical, electrical, civil, chemical, and mining and metallurgical. These are sub-divided by names which describe a great number of specializations, such as aeronautical, manufacturing, petroleum, radio and industrial engineers.

A review of technical personnel records, begun in 1951 and reported in 1953 by the Canadian Department of Labour, showed the specialties of 26,346 engineers and scientists in Canada. Here is the detail: civil engineering 4,425; chemistry and chemical engineering 4,319; physics 925; architecture 782; mechanical 4,273; electrical 3,941; agriculture 2,462; mining and metallurgy 2,052; forestry 1,015; biology 970; geology 651; aeronautical 270; mathematics 208; geography 53.

Every one of these professional crafts offers glamour and romance to the man who is specially interested in it. His interest may stem from his appreciation of the results in terms of benefit to mankind, or from the fact that he finds its problems fascinating.

Engineers in industry have a special role to play in an expanding industrial country like Canada. There is not a province that produces less than $20 million annually of manufactured products, and only two that produce less than $200 million worth, while Ontario and Quebec produced $6,823 million and $4,142 million worth of goods in the latest year of record, 1950. Expansion has been great since that time.

When manufacturing industry recruits young engineers it is looking for potential managers. It wants men with the sense of order, the quality of accuracy, and the enterprise in getting things done that

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are the marks of engineering education and training.

Engineers expend their talent largely in increasing the efficiency of others. They decrease the time consumed in making a product, thereby reducing costs so that markets can be expanded and new things introduced, with consequent increase in job opportunities. They bring about more efficient use of materials, contributing thereby to conservation of resources.

The engineering way—of gathering all the pertinent data, subjecting it to mental and experimental test, coming to a decision, and then doing something about it—contributes tremendously to the smooth flow of productive activity, the elimination of bottle-necks, the lessening of fatigue and tension, and the building up of commercial greatness.

These qualities are useful, too, in other than engineering and industrial fields. An engineering graduate who is a noted authority in dental bridge work claims that building a bridge across a river fifty feet wide and building one across a quarter-inch gap in a mouth are one and the same problem, one of loads and stresses, bending moments and abutments. Goldberg the cartoonist, and Arthur Murray, the dancing teacher, graduated from schools of engineering. Engineers have served in municipal, provincial and federal government positions.

Education for Engineering

There have been men who reached enviable success in engineering without benefit of academic engineering education. In the early days there were no technical schools or universities with special courses, and young men secured their training by years of apprenticeship, or they applied themselves to some problem until they became master of the techniques of its solution.

James Brindley, an uneducated millwright (he never learned to read and write) built the Bridgewater Canal in Engand, and went on to construct many other waterways. George Stephenson, who made the steam locomotive a practical working mechanism, was an uneducated fireman in a mine, unable to read or write until he was 18 years of age.

These, however, are not typical of men who are successful in the profession today. An increasingly higher standard in the scientific training of those who are to be responsible for the applying of science in industry is being demanded, not only by industrialists but by engineers. Training in the *fundamentals* of engineering, before specialization, is urged by men high in the profession.

These experienced men also seek to have engineers educated broadly, so that they may have a wide understanding of our complicated society, how it works, and wherein it fails to work. They recall Milton's classic definition of an educated man: "I call therefore a complete and generous education that which fits a man to perform justly, skilfully, and magnanimously all the offices both private and public of peace and war."

Industry is extending help to engineering students on a growing scale, particularly in electronics, aeronautics, and chemistry. No all-inclusive list of scholarships in Canada is available at the moment, but the Canadian Committee on Counselling in Science and Engineering is preparing such a roster. As an example, the British Columbia Engineering Society listed for us 56 scholarship awards made through the University of British Columbia, totalling $6,580 a year.

Engineering Societies

It is difficult, too, to list engineering societies. There are many organizations of men who may or may not be engineers according to this or that definition. Certain societies are beyond doubt professional associations, and are doing splendid work. They have immeasurably raised the status of the engineer, and have protected the public from incompetence.

Because of the provisions of the British North America Act, which gives to the provinces the exclusive right to legislate on the practice of the professions, and because of the wide scope and diversity of engineering, it has not yet been found possible to have a single organization capable of catering to the economic, legal, social and technical needs of all professional engineers in Canada.

There are provincial associations serving our more than 20,000 professional engineers, 4,000 graduate engineers in training, and 6,000 engineering students. They have high standards which must be met before a man may call himself a professional engineer, or use the valued initials "P. Eng." after his name and practise engineering. The Dominion Council of Professional Engineers is the co-ordinating body of the provincial associations.

The Engineering Institute of Canada, the "learned society" of engineering, was organized in 1887 and now has 50 branches with 16,000 members. It is the oldest and largest of all Canadian engineering organizations, and it has agreements for co-operation with many other societies in the United States and throughout the Commonwealth.

Qualities of the Engineer

Prominent among the qualities needed by the engineer is skill in problem analysis. The engineer must be able to pull the problem apart and say: "Here is what we are trying to do." Nothing can be taken for granted in engineering: every detail must be accounted for.

Since nature makes no allowances, but demands absolute obedience to her laws, the professional engineer is trained to respect these laws. Any infraction is certain to bring punishment. He is not one who believes in "good enough to get by with". He can't do something and then cross his fingers and wish that it may turn out all right. He must be thorough, putting first things first while bearing in mind everything that contributes to a sense of balance in solving his problems.

This calls for rare judgment. At the base of the engineer's structure of knowledge there are the laws of nature; then particularized, personal knowledge; then professional knowledge and intellectual techniques acquired in university; then specialized skills learned in practice; and at the top, supreme in its function of modifying and guiding all the rest, sits judgment.

Judgment prescribes our highest ambitions and our loftiest moral beliefs, and these are the things which give meaning and direction to all our skills, our efforts and our knowledge. It is the factor which makes the difference between a man who does things only by recourse to text books, slide rules and precedent, and the man whose wits are sharpened by the determination to do things better.

No certificate of school or university or society makes an engineer. Some spark of originality, some creative spirit, must be added to technical skill.

Engineering cannot function always as a rigorous science, but remains in some respects an art. Imagination, visualization, and a realization of the goal, these cannot be overlooked in the professional development of an engineer.

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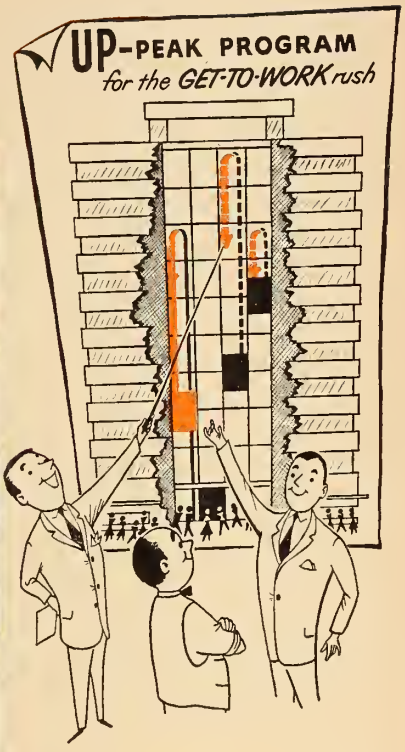

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is well stated by Leopold Nadeau, P. Eng., who is General Secretary of the Corporation of Professional Engineers of Quebec. He says, in a letter, "Professional Engineers are fully aware of their tremendous responsibility and are continually striving to improve the ethical and technical standards of their profession to enhance its usefulness to their fellow men."

The engineer with his heart in his work will keep the faith: the faith of his client that he will not undertake what he knows to be beyond his skill, and that in the service he gives he will be conscientious to the limit of his ability. He will keep the faith of his fellow engineers that he will remain true to his science and will base his efforts for public recognition upon acquired knowledge, scientific attainment and excellent performance. He will keep the faith of his community that he will undertake no service inconsistent with public welfare.

"Canada's Hidden Past"

A letter reprinted from the Globe and Mail, *Toronto, October 30, 1953*

With reference to the recent great display of our Canadian National Inferiority Complex, as per the Humber Bridge; this may be a good opportuntiy to point out that Canadians are not a race of nincompoops. We just suffer from a chronic dose of national ineptness that blinds our eyes to the great things that Canadians have done—many of them without any fitting reward or recognition.

In 1933 the Canadian Government did bring out a postage stamp to draw attention to the Canadian-built Royal William, the first vessel to cross the Atlantic under steam. But what about Benjamin Tibbits, of Fredericton, N.B., who invented the compound steam engine and drove the sailing ships off the seas? Who knows anything about the native son of Saint John, N.B., who, in 1854, invented the steam fog horn that has been copied all over the world? His name was Robert Foulis. Do you find any mention of him in our history books? No! that's too Canadian for Canadians.

Newton Gisborne, of Halifax, N.S., thought up the idea of insulating a wire against the corrosive action of sea water and joined Prince Edward Island and New Brunswick by submarine telegraph cable. This was the first demonstration in world history of such a possibility. The success of this experiment and his second successful connection of Newfoundland with Cape Breton induced him to approach Cyrus Field for funds to construct the Atlantic cable. Our school kids never heard of Newton Gisborne. We must keep his life a secret lest we commit the grave offense of creating some national pride.

Seven years before Pullman came out with the sleeping cars that carry his name, John Sharpe, the Master Mechanic of the Great Western Railway, was building sleeping cars in Hamilton. They operated between Niagara Falls and Windsor and it was from them that Pullman got the idea of making them in the United States. There was not a city in the United States that could make an electric street railway operate until Wright and Vandepole invented the trolley pole, in Toronto, Canada, in the summer of the year 1883.

And while we are on the subject of the bursting genius as exemplified south of the Great Lakes let us take a quick glance at the paper situation. During the Civil War surplus rags had been used up and as this was the basic item in the manufacture of paper the industry was in a panic. But did the great super brains of the U.S. solve the problem? They did not. The problem was solved by John Thompson, of Napanee, Upper Canada who was the first man in the world to demonstrate that paper could be made from woodpulp.

Perhaps the saddest part of this little epistle concerns Ottawa. In 1893 the great engineering brains of the United States proclaimed that Ottawa could not successfully operate an electric street railway. The winters were too cold. Two young native sons, Ahearn and Soper, thought otherwise. They went ahead and built a street railway and it worked in the wintertime. In fact it worked so well that more than ninety experts (?) from the great United States came up to Ottawa in the spring of 1894 to ascertain how this electric railway dared to operate successfully against their edict. They found that Thomas Ahearn had invented an electric heater — the first in world history — and that these heaters were the solution of the problem.

These so-called experts sat down to a meal in the Windsor Hotel, Ottawa, and every item was cooked by electricity. This was done on the first electric stove in world history. Ask any Canadian school kid today who invented the electric stove and ninety-nine and seven-eighths per cent of them will tell you it was either Tom Edison or Henry Ford. To them the name of the Canadian inventor, Thomas Ahearn might just as well be printed in Arabic.

A few years ago the Canadian Jewellers' Association did mark the site in Toronto where Sandford Fleming invented Standard Time in 1879; but who ever heard of the Connon Brothers, the two Canadian lads who first thought out and produced the idea of putting photographic film on spools for use in cameras?

The subject could be projected through insulin, the electron microscope, Marquis wheat, the first batteryless radio and a dozen other items. We are talking about our national stupidity in failure to appreciate our own native genius. The crowning example of this is found in connection with helium. Helium was first isolated from the atmosphere by the British chemist Sir William Ramsay in 1895. By 1914, the year of the start of the First World War, the process of preparing helium had somewhat progressed but the cost was very high. Helium gas was valued at $15 per cubic foot.

The British Government asked the late Sir John Cunningham of the University of Toronto, to seek a cheaper source of the much needed gas. Within a few months Sir John was giving them all the helium they needed at seven cents a cubic foot. He was knighted for this. But what does the so-called greatest encyclopedia in the world have to say concerning this great Canadian achievement? "Helium—the main supplies are however in the natural gas in Texas and in Canada, near Ontario."

Sir John extracted his helium from the natural gas flowing into the city of Calgary, Alta. It was a great Canadian triumph which played an important part in the collapse of the enemy in the autumn of 1918. But we must not let our school kids or the Canadian public know anything about it. Uncle Sam might get mad and the idea might get abroad, among ourselves, that Canadian brains are

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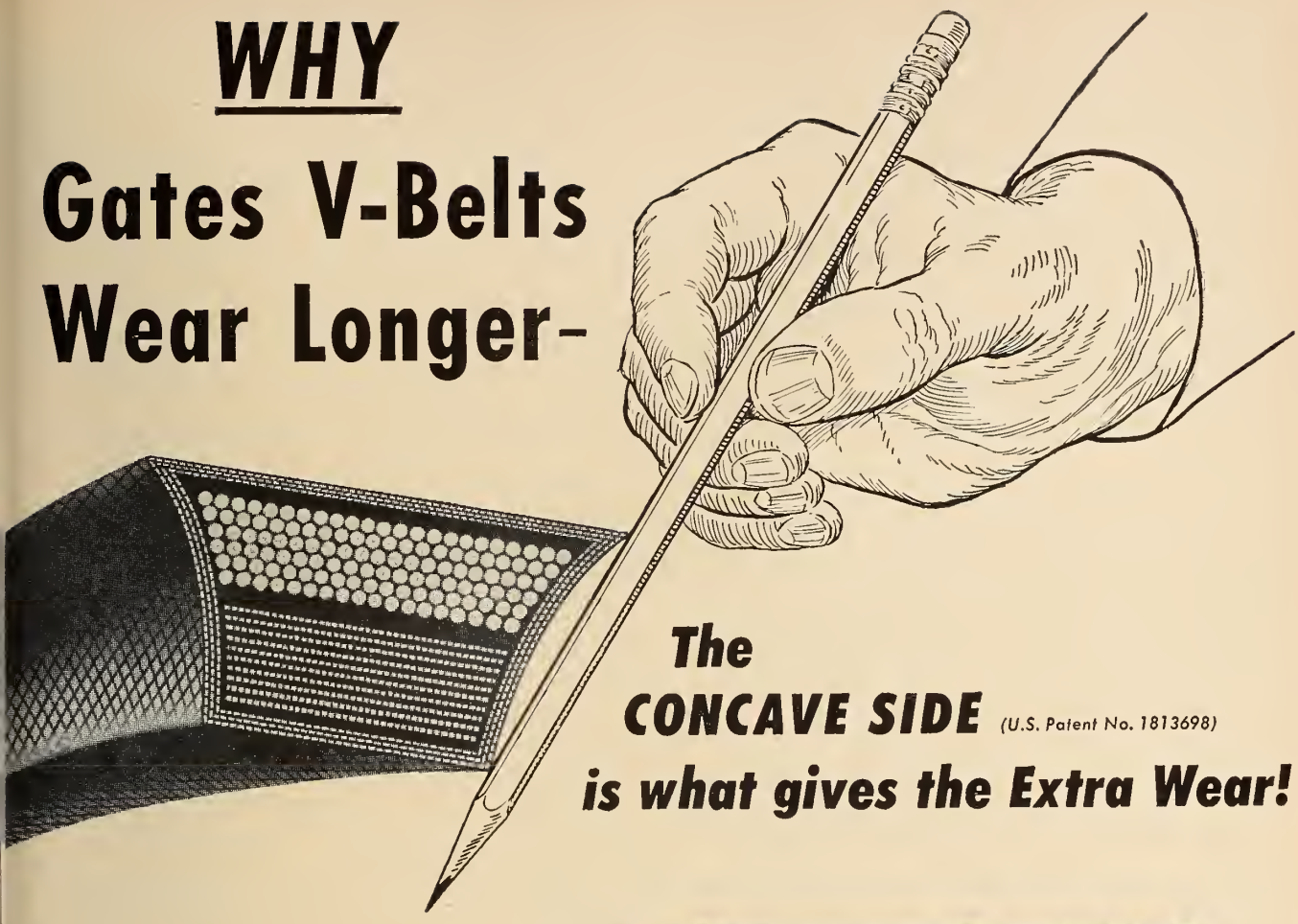

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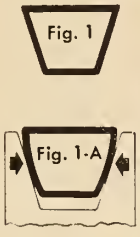

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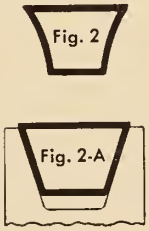

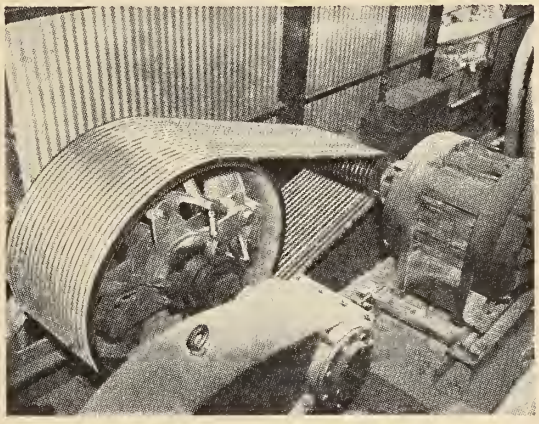

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tip top and that Canada is a great country.

Any such influx of mental process on those lines might jolt us out of our national apathy and that would bring out the very dangerous idea that we have a past that is worth knowing something about.

Toronto.

LYMAN B. JACKES.

Elections and Transfers

At the meeting of Council held at London, Ontario, on Friday, November 20th, 1953, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

J. G. D. Beresford, *Toronto.*
R. N. Boyd, *Maitland.*
N. R. Bregg, *Arvida.*
H. Copping, *Willowdale.*
C. H. Cruttwell, *Southall, Eng.*
H. S. Dennis, *Toronto.*
A. Donaldson, *Montreal.*
D. T. Fortheringham, *Calgary.*
O. S. Gislason, *Arvida.*
C. R. Haryett, *Arvida.*
H. H. Lockwood, *Arvida.*
J. S. Michener, *Toronto.*
H. C. Nolan, *Montreal.*
J. N. Ramsay, *Pt. Nelson.*
A. P. Richards, *Montreal.*
A. S. Timascheff, *Montreal.*
M. Williamson, *Arvida.*

Juniors:

H. F. Coffin, *Sudbury.*
J. R. Dupuis, *Arvida.*
I. A. Grieve, *Toronto.*
W. J. Hogg, *Montreal.*
J. M. Hollicky, *Sarnia.*
W. H. Hopper, *London.*
H. E. Marshall, *Sarnia.*
I. J. Martens, *Arvida.*
A. E. Mudge, *Ft. Erie.*
G. L. Poulter, *Hamilton.*
J. E. Schneider, *Arvida.*
G. Smith, *Montreal.*
A. G. Strand, *Shawinigan Falls.*
S. Yasui, *Calgary.*

Affiliate:

R. H. Stokes-Rees, *Montreal.*

Transferred from the class of Junior to that of Member:

A. Assaly, *Montreal.*
D. T. Bath, *Peterborough.*
F. Black, *Calgary.*
G. S. Boa, *Toronto.*
J. P. Boulay, *Montreal.*
L. J. L. Boulet, *Quebec.*
R. Bouthillette, *Montreal.*
J. L. Bryant, *Vancouver.*
S. C. Cooper, *Toronto.*
R. W. Curtis, *Ottawa.*
F. F. Dixon, *St. Catharines.*
N. Gans, *Montreal.*
A. Glassman, *Three Rivers.*
P. S. Grant, *Calgary.*
S. L. Godbout, *Valleyfield.*
P. A. Haridge, *Ottawa.*
L. E. Henne, *Vancouver.*
H. L. Kasten, *Edmonton.*
J. Keith, *Montreal.*
M. H. Kert, *Montreal.*
H. Kolbeins, *Vancouver.*

The following Students were admitted:

Queen's University

D. M. Ackford — J. Korta
W. G. Bedell — J. A. Maguire
J. N. Clark — F. H. H. Siemonsen
J. A. Cochlin — W. R. Sweet
J. K. Cran — M. T. Vander-Velde
G. N. S. Graham — H. Varley
R. F. Gurr — R. C. Walker
E. M. Hall — R. H. Warkentin
P. D. Hill — H. A. Zuzek

University of Manitoba

J W. Bouskill — J. E. Marshall
B. A. Guberman — M. L. Olynyk
H. T. Hazleton — E. Parfeniuk
R. F. Klassen — O. S. Roscoe
K. J. Kramer — R. A. Smith
C. D. Laing — S. A. Stone
A. G. McMillan — L. D. Taylor
W. Mann — L. H. Tough

University of Alberta

D. A. Carlson — T. K. Hertel
J. M. Crawford — L. F. Maier
J. H. Daniels — C. G. D. Poland
A. V. Dengan — B. L. Potter
G. C. Duthie — M. Romanow
P. M. Heaton

University of New Brunswick

H. A. Baxter — N. J. Soucy
C. C. Bowlin — C. W. Turner
D. M. Hayter — L. R. Ward
P. H. Knowlton — H. H. Williams
W. F. Lord

McGill University

C. Batistatos — J. A. Kibirkstis
H. A. Campbell — P. K. Lauren
J. H. S. Dyson — I. H. Mitchell
L. Hanna — E. J. Rice

Nova Scotia Technical College

D. D. Dickie — H. R. Whitehead
C. J. McManus

University of Toronto

R. A. Brownlee — G. M. P. Sernas

Acadia University

D. F. Baird

Applications through Associations

By virtue of the co-operative agreements between the Institute and the Associations of Professional Engineers, the following elections and transfers have become effective:

ALBERTA

Members:

M. G. Capen — J. F. B. O'Sullivan
A. J. Harrison — A. B. Yates
I. T. Munro

Junior:

J. B. Morgan

Student:

W. M. Synhorst

Junior to Member:

W. E. Kimler — E. L. Phillips

Student to Junior:

W. J. Martenson

SASKATCHEWAN

Members:

W. W. Archer — R. D. Stroud
S. H. G. Bock — H. F. Wheaton

Juniors:

T. M. Baleshta — W. J. Riddell

Junior to Member:

H. E. Dishaw — W. C. Phillips
G. T. Hughes — W. F. Stratychuk

Student to Junior:

D. L. E. Marcoux — I. B. Sveinbjornson

MANITOBA

Student to Junior:

H. E. Moller

NOVA SCOTIA

Junior to Member:

G. H. Dunphy

QUEBEC

Member:

E. V. Tidman

Junior:

R. Thomson

The *Journal* Thirty-five Years Ago

December 1918

The principal item of this issue is "General Specifications for Steel Railway Bridges." The opening paragraph states that this is "The final draft as approved by meeting of committee held on October 17th, 1918." The membership of the committee shows the presence of many of the leading engineers of the day. P. B. Motley, engineer of bridges for the C.P.R., was chairman, and W. Chase Thomson, was secretary. The members of the committee were H. B. Stuart, H. P. Borden, F. P. Shearwood, G. H. Duggan, A. E. Johnson, W. A. Bowden, J. G. Legrand, George W. Craig, F. D. Cole, E. G. W. Montgomery, H. A. Icke, M. A. Lyons, A. H. Harkness, and C. N. Monsarrat.

The introduction states "This specification applies to steel railway bridges; but does not cover the design of suspension bridges, nor of turntables for locomotive engines. When highway traffic is to be accommodated, the various parts of the bridge pertaining thereto, shall be designed in accordance with the Institute's general specifications for steel highway bridges."

Those were the days before the full blossoming of the Canadian Engineering Standards Association (subsequently the Canadian Standards Association). In those days the Institute committees were the source of and the authority for specifications. This work has since been transferred to the Canadian Standards Association.

There follows an interesting article by L. M. Arkley, at that time assistant professor of mechanical engineering at the University of Toronto, with the title "Heat Transfer Tests of Building Materials." The opening paragraph ex-

NUMBER OF UNITS	One
STEAM CAPACITY	200,000 lbs. per hour
DESIGN PRESSURE	670 p.s.i.
OPERATING PRESSURE	605 p.s.i.
FINAL STEAM TEMPERATURE	840° F.
FEED WATER TEMPERATURE	340° F.
FUEL	Bituminous Coal
FIRING EQUIPMENT	2-FW Riley Pulverized Coal Burners
HEAT RECOVERY EQUIPMENT	FW Tubular Air Heater
TEST EFFICIENCY	86.7%

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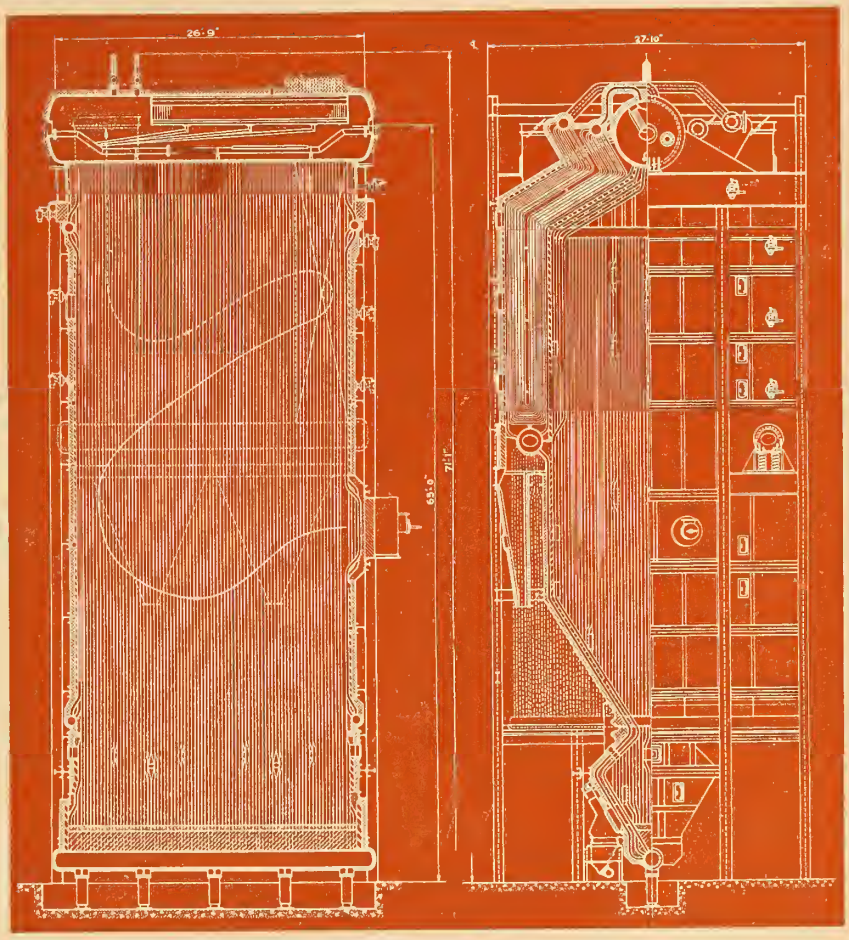

A total of three (3) SA steam generating units are in service at utility stations of the New Brunswick Electric Power Commission and demonstrate a measure of satisfaction in our ability to provide furnace designs which will burn Minto coal of the following approximate analysis:

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VOL. MATTER	30.0%
FIXED CARBON	46.0%
ASH	20.0% (MAX. 26%)
FUSION TEMP. OF ASH	1980° F.

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plains that "in 1912, the following series of tests were started at the request of the Department of the Provincial Secretary of the Ontario government for the purpose of assisting in a selection of the proper materials to be used in buildings in course of erection at that time by the Department." The introduction goes on to say "The general method of making the tests was decided at a conference including Professor Angus of the University of Toronto, Captain R. J. Durley, consulting engineer to the Ontario Government (and later general secretary of the Engineering Institute of Canada), James Govan, architect of the department of the provincial government, and the writer."

There is notice of amendments to the by-laws which indicates many changes, although most in the wording for purposes of clarification. However, the proposals do take five pages.

The Khaki University of Canada is described both from a historical and from the operational angle by Dr. Frank D. Adams. Dr. Adams introduces the article by saying "When the work of an army is for the most part necessarily of a destructive character, the Khaki University which now forms part of the regular Canadian army, is carrying on constructive work of the highest order. The idea originated with the Canadian Y.M.C.A., assisted by the Chaplain service and many voluntary workers, to provide a means whereby the soldiers of our army may make use of the time which is not directly occupied in ordinary training in carrying on their education and preparing themselves for the return to civil life when the great war is over." Dr. H. Marshall Tory who was president of the University of Alberta, was head of Khaki University.

Cessation of War

As would be expected, the December issue carried editorial comment on the cessation of the 1914-18 war. There is one interesting sentence which illustrates again how risky it is to prophesy. It reads: "By the terms which include the evacuation of occupied territory, the forfeiting of most of the German fleet, the occupation by the Allies of German territory, it seems evident that the ruthless foe of civilization would be impotent to renew hostilities." Would that it had been true!

The editor goes on to urge upon engineers the recognition of the responsibility which is theirs in picking up the economic life of Canada. He says "Engineers are proud of what has been accomplished by their fellows in the field and in the factories. What part are we going to take in the reconstruction of the material things which need replacing, the social system which the war has brought to a state of rapid evolution? What is our individual sense of responsibility toward the leadership which the members of this organization should take in assisting to solve the problems facing mankind. Governments are for the most part made up of men not trained as is the engineer, to definite accomplishments in matters such as a more definite system of technical eduction, to solving the labour situation, the reconstruction not only of devastated areas but of countries needing development, utilization of our own vast national resources, and assisting Canada to grow strong and wealthy, that the financial burdens may be easily borne. Therefore in these things we must play a very important part."

In different issues published during the war, there is reference to the cigarettes that were sent frequently by the Institute to the members overseas. The money to finance this activity was donated by the members at home. This issue relates to 500 parcels of cigarettes which were sent in time to reach the members before Christmas. In the correspondence column are several letters acknowledging these gifts.

The Council

In the minutes of Council there is reference to a proposal to create a Town Planning Institute. J. B. Challies and G. C. Gale represented the Institute at a meeting called by the Dominion Land Surveyors and the Architects and others for consideration of this project. The Institute supported the project, and recommended that a committee of surveyors, architects and engineers be appointed immediately to prepare a plan for the creation of this new institute.

Another item of business before Council was a proposal of the Institution of Electrical Engineers that their members, 81 in number, "form the nucleus of an electrical section in Canada" of the Engineering Institute. This is interesting right now, in view of the present negotiations which it is intended shall lead to a closer cooperation between the two organizations in Canada.

The outcome was that a letter was authorized to be sent by the president, H. H. Vaughan, to the secretary of the Institution, P. F. Rowell, which expressed appreciation of the proposal but doubt as to how it could be carried out, inasmuch as the Engineering Institute had no national electrical section but only such sections within the branches.

The letter went on to express the hope that the members of I.E.E. in Canada would join the Institute and assist in the many activities which were already under way. Mr. Vaughan went on to say that the Institute would accept any applicant who was already a member of the Institution. He concludes with this sentence: "Generally speaking, we shall be only too happy to receive the cooperation and assistance of your members resident in Canada, and will be glad to do anything we can to make them welcome."

An item of business which it will surprise many people to find on Council's agenda so many years ago, relates to the Grand River conservation. It seems that W. H. Breithaupt, a member in Kitchener, Ontario, had prepared a paper on this subject, and the Council of the Institute decided it should be published in *The Engineering Journal.*

In the News

In the Branch News columns there continues to be frequent mention of legislation. Saskatchewan reports that unfortunately they have not been able to hold a sufficient number of meetings because of the 'flu epidemic. However, they report that there has been considerable progress and that the Act which they proposed earlier is now being revised, and to some extent curtailed. Reference is made to a suggestion that came from the Winnipeg branch to the effect that this draft in Saskatchewan should be submitted to all branches in order to obtain if possible one Act that could be used in every instance. Members familiar with this development will remember that a Model Act was agreed upon but each province in turn made substantial changes in it when applying for their own legislation.

A page is devoted to organizational details about the Lignite Utilization Board of Canada. It is interesting to see that the personnel of the Board as appointed by the Federal Government is R. A. Ross, chairman, the Hon. J. A. Shepherd, M.P. for Moose Jaw, Sask., and J. M. Lemay, provincial

electrical engineer of the government of Manitoba. The staff consisted of "Lesslie R. Thomson, secretary, Hector Stansfield, chemical engineer, R DeL. French, engineer."

There is an interesting exchange of letters between John Taylor of Hamilton, Ontario, and J. J. MacDonald of Halifax, which discusses the credit for developing the diving bell. It seems that Mr. MacDonald had presented to the *Journal* a paper dealing with this bell, and Mr. Taylor had taken exception to the suggestion that Mr. MacDonald was the inventor. Mr. Taylor points out that a year or so earlier he had used this principle in doing harbour work in Hamilton. He quotes an article in the *Engineering News Record* in which his device was described.

Mr. MacDonald in reply claimed that the bell which he used in Halifax was entirely different, and that the many complicated features which made it possible to raise and lower the bell for a distance of fifty-five feet, whereas Mr. Taylor's bell had only been used at a depth of three feet made such a difference that there was hardly any comparison.

Both gentlemen had developed this diving bell idea at the same time without either knowing of the other's interest.

In the personals there is a note to the effect that "Major N. C. Sherman, who has been for some time a member of the War Purchasing Commission at Ottawa, left recently with the Canadian Expeditionary Force to Siberia. He was to occupy the important position of Inspector of Ordnance Machinery."

Another item refers to Professor Loudon of the University of Toronto. It says "Major T. R. Loudon, invalided home from France in January 1918, has recently been appointed Officer Commanding the Royal Canadian Engineers, Military District No. 11, which includes British Columbia and Vancouver Island, with charge of all military engineering work. Before going overseas in 1916, Major Loudon was a lecturer in the Faculty of Applied Science, University of Toronto, and is a member of the firm of James Loudon & Hertzberg, Ltd."

Another personal which brings the news back to Montreal says "B. E. Norrish, formerly superintendent of commercial exhibits branch, Department of Trade & Commerce, Ottawa, has been appointed by the Dominion Government to take charge of the Federal moving picture work with which he has already had considerable experience. It is proposed to more fully advertise Canada by means of moving pictures and arrangements have already been made for the exhibition of Canadian films in the United Kingdom, Australia, New Zealand and South Africa." Apparently Mr. Norrish stuck to this field because eventually he became president of the Associated Screen News, Ltd., in Montreal.

Fifteen pages are devoted to The Engineering Index, which lists from month to month the titles of current engineering papers. This was a service made possible by cooperation with the American Society of Mechanical Engineers. The Engineering Index published annually is now one of the principal books of reference in the library of the Institute at Headquarters.

Employment

In the Employment Bureau there is an interesting letter from P. E. Doncaster, in which he points out that the Federal Government was then making a reclassification of its employees in the outside services. He thought the Engineering Institute should take some interest in this in order to protect the interests of its members, as well as other properly qualified engineers.

Mr. Doncaster pointed out that it was worthy of note that not a member of the Civil Service Commission was a technical man, nor had any understanding of technical matters and "work to determine the qualifications necessary and the remuneration to be paid for the different classes of work placed in the engineering branches of the different departments." He thought the Institute should do something to remedy this condition. Alas, then and many times since the Institute has urged upon the government that there should be a properly qualified engineer on the Civil Service Commission. It has been the Institute's thought that it was not good enough simply to have engineers available to the members of the Commission for consultation. However, nothing has happened, and it looks as though the present system would remain unchanged in the foreseeable future.

On the very last page, there is a filler put in doubtless by the secretary of the Institute which reads "The Journal of the Engineering Institute is the medium through which to reach the engineering profession in Canada." That was true then and is even more so today.

Westinghouse Celebrates

The vital statistics of business would probably show a high mortality and short life. Consolidation, the deaths of owners and bankruptcies cut off many concerns before they reach respectable middle age, though, of course, there are those which seem to be destined to immortality, the Hudson's Bay Company, for example, which is celebrating its 283rd birthday this year. It is therefore quite natural that any concern which reaches the relatively advanced age of fifty years should wish to mark the event.

Generally, such celebrations are strictly family affairs and the public hears little of them, much less is invited to participate. So the fiftieth anniversary of the foundation of the Canadian Westinghouse Co., Ltd., is noteworthy because it was marked not only by company celebrations, but by an assembly of some 300 leading Canadians in a meeting at the Chateau Frontenac in Quebec on November 13 and 14 last, where "Canada's Tomorrow" was considered from many angles.

Though most of the discussion had little direct bearing on engineering or industry, it is always stimulating to learn of what others are thinking and particularly to note how closely in their outlooks prophets will agree. The speakers at this meeting were generally optimists, in spite of the misgivings of Dr. Brogan, to be referred to later. They thought that if we use our heads wisely, Canada faces a brilliant future.

Speaking on "The Canadian People", Dr. B. K. Sandwell, for many years editor of *Saturday Night*, stressed the fact that we are only beginning to develop our natural resources and that the logic of economics will lead to greater industrialization here and less exportation of raw or partly manufactured goods. Continued immigration will be necessary, he said, but "mere muscle, unaccompanied by any technical skill or native intelligence will henceforth be of very little value."

Continuing on "Canada's Resources", Mr. M. W. Mackenzie,

vice-president of the Canadian Chemical and Cellulose Co., Ltd., and former Deputy Minister of Defense Production, felt that the combination of great resources, a stable government, even-handed justice and a good reputation would attract the capital needed for future development. "Few countries have this happy combination of circumstances." But if we are learning to get along in the rigorous north, so are others conquering life in the tropics and competition from these areas must be expected to increase.

Energy is the key to development; we must have "a network throughout the country by which energy can be transported, whether by interconnection of electrical systems, pipe lines or any other method." There seems little danger of there not being enough non-renewable resources for any foreseeable population; they should not be hoarded, but wisely used.

Dr. R. K. Stratford, scientific adviser to Imperial Oil., Ltd., and president of the Research Council of Ontario, spoke on "The Challenge to Science". He drew a rosy picture of the kind of place Canada might be in fifty years if there were prompt application of discoveries in the physical and biological sciences, but to make this picture real, much greater research in the social sciences is imperative. "There is practically no end to the number of sociological problems that need systematic study, the solution of which might very well have a profound influence on the future of our society." This study, he thought, ought to be carried out in the universities, as free from political influence, and it should be generously supported, both by government and by industry.

Apropos of "The Contribution of Industry", Mr. D. W. Ambridge, president and general manager of the Abitibi Power and Paper Co., Ltd., thought that Canada must share its great industrial potential "to offset the dangers which face it." He felt this could best be done by assisting in the industrialization of undeveloped countries, with Canadian government help, by setting up in them branches of Canadian concerns, not for the purpose of adding to the Canadian stockholders' dividends, but as more or less independent units, devoted to the purpose of raising the standard of living in the countries where they were located, because he was "convinced that the dedication of a part of our national energies to the cause of mankind will be as effective as some of the defence programs in which we lavish money today."

The "Role of Government" was the topic of the remarks of Professor Maurice Lamontagne, chairman of the Department of Economics of the Faculty of Social Sciences of Laval University.

He declared that if a high level of economic activity is to be maintained, "the main initiative must come from outside the private sector of the economy, from an institution which is influential enough to produce a sufficient compensatory effect and which does not respond to the profit motive. "Only the government is in a position to fulfill that role."

Thus, if the theory holds, the main responsibility of our government in the future will consist in maintaining short-term economic stability. On the success of this vital role will depend the stable level of general welfare and the survival of private initiative in the field of long-term development."

"It will require centralized responsibility, a growing reliance on expert knowledge and judgment, a constant collaboration between different levels of government and co-operation from private groups as well as from the people generally. We must be conscious of these essential requirements and act accordingly if we want to avoid large-scale and dangerous disequilibrium."

In discussing "The Role of Education", Dr. Norman A. M. MacKenzie, president of the University of British Columbia warned of the type of demagogue who at the present time threatens the academic freedom of schools and universities in a free society such as the United States, and the freedom of thought and speech of all adult persons.

He cited these as the four basic objectives of Canadian education: To prepare the young Canadian to make a living; to prepare him for enlightened citizenship in a democracy; to attempt to refine his emotions, his intellect, and his taste, and to extend through him "the rule of love among men."

Emphasizing "the hard fact of competition from those tireless agents of education, radio and television, films, newspapers and magazines," Dr. MacKenzie said it is imperative to help the young Canadian develop "standards of taste which will recognize and demand the first-rate among all the varying grades of offering found in any lively and productive culture."

He declared that the four objectives which he outlined can be attained only if the most considered care is given to the instruments which are to carry them out. "They will require a concept of teacher-training which is concerned not simply with obtaining greater numbers of teachers, but much more with the quality of the teacher, his ability, his human interests, his cultural sympathies, and his understanding of the need for spiritual emphases"

Dr. Hilda Neatby, Professor of History at the University of Saskatchewan, spoke on "Cultural Evolution". In part she said:

"The arts everywhere and at every time have needed material support and Canadian conditions make this support particularly necessary."

"The true artist has vision and insight; by definition he is a seer. He conveys the truth by which, literally, men and nations live. He shows what life is in all its aspects. Man cannot exercise his faculty of refusing the evil and of choosing the good unless he knows, and that means unless he has been shown, what these are."

"Do we want to get below the surface of the obvious and the material in order to penetrate into those mysteries which, even though they may sometimes be dark and difficult, yield, we are told, life as distinguished from existence? Or do we want rather to use the wealth which we have gained from the achievements of reason and the fruits of toil to bury ourselves in material satisfactions?"

Turning to another aspect of culture, that of religion, Dr. Neatby saw indications of a modern movement toward greater religious faith. "It is impossible to say," she asserted, "whether a culture can develop without being centered in a religious faith of some sort; it is a fact that such a thing never has happened. In Canada, as elsewhere, there are numerous signs of an increase of energy and enthusiasm among those who depend for moral and even intellectual security on the work of grace as well as on the operations of human intelligence."

"It is certain that we shall not know the extent of our collective artistic capacity unless we extend further material encouragement to the individuals who possess it. The cultural future certainly depends on increased generosity, with at least a corresponding increase in wisdom in determining the form which generosity shall take."

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"Canada and the World" claimed the attention of Professor D. S. Creighton of the Department of History of the University of Toronto. To him the most important occurrence of the post-war world, and the one that will have the most powerful influence over international events of the next 50 years, is the revolution that has taken place in Asia.

He asserted that "our real task, once we have built up our defences and proved that we are ready to resist attack, is to accept the unquestionable fact that Communism is the established system in a large part of Asia, and to build an international order in which we and Communist countries may live side by side in peace."

He noted that "three nations, China, India and Japan, will probably reach or regain the stature of great powers. Above all these countries, tower at present the two super-powers, the United States and the Soviet Union. But below the super-powers there is a small group of states which may exercise a secondary leadership. Canada is not of this stature yet, but in 50 years, how far away will we be from it ?"

The conference ended with a dinner at which Dr. Denis W. Brogan, University of Cambridge political scientist and economist, spoke on "The Outsider Looking In". He challenged his distinguished Canadian audience to be less complacent and more dynamic and positive in fostering Canada's growth and recognition among other nations.

"There is, for an outsider like myself, a permanent shock arising from the fact that Canada is so like the United States, and another from the fact that being so alike, she is not identical. I speculate with great diffidence on the proposition that the only real Canadians are the Canadian politicians, government servants, and the armed forces. If this view can be defended, then 'Canadianism' is, I fear, too thin an idea to bear much strain.

Dr. Brogan pointed out that the basic Canadian relationship is neither with the United States nor with the United Kingdom, but with the world of the hydrogen bomb. The very fact that Canada is now one of the treasure houses of the world makes the naive isolationship of the inter-war years impossible. A uranium producing country, he said, cannot be neutral!

He noted an inclination towards apologetic pessimism in the opinions expressed during the conference. "Some of the pessimistic things said about culture, the fine arts, the state of basic scientific research, the general conditions of education in Canada will change for the better when the reality, the permanence of your good fortune, really soaks into your minds," he declared.

On the question of Canada's French and English cultural traditions, Dr. Brogan commented at length. "There is a special opportunity open to the culture of French Canada arising from the comparative lateness of the entry of French Canada into the world of modern industry. The innocent optimism of a generation ago, which afflicted and blinded so many in the English-speaking world, is no longer permissible. We know too much of what mere industrialization can do. On the other hand, we know how sterile and how self-defeating is a blind and uncritical clinging to traditions that the economic and social structure are undermining. There is no future and not much life in 'la culture folkloristique', to use a rather barbarous French phrase. What is possible is the prudent yet critical preparation of a traditional culture like that of French Canada for this encounter with the modern world. For that encounter not to end in an easy victory for the modern world, that world must be understood. That modern world is not by any means the enemy of the good life in all things; its essential gains, which are real, can be preserved and developed."

The arrangements for the conference were made by a committee under the chairmanship of Dr. G. P. Gilmour, president and vice-chancellor of McMaster University. Judging from press reports, the committee is to be congratulated on the success of its efforts. And it is to be hoped that the proceedings of the conference will appear in full in print and will be widely distributed, which they certainly deserve.

Granted that there is always much useless talk in all meetings of this kind, our own included, there also always emerges something of value from them. All thinking Canadians owe Westinghouse their thanks for the inspiration which led to the conference and for the excellence of its proceedings. Westinghouse has set a precedent which may well be followed by others under similar circumstances.

News of Other Societies

The **Canadian Electrical Association** (Room 704, Tramways Building, Montreal 1, Que.) announces division meetings, as follows: The eastern meeting of the Engineering, Sales and General Divisions, January 18-22, 1954, Quebec, Que.; the western meeting, Engineering, Sales and General, March 1-5, 1954, Winnipeg, Man.

On the calender of the **Chemical Institute of Canada**, early in 1954 there are four division meetings of interest, as follows: Analytical Chemistry Division, Royal Hotel, Guelph, Ont., February 18-19; Protective Coatings Division, Montreal, February 25; Protective Coatings Division, Toronto, February 26; Chemical Engineering Division, Montreal, March 1-2.

The winter general meeting of the **American Institute of Electrical Engineers** will take place from January 18-21, at the Statler Hotel, New York, N.Y.

The annual meeting of the **American Institute of Mining and Metallurgical Engineers**, is scheduled for February 14-18, 1954, at the Hotel Statler, New York, N.Y.

The thirty-fourth annual general meeting of the **Institution of Engineers (India)** (8 Gokhale Road, Calcutta, India) is planned for February 13-17, 1954, at Calcutta, India. Members of the Institute able to attend are invited to do so on the same terms and conditions as members of the Institution.

The **Institute of the Aeronautical Sciences** (2 East 64th Street, New York 21, N.Y.) announces the twenty-second annual meeting at the Hotel Astor, New York, January 25-29, 1954. I.A.S. Honours Night dinner is on January 25, at the Hotel Astor, New York.

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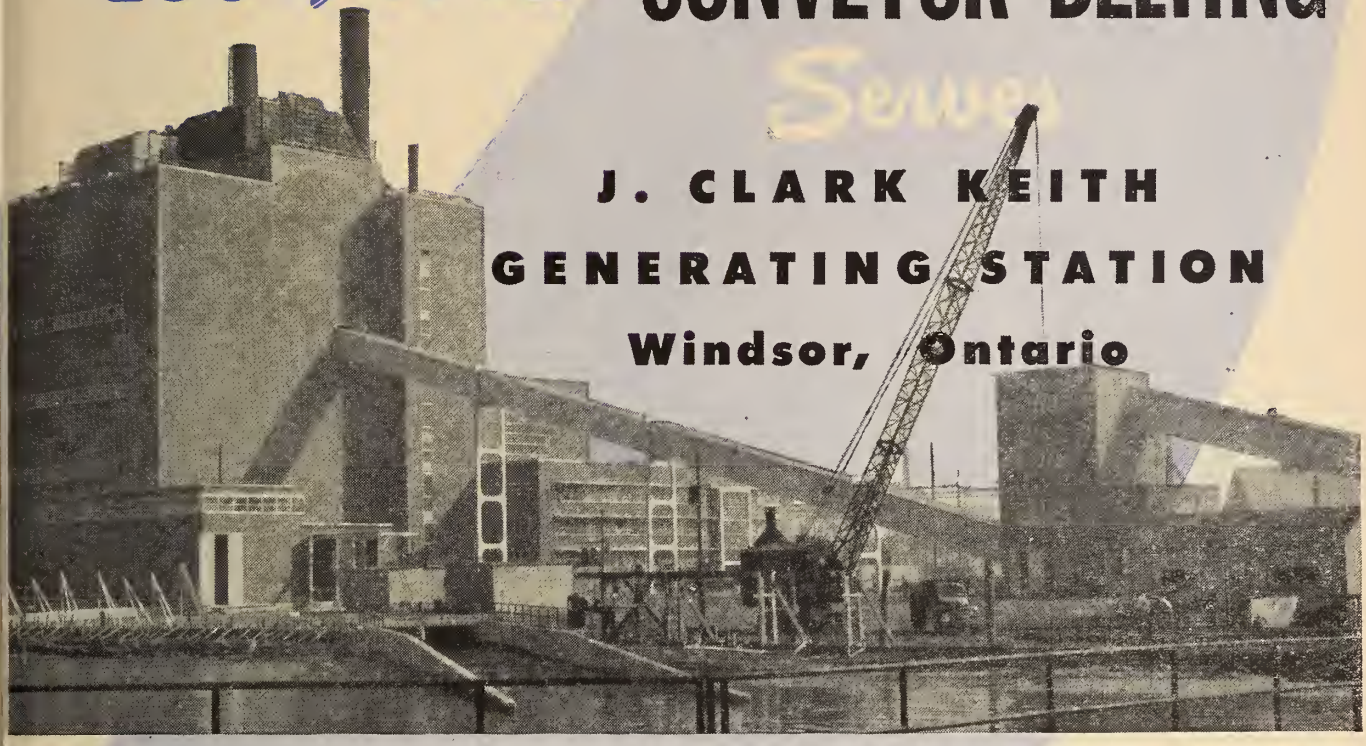

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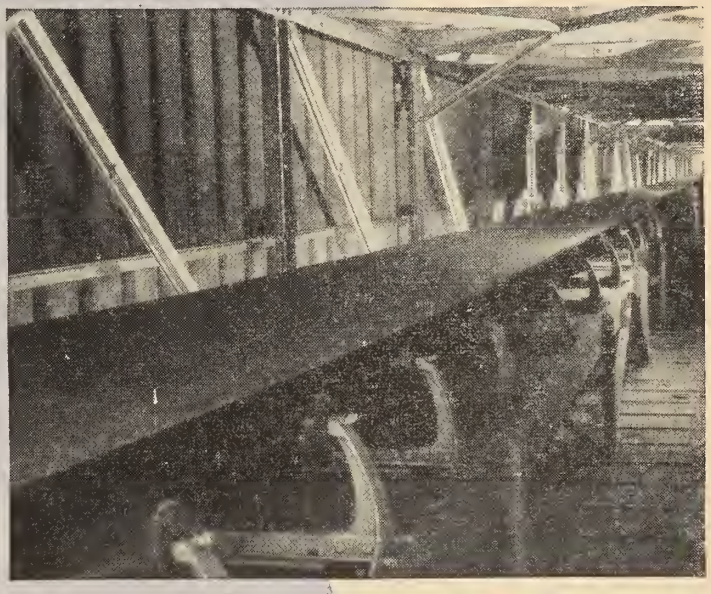

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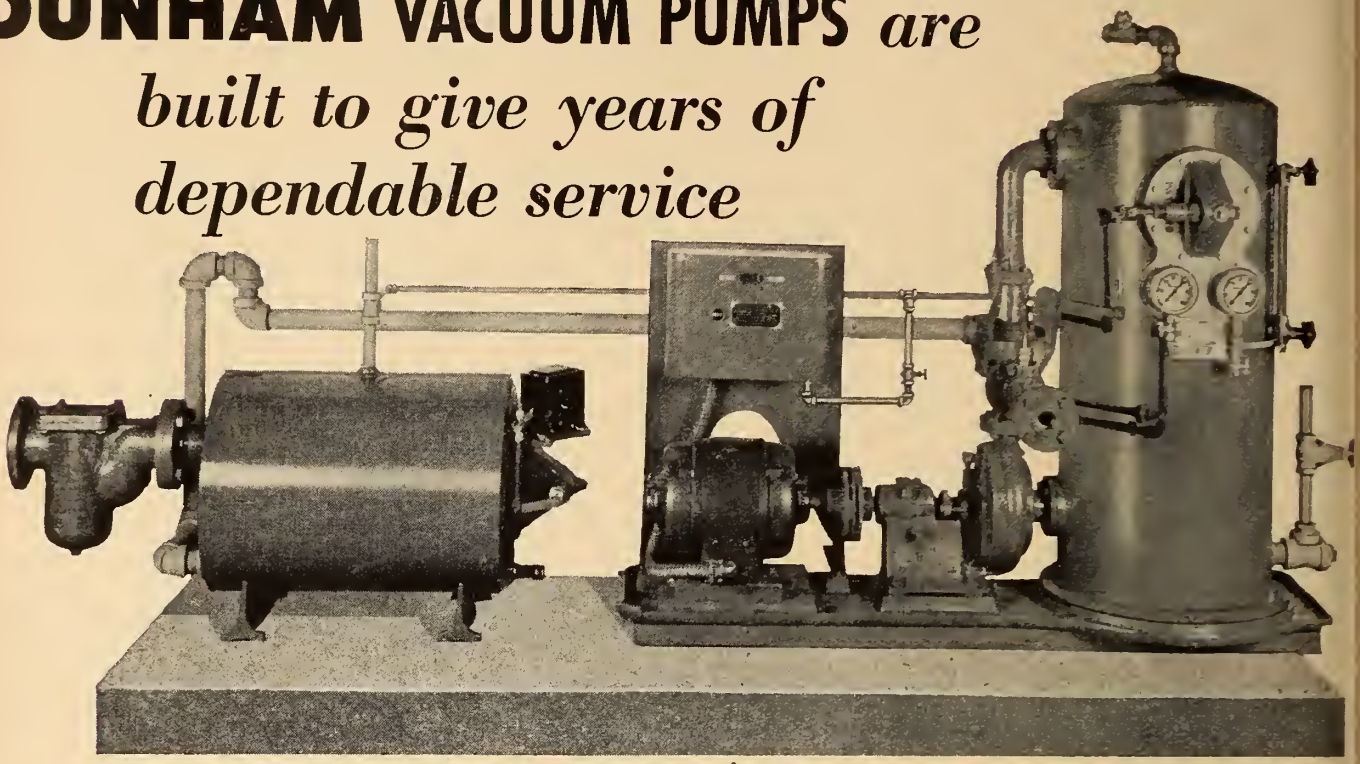

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Personals

News of the Personal Activities of Members of the Institute

Hon. C. D. Howe, Hon. M.E.I.C., Trade and Commerce and Defence Production minister, was appointed an alumni term member of the Corporation of Massachusetts Institute of Technology.

He was elected, together with General James Doolittle, vice-president of the Shell Oil Company, in a nation-wide balloting of M.I.T. alumni. Their term will end June 30, 1958.

Dr. Lillian M. Gilbreth, Hon. M.E.I.C., has been in the Philippines for several months studying certain phases of the teaching in the universities. This study is being made under the joint auspices of the American and Philippine governments.

After her stay in the Philippines, where she was recently named an honorary member of the Philippine Association of Mechanical and Electrical Engineers, Dr. Gilbreth will fly to Australia to conduct a series of meetings in Sydney, Melbourne and Brisbane. She will later return to Manila and then proceed to the Far East to work with a team from Purdue University.

Early in the new year she will fly to India where she will take part in further meetings in several cities on the subject of management. From India she will continue her tour to Madrid, Lisbon and Rio de Janiero, and will conclude her South American visit by attending the International Management Congress in Brazil on February 19 to 25.

G. H. N. Monkman, M.E.I.C., has retired after 18 years with the Alberta civil service, 16 of which were in the capacity of deputy minister of public works.

Mr. Monkman was born in Winnipeg, Manitoba. He was employed for 25 years with the Canadian Pacific Railway as a civil engineer, reaching the post of assistant chief engineer of construction before he left the railway in 1935. His duties covered the CPR territory from Fort William to the Pacific coast.

During the first World War, Mr. Monkman served overseas, attaining the rank of major in the Royal Engineers. During the second World War he served as a captain in the reserve force of the Royal Canadian Electrical and Mechanical Engineers.

He joined the public works department in 1935 as a resident engineer and two years later became deputy minister.

When Mr. Monkman joined the department, it was responsible for the maintenance and construction of Alberta's highways as well as government buildings.

Arthur Arnold, M.E.I.C., has been appointed deputy minister of public works for Alberta, succeeding G. H. N. Monkman, M.E.I.C., who has recently retired.

Mr. Arnold is a native of England. He attended Dudley Grammar School and was later articled for ten months with the architectural firm of Webb and Gray.

He came to Canda when 15 years of age and enrolled at the Hamilton Technical Institute for one year.

Mr. Arnold apprenticed with William James Walsh, Hamilton architect, and was his assistant architect for four years. He then worked for three years with architect W. P. Whitton in Hamilton, and was employed on the plans for the Hamilton General Hospital, Technical School, and Home for the Aged.

After this he organized his own construction company and took charge of designing and building.

He entered the federal bureau of technical personnel at Ottawa at the start of the second World War and was subsequently transferred to the National Steel Car Corporation where he worked on plans for the construction of a shell plant and an airplane building at Malton airport. His war service also saw him with Canadian Industries Limited and the Coal Carbonizing Company.

For two and a half years prior to April, 1946, he was senior assistant for housing for the federal government during which time he held the directorship of housing in various parts of Canada. In Edmonton he was attached to the administrative staff of the National Housing Act and did appraisal work on the Alaska highway.

In 1946 he joined the housing branch of the provincial department of economic affairs and one year later became superintendent of building for the public works department.

Mr. Arnold is a member of the legislative committee of the Association of Professional Engineers of Alberta, and a member of the associate committee of the National Building Code, representing the Alberta government.

Thomas M. Patterson, M.E.I.C., has been appointed to the post of chief of the Water Resources Division of the engineering and water resources branch of the Resources and Development Department.

A graduate civil engineer from the University of Toronto, class of 1925, Mr. Patterson has been in the government service for about 20 years.

G. G. Murdoch, M.E.I.C., of Saint John, N.B., has retired from active consulting practice, having transferred his business, Murdoch-Lingley Limited, to Harold P. Lingley, M.E.I.C., who has been associated with him for a number of years.

G. G. Murdoch, M.E.I.C.

Mr. Murdoch joined the Engineering Institute as a Student in 1905 and has been actively engaged in its affairs until his recent retirement, having served as one of the early chairmen of the Saint John Branch. He was one of the wardens of Camp 9 The Corporation of the Seven Wardens, and attended the last meeting held in Montreal in

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1951. In addition, he served as a vice-president of the Engineering Institute representing the Maritime Provinces in 1942-1943.

Mr. Murdoch was one of the incorporators in the Association of Professional Engineers of New Brunswick, and subsequently became president of that organization. He was a member of the Dominion Council since its inception, serving as one of the three representatives of the New Brunswick Association.

He is also a member of the Association of Consulting Engineers of Canada.

Mr. Murdoch was granted Life Membership in the Institute in 1947.

L. J. R. Sanders, M.E.I.C., president and general manager of the L. J. R. Sanders Engineering Company in Galt, Ontario, has recently been granted full membership in the Institution of Mechanical Engineers in London, England.

Mr. Sanders is a 1923 graduate in mechanical engineering from Loughborough College, England.

G. E. Blake Sinclair, M.E.I.C., is now associated with the engineering consulting firm, G. C. McRostie, specializing in foundations and structural design, as well as microwave relay installations.

G. E. Blake Sinclair, M.E.I.C.

A graduate in civil engineering from the University of Manitoba, class of 1922, Mr. Sinclair has been in the service of The Geodetic Survey, and Duke-Price and Beauharnois Power projects. He was also chief of the National Parks Division, dealing with development and engineering maintenance, and latterly completed 35 years' federal service as director of Northwest Territories and Yukon affairs dealing with the government of the territories, their development and their mineral resources.

Roy H. Smith, M.E.I.C., has retired from his position as assistant manager of the co-ordination and economics department of Imperial Oil Limited in Toronto to become petroleum consultant in Toronto after completing 30 years' service in the oil industry.

A Nova Scotian by birth, Mr. Smith attended Pictou Academy and Mount Allison University, and graduated in chemical engineering from McGill University in 1921.

He joined Imperial Oil Limited in 1923 as laboratory assistant at Sarnia, and became chief chemist in 1926.

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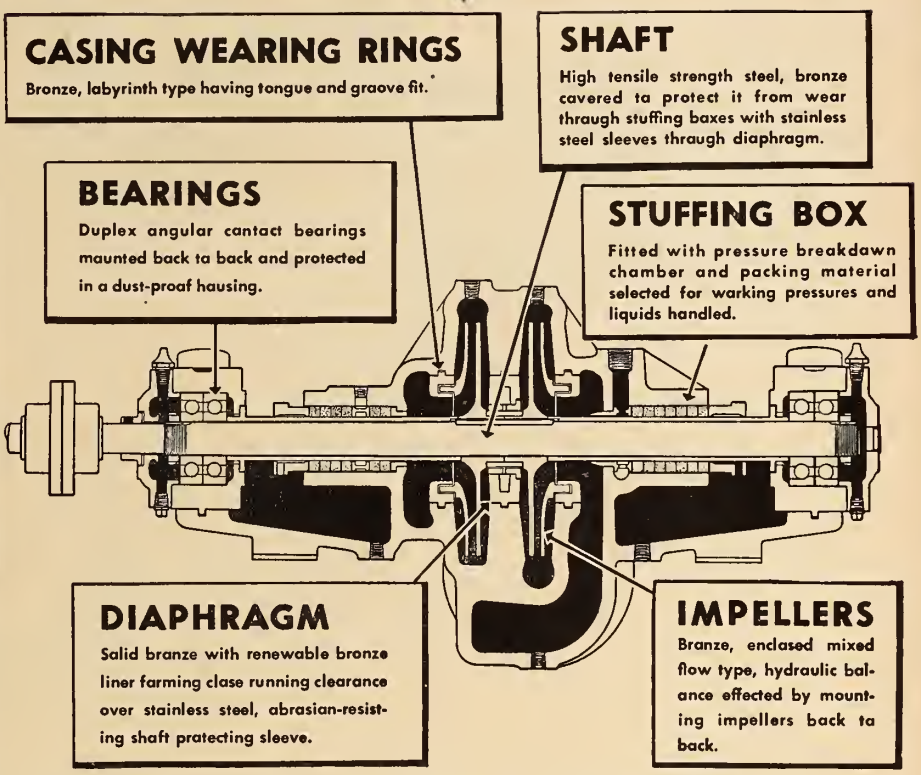

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the manufacturing department, he acted in an advisory capacity to Polymer Corporation for two years in connection with the design and construction of the rubber project in Sarnia.

In the spring of 1945 he served for two months with the Department of National Defence on the Combined Objectives Sub-committee in Europe.

He was named assistant chief engineer of the manufacturing general engineering department in 1943 and transferred in 1946 to International Petroleum Company Limited as executive representative in New York.

He performed various functions with International, and since 1949 was advisor on crude oil sales, manufacturing and pipe line operations, and was a director of Andian National Corporation.

Mr. Smith returned to Imperial Oil Limited in Toronto at the beginning of this year.

He is a Fellow of the Chemical Institute of Canada, a member of the American Petroleum Institute, and of the Association of Professional Engineers of Ontario.

D. O. D. Ramsdale, M.E.I.C., has been appointed sales manager of the English Electric Company of Canada Limited following the resignation of I. S. Patterson, M.E.I.C.

Mr. Ramsdale was previously manager of Central Station sales. He has been

D. O. D. Ramsdale, M.E.I.C.

with the company since 1940, working in the Ontario and Quebec mining areas, and as manager of the Toronto district office.

Mr. Ramsdale is an electrical engineering graduate of McGill University, a registered professional engineer of the Province of Ontario, an associate of the Canadian Mining and Metallurgical Institute, and of the Association of Iron and Steel Engineers.

R. S. Wilson, M.E.I.C., has been appointed assistant vice-president of engineering and sales of The Holden Company Limited in Montreal.

Mr. Wilson joined The Holden Company in 1947 as mechanical engineer, and was previously with National Har-

R. S. Wilson, M.E.I.C.

bours Board in Montreal as assistant mechanical engineer.

Upon graduation in mechanical engineering from McGill University, Mr. Wilson served as a naval lieutenant until his discharge in 1945.

F. L. Peckover, M.E.I.C., is now in Montreal, Quebec, as engineer in the special

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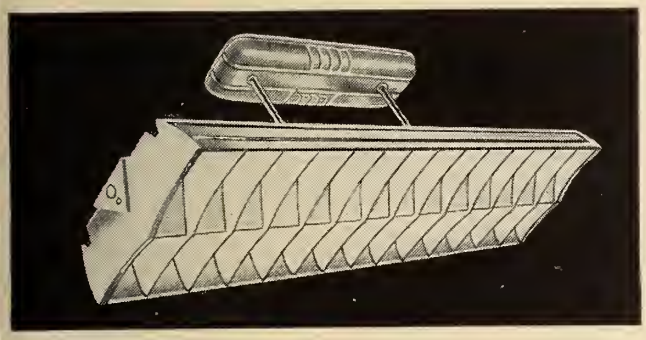

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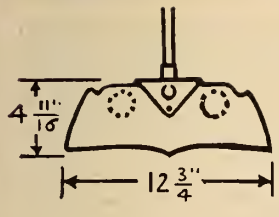

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projects branch of the St. Lawrence Seaway for the Department of Transport.

He was previously assistant research officer in the Building Research Division of the National Research Council in Ottawa.

Mr. Peckover received his B.A.Sc. degree in civil engineering from the University of Toronto in 1944 and his S.M. degree in civil engineering from Harvard University in 1947.

C. K. McLeod, M.E.I.C., managing director of Walter Kidde and Company of Canada Limited in Montreal, has been re-elected president of the National Council of the Navy League in Canada.

C. H. Vatcher, M.E.I.C., has recently joined the staff of Dominion Cutout Company Limited and Dominion Carbon Brush Company Limited.

A graduate of the University of Toronto in electrical engineering, class of 1939, he has spent some years in industrial sales work with Canadian National Carbon Company Limited and English Electric Company of Canada Limited.

During the war Mr. Vatcher served as a lieutenant with the R.C.N.V.R.

W. Alex Williamson, M.E.I.C., has been appointed general sales manager of Reliance Electric & Engineering (Canada) Limited in Welland, Ontario.

Mr. Williamson will have complete responsibilty for the direction of the sales department and sales activity.

W. Alex Williamson, M.E.I.C.

Previous to assuming the duties of sales manager, Mr. Wiliamson was manager of Reliance's western region.

S. O. Shields, M.E.I.C., is manager of the switchgear and industry control department of the Apparatus Division of Canadian General Electric Company Limited.

Mr. Shields was born in Belfast, Ireland. He graduated with a B.A.Sc. degree from the University of Toronto in 1924. He entered the C.G.E. 'Test' course that same year, and from 1925 until 1930 was engaged in draughting, industrial control and induction motor engineering. He was appointed general foreman in the winding and insulating department of the Peterborough Works in 1930, and ten years later became production manager at Peterborough.

In 1952 he was named manager of manufacturing and switchgear.

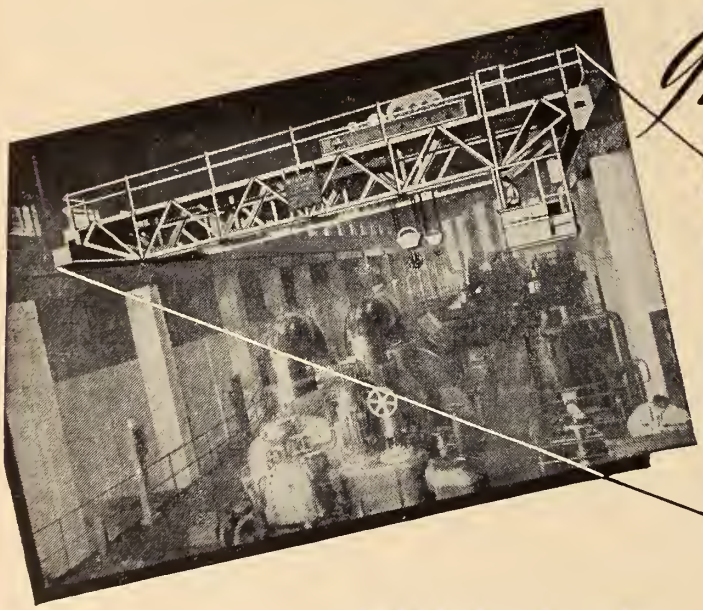
Mr. Shields is a member of the Association of Professional Engineers of Ontario.

Wm. A. Arsenault, M.E.I.C., is employed as resident engineer with The Rankin Newfoundland Company at St. Lawrence, Newfoundland.

He was formerly resident engineer with the Nova Scotia Department of Highways at Amherst, Nova Scotia.

Mr. Arsenault is a graduate of the Nova Scotia Technical College, class of 1937.

Karel R. Rybka, M.E.I.C., has reorganized his practice in Toronto into a consulting company in which he is president and managing director. **Odric H. Smith,**



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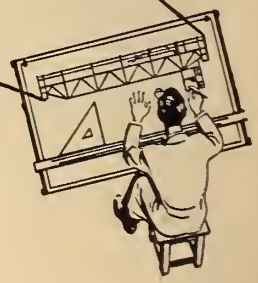

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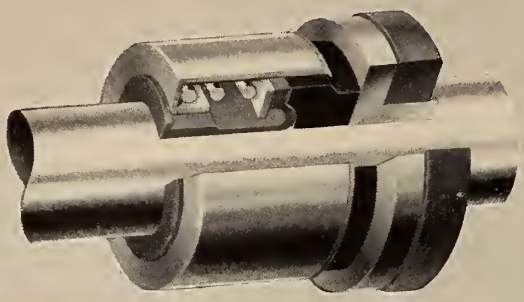

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Liquids	For water, oils, alcohol, solvents (except aromatic, chlorinated and ketone types) and other liquids (except strong acids).	For very strong acids, oils, solvents (including aromatic, chlorinated and ketone types) and all other liquids.
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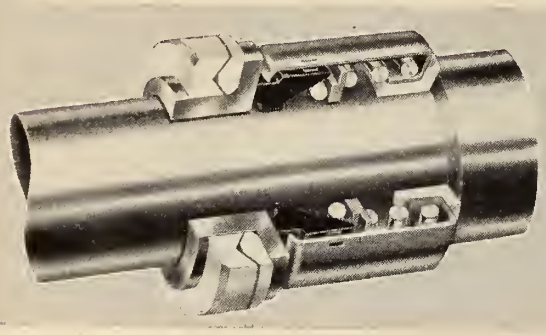

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M.E.I.C., who has been associated with Mr. Rybka since 1937, has been named vice-president of the company.

Lt. Col. L. Martin, M.E.I.C., president of Martin Engineering Inc. in Montreal, has announced the opening of a Sherbrooke, Quebec, office which will come under the management of John S. Nightingale who has recently joined the firm.

Mr. Nightingale is secretary of the newly formed Eastern Townships Branch of the Institute of Power Engineers and a member of the Canadian Institute of Mining and Metallurgy and the Canadian Pulp and Paper Association.

G. D. Floyd, M.E.I.C., director of planning in the Hydro-Electric Power Commission of Ontario, has been named deputy to Dr. Otto Holden, M.E.I.C., the assistant general manager of engineering.

Mr. Floyd was born at Westville, Nova Scotia, where he received his early education. He graduated in 1913 in science from Dalhousie University, and in 1915 in electrical engineering from McGill University.

After two years' post-graduate work at Cornell University, he served with the Royal Flying Corps from 1917 until 1919.

Mr. Floyd joined the Commission in 1919 as an assistant laboratory engineer, transferring to the electrical engineering department in 1926 to assist in high voltage transmission studies.

He was subsequently attached to the newly-formed planning department, and in 1949 was appointed system planning engineer. With the formation of the Planning Division in 1952, Mr. Floyd was made its first director, a position he held until his current appointment.

He is presently vice-president of the Canadian District of the American Institute of Electrical Engineers. He is a member of the Canadian Electrical Association, and the Association of Professional Engineers of Ontario.

The executives of The Foundation of Canada Engineering Corporation Limited, a new subsidiary of The Foundation Company of Canada Limited, are: president, **R. E. Chadwick,** M.E.I.C., chairman of the board of The Foundation Company of Canada Limited; vice-presidents, **W. E. Hickey,** M.E.I.C., of Toronto, and **Per Hall,** M.E.I.C., of Montreal. The other directors are Ralph P. Bell of Mahone Bay, N.S., L. J. McGowan and J. A. Scythes of Toronto, and V. N. Drury, **F. G. Rutley,** M.E.I.C., and **R. F. Shaw,** M.E.I.C., of Montreal.

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The executive of the Canadian General Electric Company's Test Alumni Association for 1953-54 are: **L. D. W. Magie,** M.E.I.C., honorary president; **A. R. Jones,** M.E.I.C., president; **G. C. Tollington,** M.E.I.C., W. H. Prevey, R. D. Mawhood, H. J. MacTavish, vice-presidents; and J A. Archibald, secretary-treasurer.

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neering graduates from Australia, India, England and The Netherlands, were added to the Association from the 1953 'Test' course.

Dr. J. T. Rogers, Jr.E.I.C., received the first doctor of philosophy degree in mechanical engineering to be conferred by McGill University. The degree was awarded at the Founder's Day Convocation on October 6, 1953.

A student of St. Leo's Academy and Notre Dame University before entering McGill, Dr. Rogers was awarded the British Association Medal for the highest standing in mechanical engineering when he received his B.Eng. degree in 1948. The subject of his thesis for his master's degree, which he received in 1950, was "The Stability of Gas Turbine Combustion Chambers". The title of his Ph.D. thesis was "Temperature Distributions in Heat-exchanger Tube Plates".

Dr. Rogers played senior intercollegiate football for four years, and acted as assistant coach for the McGill intermediate team, and the Macdonald College team. He also played inter-faculty hockey and was finalist in the welterweight intercollegiate boxing competition in 1950.

R. E. Chant, Jr.E.I.C., has been appointed associate professor of mechanical engineering of the University of Manitoba.

R. E. Chant, Jr.E.I.C.

He was previously with the Gas Dynamics Laboratory of McGill University at Ste. Anne de Bellevue, Quebec.

Mr. Chant received his B.Eng. degree from McGill University in 1948.

M. J. McAuliffe, Jr.E.I.C., has been appointed superintendent of graduate training at Canadian Westinghouse Company Limited in Hamilton, Ontario. In this capacity he will be responsible for the administration of the Westinghouse graduate student training program which provides new engineers with a thorough grounding in all phases of the company's operations in the electrical industry.

A graduate of the University of Toronto, class of 1951, Mr. McAuliffe joined Canadian Westinghouse after service with Canadian Industries Limited where he had been in charge of engineering studies at their Hamilton Works.

Mr. McAuliffe is chairman of the Professional Development Program of the Engineering Institute's Hamilton

M. J. McAuliffe, Jr.E.I.C.

Branch. He is also a member of the Association of Professional Engineers of Ontario.

M. L. Narraway, Jr.E.I.C., has been transferred from Ottawa to Montreal as supervisor of engineering methods for the Bell Telephone Company of Canada. While in Ottawa, Mr. Narraway was plant engineer. During that time he served as secretary-treasurer of the Ottawa Branch of the Engineering Institute.

Mr. Narraway graduated in electrical engineering from Queen's University in 1947.

G. R. O. Thim, Jr.E.I.C., has joined the engineering staff of the St. Lawrence Cement Company in Quebec, Quebec.

He was previously associated with Canadian Industries Limited in Montreal.

Mr. Thim is a graduate of the Technical College of Vienna, class of 1949.

Wm. J. Gall, Jr.E.I.C., has been assigned to the Arvida Works of the Aluminum Company of Canada, Limited, as project engineer in the chemical process development group of the technical department.

Dr. Gall joined the Aluminum Company of Canada in April of this year, and prior to his present appointment, made a tour of the company's plants and installations in Ontario and Quebec. During this time he was also for four months in the technical department of Aluminum Goods Limited in Toronto.

D. W. Blair, M.B.E., Jr.E.I.C., has been named district engineer of the Southern Ontario District of Canadian National Railways with headquarters in Toronto.

Mr. Blair was born in Quebec, Quebec, and graduated from the University of New Brunswick.

He entered the railway service in June, 1946, as junior assistant engineer in the Department of Research and Development in Montreal. He was appointed assistant engineer at Levis, Quebec, in March, 1947, and later in the year, division engineer in the Laurentian Division, Quebec, Quebec.

He was transferred in the same capacity to Montreal Terminals and St. Jerome Division in 1950.

From 1940 until 1945 Mr. Blair served with the R.C.N.V.R. on loan to the Royal Navy. He rose from ordinary seaman to lieutenant and was awarded the M.B.E. in January, 1943.

G. W. Madore, Jr.E.I.C., was recently appointed manager of the Air Conditioning Division of Foresteel Products Limited.

Mr. Madore, who graduated in mechanical engineering from McGill University in 1948, has been associated with the heating and air conditioning department of Canadian General Electric Company Limited, and with Minneapolis-Honeywell Regulator Company Limited.

J. B. Nuttall, Jr.E.I.C., is in the hydraulics section of the Mechanical Engineering Division of the National Research Council.

He was formerly with City and Guilds College, London, England.

Mr. Nuttall received his B.A.Sc. and M.A.Sc. degrees from the University of British Columbia in 1950 and 1951, respectively.

Jean Claude Hurtubise, Jr.E.I.C., former scientific officer with the Defence Research Board at Shirley Bay, Ontario, has joined the engineering staff of the R.C.A. Victor Company in Montreal, Quebec.

J. C. Hurtubise, Jr.E.I.C.

Mr. Hurtubise graduated in 1949 from Laval University where he specialized in electronics.

G. H. Johnston, S.E.I.C., is in the permafrost section of the Building Research Division of the National Research Council.

Mr. Johnston graduated with a B.Sc. degree in civil engineering from the University of Manitoba this year.

S. J. McGurk, S.E.I.C., now in his fifth year engineering study at McGill University, was awarded the 1953 Engineering Institute of Canada Prize.

Edward J. Carpenter, Jr.,S.E.I.C., has been employed as field engineer with International Business Machines in Poughkeepsie, N.Y., since his graduation in electrical engineering from McGill University in 1952.

Visitors to Headquarters

L. C. Jacobs, M.E.I.C., Bolton Centre, Quebec, November 5, 1953.

F. S. B. Heward, M.E.I.C., Sidney, British Columbia, November 23, 1953.

H. T. Libby, M.E.I.C., Vancouver, British Columbia, November 23, 1953.

Obituaries

The sympathy of the Institute is extended to the relatives of those whose passing is recorded here.

Senator John Caswell Davis, O.B.E., M.E.I.C., first professional engineer to become a member of the Senate, died in hospital in St. Boniface, Manitoba, on October 25, 1953.

Senator Davis was born in Montreal in 1888. He received his education at Loyola College where he obtained his B.A. degree in 1907, and at McGill University where he graduated with a B.Sc. degree in mechanical engineering in 1912.

While attending McGill University he was engaged during the summer months in railroad construction, and in the design and installation of automatic fire protection equipment with Grinnell Company of Canada Limited. After graduation he continued his association with this company until 1930, and the following year formed his own business in Winnipeg, Manitoba, under the name of J. C. Davis Limited, and engaged in the sale and installation of building sprinkler systems.

Senator Davis was president of the Manitoba Liberal Association from 1928 until 1936, and later was the party's chief organizer in the province. He was appointed to the Senate on January 5, 1949. An active participant in Upper Chamber debates, he was named chairman of the special committee on salacious and indecent literature. To him fell the task of preparing the committee's report.

During the second World War Senator Davis worked on the Advisory Board of the Department of War Services. He was decorated with the Order of the British Empire in September, 1949.

He was a member of the Association of Professional Engineers of Manitoba. He was also an executive of the Greater Winnipeg Co-ordinating Board and a member of the Greater Winnipeg Town Planning Board.

Senator Davis joined the Engineering Institute as a Member in 1946.

Douglas Moore Chadwick, M.E.I.C., district contracting engineer with the Canadian Bridge Company in Montreal, died at his residence in the Town of Mount Royal, Quebec, on October 21, 1953.

Mr. Chadwick was born in Montreal on May 9, 1885. He attended schools in both Ontario and Quebec, and completed his education at St. Johns the Evangelist in Montreal.

In 1902 he joined the staff of Dominion Bridge Company in Lachine, Quebec, as draughtsman, transferring to the position of checker on both bridge and structural work in 1906. Two years later he became engaged in the Company's designing office, continuing there until 1910, when he joined Cleveland Bridge and Engineering Company Limited and was placed in charge of the drawing office in Montreal.

He was subsequently employed by the Maritime Bridge Company in New Glasgow, Nova Scotia. In the early 1920's he entered the Canadian Bridge Company in Montreal as a sales engineer.

Mr. Chadwick joined the Engineering Institute of Canada as an Associate Member in 1912, transferring to Member in 1940. He was granted Life Membership in the Institute in January, 1947.

Chester Brown Hamilton, M.E.I.C., president and founder of Hamilton Gear and Machine Company Limited in Toronto, passed away on October 5, 1953, after a brief illness.

Mr. Hamilton was born in Toronto on April 8, 1884. He entered the mechanical and electrical department of the School of Practical Science, University of Toronto, in 1903 and graduated in 1906. The following year he received his B.A.Sc. degree from the University of Toronto.

Chester Brown Hamilton, M.E.I.C.

During the summer months of his engineering course and for the first year after graduation, he served his apprenticeship as machinist, principally on engine work. In 1908 he was employed as draughtsman on crude oil engines with Johnston Oil Engine Company, and during 1909 and 1910 he was engaged in draughting, purchasing and specification work with Smith, Kerry & Chace.

Mr. Hamilton formed his own business in 1911 under the name of Hamilton Gear and Machine Company Limited specializing in the production of cut gears.

In 1920 he obtained his M.E. degree from the University of Toronto.

During World War II Mr. Hamilton was a member of the Canadian Preparedness Association. At that time, also, he developed a substitute bronze for worm gears to conserve scarce tin and offered to all industry the free rights to the use of the analysis.

A keen sailor, Mr. Hamilton sailed his own ketch *Spendrift;* as a marksman, he had won many trophies.

He was a life member of the American Society of Mechanical Engineers, and a member of the Institution of Mechanical Engineers of Great Britain, the American Society of Tool Engineers, the American Society of Metals, the American Welding Society, and the American Society for Testing Materials. He was also representative for the Canadian Standards Association to the American Standards Association in the field of gear work.

In 1947 he was appointed a councillor of the Engineering Institute of Canada representing the American Society of Mechanical Engineers.

Mr. Hamilton joined the Engineering Institute of Canada as a Member in 1918, and in January of this year he was granted Life Membership.

William Gray Stuart, M.E.I.C., territorial engineer for the Yukon, was killed in a car accident near Mayo on May 8, 1953.

Mr. Stuart was born at Moulmein, Burma, on March 27, 1892. He received his high school education at Glasgow, Scotland, and his engineering training at Glasgow Technical College and Glasgow University, graduating from the latter in civil engineering in 1911.

Upon graduation, Mr. Stuart came to Canada and was employed until 1914 as rodman, topographer and instrumentman in the construction department of the Canadian Pacific Railway Company.

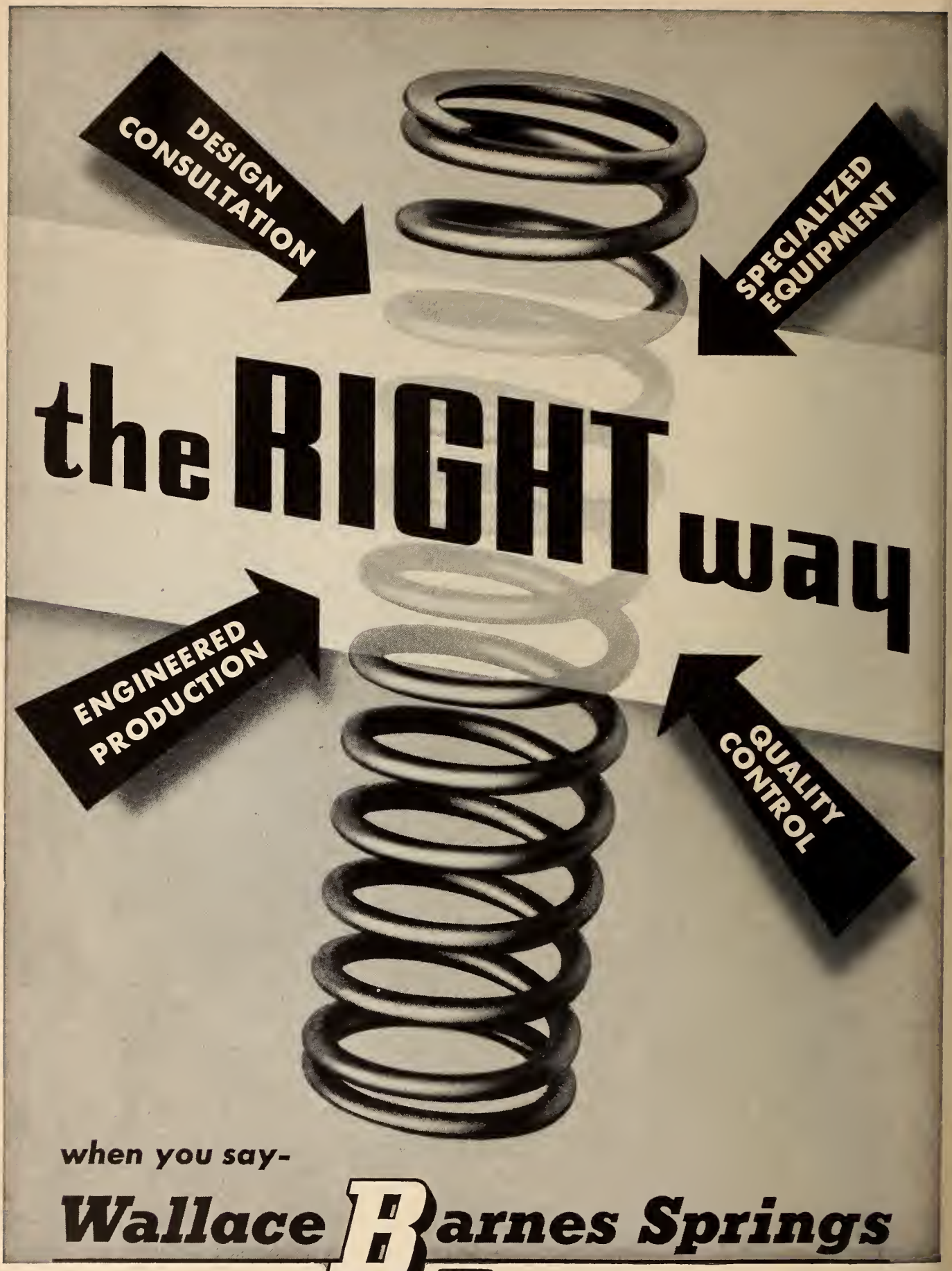
In 1914 he enlisted in the Royal Flying Corps and served overseas until 1919 when he was discharged with the rank of captain.

Upon his return to Canada he joined the irrigation branch of the Department of the Interior as district hydrometric engineer. In 1924 he was appointed district engineer with the Dominion Water Power and Reclamation Service in inspecting and laying out of drainage and industrial schemes.

From 1932 until 1942 Mr. Stuart was employed as hydraulic engineer and field engineer in the Northwest Territories with North West Minerals and with Northern Canada Development and Holdings Limited. He then joined the Demerara Bauxite Company at Mackenzie, British Guiana, returning to the Frobisher Exploration Company in Yellowknife, N.W.T. in 1946 to serve as resident engineer on the Swan River Power Project.

Mr. Stuart joined the Aluminum Company of Canada's power division at Mackenzie, British Guiana in 1949, and a year later was transferred as hydraulic engineer to the West African Aluminum Company on the Gold Coast. He joined Aluminum Laboratories Limited in Montreal in 1951 and subsequently became territorial engineer for the Yukon at Whitehorse.

Mr. Stuart joined the Engineering Institute of Canada as an Associate Member in 1927, transferring to Member in 1937.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Employment Service

THIS SERVICE is operated for the benefit of members of The Engineering Institute of Canada and for industrial and other organizations employing technically trained men—without charge to either party. It would be appreciated if employers would make the fullest use of these facilities to list their requirements—existing or estimated.

NOTICES appearing in the SITUATIONS WANTED column will be discontinued after three insertions. They will be reinstated, on request, after a lapse of one month.

REPLIES to advertisements should be addressed to File No. 000, Employment Service, The Engineering Institute of Canada, 2050 Mansfield Street.

INTERVIEWS with the Institute Employment Service, 2050 Mansfield Street, Montreal—Telephone PLateau 5078—may be arranged by appointment.

Situations Vacant

CIVIL

CIVIL ENGINEER, age 35 to 40, for a position in the steel work section of the Engineering Structural Division. Applicants should be either registered professional engineers in the Province of Ontario or capable of being so registered. They should have a wide experience in the design and fabrication of structural steel preferably for power developments and experience in tower design would be an additional qualification. They should be capable of writing reports and handling correspondence, and also capable of handling personnel. The salary will be dependent upon qualifications. Location Ontario. File No. 4715-V.

ELECTRICAL

RECENT ELECTRICAL ENGINEERING graduate required by large Canadian electrical manufacturer for sales and engineering work in Western Canada. Applicant should provide information in respect of educational qualifications and background in sales work, past experience, etc. File No. 4697-V.

ELECRICAL ENGINEER required by large public utility in Brazil. Recent graduates having test course experience with large electrical manufacturer. Applicants must be single. Excellent pension plan. Apply in writing with complete details of past experience. File No. 4698-V.

JUNIOR ELECTRICAL ENGINEER required by large transportation company in Montreal in the motive power department staff. Duties will entail the designing and draughting of building and yard power supply equipment. File No. 4700-V.

ELECTRONIC ENGINEER required to take complete responsibility for the supervision of maintenance of extensive radar and communications installation. To provide technical liaison and able to work under adverse conditions. Must have Canadian or United States citizenship or a British subject. Salary commensurate with experience. Living expenses paid. Graduate electrical engineer or equivalent with minimum of 3 years experience. File No. 4704-V.

SENIOR ELECTRICAL ENGINEER required in Ontario, preferable with at least 6 years experience in 2.3 K.V. and 4.0 K.V. distribution construction and maintenance. Please state age, education, experience and salary expected. Replies will be held strictly confidential. File No. 4705-V.

SALES ENGINEER required by the Canadian organization of a very prominent United States manufacturer of electric controls for heating, refrigeration, and air conditioning. Some experience with electric controls preferred. Would be located in Toronto area. Good opportunity to grow with a new Canadian company. Salary commensurate with ability. Not absolutely necessary that the applicant be a graduate engineer. File No. 4708-V.

ELECTRICAL ENGINEER required in junior capacity in utility located in Prairie City. Experience not necessarily required but desire to learn all aspects of civic electrical utility will be decided asset. State salary required and full details of qualifications and experience. File No. 4710-V.

MECHANICAL

GRADUATE MECHANICAL engineer preferably with sales experience to handle complete line of mechanical power transmission and materials handling equipment. Location Montreal. Age 35 to 45. Substantial income possible qualified person. File No. 4699-V.

SALES ENGINEER, graduate mechanical, required by steel fabricating shop located in Montreal. Applicant should have 4 or 5 years shop experience. Salary open. File No. 4702-V.

MECHANICAL ENGINEER preferably college graduate and registered professional engineer with at least 5 years experience in design of pressure vessels, pressure piping and steam plant design. Also design experience in piping, heating, plumbing and boilers for industrial installations is desired. Please write giving full details including experience, age, salary requirements, references, etc. Interview will be arranged. File No. 4707-V.

MECHANICAL ENGINEER required to assist mill engineer in large paper company in Province of Quebec. Duties would involve mechanical maintenance, construction and repair work. Starting salary would depend on past experience. A low rental company house available. File No. 4711-V.

MECHANICAL ENGINEER REQUIRED as assistant in the materials handling department of leading paper manufacturer in Eastern Canada. Applicant should have experience and the ability to take over the responsibility of entire department. Good salary to successful applicant. File No. 4712-V.

THREE GRADUATE MECHANICAL ENGINEERS TO ACT as sales engineers for large coal mining company with offices in Montreal and the Maritimes. One should be bilingual to cover Montreal and surrounding area, other to locate in Maritime office. File No. 4713-V.

MISCELLANEOUS

TOWN ENGINEER and manager required for the Town of La Tuque, Quebec. Applicants must be engineers in good standing. Salary is open up to $10,000 depending on qualifications of the applicant. File No. 4696-V.

ENGINEER CO/ORDINATOR to supervise sales for organization in Montreal, representing leading American manufacturers in power plant process and industrial equipment field. File No. 4701-V.

EXPERIENCED CONTRACTING engineer to organize contracting department for old established firm specializing in brick floors, tank linings and tile setting. Headquarters in Montreal. Jobs throughout Eastern Canada. File No. 4703-V.

ELECTRICAL OR MECHANICAL project engineer required by electrical manufacturer in Ontario, a young graduate engineer to supervise the development of special prototypes through laboratory to production stage. This is a rapidly growing company and men with initiative should progress favourably. File No. 4709-V .

The following advertisements are reprinted from last month's Journal, not having yet been filled.

CHEMICAL

CHEMICAL ENGINEER for employment in the technical service department required for large pulp and paper organization in Newfoundland. File No. 4656-V.

QUALIFIED CHEMICAL ENGINEER with some chemical plant and or oil refinery processing experience. This person would be employed as technical sales representative covering the whole of Canada. Age range 35 years. Organization is a chemical plant and oil refinery construction company providing process engineering, design and construction services. Location Ontario. File No. 4659-V.

CHEMICAL ENGINEER with experience in production, or allied engineering services is required as technical representative of manufacturer of centrifugal separators, heat exchangers, special process equipment and plants. Wide field of inquiry is afforded since such equipment finds application in virtually all types of industry. In reply please outline personal and technical history. File No. 4682-V.

CHEMICAL ENGINEER, recent graduate required by Montreal firm in the chemical construction and lining field. This opening includes designing, estimating and recommending for specific chemical problems, the handling of some technical correspondence as well as field supervision. Replies should include age, marital status, salary expected and if possible, a recent photograph. File No. 4688-V.

CIVIL

CIVIL ENGINEER preferably college graduate and registered professional engineer with at least fifteen years practical experience in a supervisory

capacity, specializing in design of structural steel and reinforced concrete buildings, to supervise group of engineers and draughtsmen in consulting engineer's office in Windsor. Please write giving full details including experience, age, salary requirements, references, etc. Interview will be arranged. File No. 4649-V.

CIVIL ENGINEER required by municipality in Province of Quebec with a population of 5,000. Applicants must be thoroughly bilingual with not less than two years experience. Duties include budget survey, preparation of estimates and the keeping up to date of a large scale plan of all municipal services. In cooperation with a committee, to elaborate construction standards and a town planning program. Please give full particulars of age, education and experience in reply. File No. 4661-V.

CIVIL ENGINEER or architect for work in the building code section and to assist with technical work on the National Building Code. Location Ottawa. Age preferably below 35. Knowledge of French desirable. Good academic standing. Some building experience desirable. Work will involve some travel. A challenging opportunity in an expanding field, closely allied with research into problems of building design maintenance and operation. Salary will depend on qualifications and experience. File No. 4670-V.

FOUR GRADUATE CIVIL engineers are required by the department of public work of Newfoundland for surveying, planning, estimating and supervising construction of highways and two others to assist in design and to supervise construction of reinforced concrete bridges. Salary range $3,400 to $6,000 per annum depending upon qualifications and experience. Apply by letter giving full information and salary expected. File No. 4685-V.

STEEL MAN, experienced in structural detail design and estimating required for engineering and sales work with steel fabricator located in Niagara Peninsula. Applying stating age, experience and salary expected. File No. 4690-V.

ELECTRICAL

ELECTRICAL ENGINEER required for design of electrical installations in generating stations and substations. Will be responsible for layout, purchase specifications, scheduling and general supervision of installations and placing in service. Excellent fringe benefits including attractive pension plan. Apply stating salary required and giving full details of qualifications and experience. File No. 4655-V.

Sales Engineers

Long established company located in Toronto area has interesting vacancies for sales engineers, preferably experienced on pumps and compressors, or would consider men with a good knowledge of heavy machinery or power plant equipment.

All replies held in strictest confidence.

File No. 4714-V.

RESIDENT ELECTRONIC ENGINEERS required by company located in Montreal. Applicants should be Canadian with a degree in electrical engineering and 5 to 10 years experience on radar (ground radar) and communications work. File No. 4660-V.

ELECTRICAL ENGINEER required by army headquarters, Ottawa to assist and support an electrical engineer in connection with all electrical plant distribution and interior wiring systems—operation and maintenance. To carry out field work on a Canada wide basis in connection with all electrical facilities and appurtenances. Sixty per cent of the work will be field liaison visits. To provide a continuous check of all electrical consumption and use of equipment to ensure maximum conservation. File No. 4662-V.

SALES ENGINEER required by well established and highly respected company in the field of scientific illumination. Duties, after a specific training program of approximately two years duration, will involve the sale of prismatic lighting units and the discussion of lighting applications with architects, consulting engineers, and electrical contractors, officials of industrial and commercial firms, municipal and hydro offices. Qualities of personality, diligence, and dependability along with a sincere desire for a permanent career in the lighting industry are of prime importance. File No. 4663-V.

ELECTRICAL SALES ENGINEER wanted in Toronto by manufacturer of low tension signalling equipment. Preferably with experience in contracting or electrical distributing. Salaried position. Car supplied. File No. 4679-V.

TWO PRODUCT managers required by manufacturer of radio communications and electronic equipment. Graduate in engineering with experience in sales and marketing. Applicants will be expected to plan and organize a sales programme, in a country wide basis. File No. 4684-V.

NATIONAL SERVICE MANAGER required by manufacturer in Ontario. Applicant should be graduate engineer, with communications option, from a recognized university. He should have administrative ability and experience in radio communications in the frequency modulation field. File No. 4684-V.

ELECTRICAL ENGINEER required by large paper company located in the Quebec City area. Graduate with two or three years experience preferred. In reply, please give complete details of experience and personal history. File No. 4686-V.

ELECTRICAL ENGINEER with one or two years experience in distribution planning, which eventually could lead to the position of Superintendent of distribution. The immediate work would consist of making up maps of our distribution system, planning and layout in the field, any new extensions or reconstruction of present facilities, voltage and load studies, substation design and layout, with a gradual breaking-in to supervise of operating and maintenance personnel. Location Ontario. File No. 4695-V.

MECHANICAL

MECHANICAL ENGINEER to engage in mill maintenance engineering including draughting and designing by large pulp and paper organization in Newfoundland. File No. 4656-V.

MECHANICAL ENGINEER required by Army Headquarters, Ottawa to assist and support a mechanical engineer in connection with all types of heating plants operation and maintenance. To carry out detailed field work on a Canadian wide basis in connection with all heating plants and appurtenances. Sixty per cent of the work will be field liaison work. File No. 4662-V.

MECHANICAL ENGINEER required by a large oil company for its Montreal head office engineering division. Position involves pressure vessel and pipe design. Recent graduate with 2 or 3 years experience desired, preferably with experience in same or related field. Good possibilities for promotion. Attractive employee benefit plans. Salary commensurate with experience. File No. 4673-V.

REQUIRED YOUNG MECHANICAL engineer, former experience in factory operations essential preferably in plant layout. Knowledge of wire and cable

Senior Electrical Engineer

We require the services of a senior electrical engineer, preferably with at least 6 years' experience in 2.3 K.V. and 4.0 K.V. distribution construction and maintenance.

Please state age, education, experience and salary expected.

Replies will be held strictly confidential. Apply

General Manager
Kingston Public Utilities Commission

manufacturing processes an advantage. Position one of industrial engineering work, excellent opportunities. Please reply giving full details. Salary requirement etc. File No. 4674-V.

MECHANICAL ENGINEER with industrial engineering background to train in industrial department of large paper company with mills in the Province of Quebec. File No. 4675-V.

MECHANICAL ENGINEER bilingual, single man with a desire to travel to conduct diesel service training sessions in distributor territories throughout Canada. This position is an ideal opportunity for an engineer desiring to advance in the diesel field. File No. 4676-V.

JUNIOR SALES ENGINEER, graduate with sales experience, technical knowledge of diesel engines and their application an asset. There is a definite future to this job with possibilities leading to executive levels. File No. 4676-V.

GRADUATE MECHANICAL ENGINEER wanted for large Canadian organization in Vancouver, B.C. Four to five years experience in medium or heavy machinery design preferably but creative mind with initiative to handle unusual design problems more important. Reply with full particulars including names for reference in first letter. File No. 4677-V.

JUNIOR MECHANICAL ENGINEER to work under the direction of a senior engineer in a research branch to develop test and modify remote control equipment, instruments and techniques. Recent graduate in mechanical engineering with some training in shop or instrument work. Should be fond of gadgeteering. Salary according to qualifications. State particulars including age, marital status, education and experience in 1st letter. File No. 4693-V.

MISCELLANEOUS

CHIEF ENGINEER HOME APPLIANCES. A well known Canadian manufacturer of refrigerators, ranges, washing machines, furnaces and other home appliances requires a chief engineer to head up their engineering department for home appliances. Should have proven ability to run a creative design department including basic development mechanical design, styling, standardization, lab. etc. Canadian engineer with experience in home appliances design, age 35 to 40 preferred. This is an excellent opportunity for creative engineering since this company is Canadian-owned and wishes to produce Canadian

designs for the Canadian market. Location Ontario. File No. 4616-V.

TWO SALES ENGINEERS required by manufacturer of code testers, convector radiators, unit heaters, fluorescent and incandescent fixtures etc. to contact architects, engineers, contractors, plumbers, and electricians, to prepare plans and estimates. Must be bilingual. Good salary and commission. File No. 4654-V.

CITY OF MONTREAL architects office offers permanent employment opportunities to engineers. Age must not be over 55 years at date of employment. Education: preferably graduation in engineering from a recognized university; must be a member in good standing of the corporation of professional engineers of Quebec at date of appointment. Post graduate studies; a compensation on the number of years of experience required will be alloted to candidates who have followed recognized post graduate courses. Experience at least 6 years practical professional experience or its equivalent, must have an extensive general formation in addition to proved administrative qualities. must be capable of taking the entire technical responsibility of a project. File No. 4657-V.

DIESEL ENGINEER (diesel electric) required in Montreal. Duties would involve the supervision of repair and maintenance on diesel power units. File No. 4660-V.

UTILITIES CONTRACT ENGINEER required by army headquarters, Ottawa to continuously develop more economical procurement of utilities and services (furnished by contract), such as electricity, steam, gas, water sewage disposal, boiler inspection, instrument repair, elevator maintenance, railroad siding maintenance, at Canadian Army installations. File No. 4662-V.

RECENT GRADUATES in metallurgical or chemical engineering for laboratory pilot plant and plant operations in the ore dressing and extractive metallurgical field. Location Ontario. Supply full particulars regarding qualifications to File No. 4664-V.

YOUNG ENGINEER to act as sales engineer. Age 25 to 35 years. Graduate with 6 months to 3 years experience. Manufacturers of finned tube and products manufactured from it. Although travelling is involved, it is not of a routinized nature. Periodic trips throughout Ontario and occasionally Quebec are required. The applicant should either have, or be interested in obtaining a knowledge of design and application of heat transfer treatment. The selected applicant will be expected to undergo a training period in London, Ontario, eventually locating in Toronto where he will operate independently. File No. 4665-V.

YOUNG GRADUATE ENGINEER preferably with manufacturing experience required by fniancial institution to make surveys of and write reports on industrial plants in Eastern Canada. Permanent position. Salary according to qualificatoins. File No. 4666-V.

CHEMICAL OR MECHANICAL ENGINEER, recent graduate with Bachelor's or Master's degree, for research in the engineering and development section of the divisiion of applied biology, National Research Council, Ottawa. Immediate duty to assist in small scale fermentation pilot plant investigation. Interest in food preservation and refrigeration research desirable. Starting salary up to $4400 per annum depending on qualifications. Apply in writing giving all relevant details, including experience, academic standing, and if possible, references. File No. 4669-V.

RECENT GRADUATES ('51, '52, '53) required for positions open in design, technical sales, technical service, process development, process supervision. Location Ontario. File No. 4672-V.

SALES ENGINEER new Canadian subsidiary of established U.S. manufacturer of architectural metal products recognized as leader in its field requires experienced sales engineer to handle Montreal territory. Age 28-35. Must be familiar with architectural blueprints and the construction industry. University graduate in engineering or architecture will receive preference and premium salary consideration. Excellent opportunity to advance with new, young organization. Starting salary $5,000 to $6,000 plus car and expenses, insurance benefits, retirement plan. In reply state age, education, family status, work experience and present earnings. Replies absolutely confidential. File No. 4680-V.

A CO-ORDINATOR of basic material practices. $6,420 - $7,200. Competition 53/583 and an assistant co-ordinator of basic material practices $5,640 - $6,360. Competition 53/584 for the Department of National Defence at Ottawa. Full paticulars on posters displayed at your nearest Civil Service Commission offic, National Employment Office and Post Office Application forms obtainable thereat, should be filed immediately with the Civil Service Commission, Ottawa. File No. 4683-V.

THE PAKISTAN INDUSTRIAL Development Corporation invites applications for position of Works Manager for a paper mill to produce 100 tons per day of fine and superfine papers, utilizing bamboo as raw material. Also position of Works Manager for a high grade board mill and Works Manager for a straw board mill, utilizing cereal straws. Qualifications a degree in mechanical or chemical engineering or at least 10 years practical experience of management of a comparable mill and for board mill jobs a degree or at least 5 years practical experience of management of a comparable mill. Salary in accordance with qualifications and experience. File No. 4687-V.

ELECTRICAL OR MECHANICAL engineer required in Quebec City by large organization to do development work on Watthour meters. Applicant should be preferably bilingual. File No. 4691-V.

QUALIFIED MINING ENGINEER to take care of development in N. Saskatchewan. Applicant must be prepared to live on site and devote entire time to one project and be capable of handling the entire project. Excellent salary to applicant with ability and good record. File No. 4692-V.

YOUNG GRADUATE ENGINEER urgently needed for new expanding oil company in Quebec and Eastern Ontario, with headquarters in Montreal. Work will include field inspection and contract control of construction of all service stations, bulk plants and larger petroleum handling installations. Position will also involve some travel and responsibility. Applicant should have necessary qualifications for membership in the Corp. of Professional Engineers. Previous experience is an asset but not absolutely essential. Replies should state age, qualifications and salary expected. File No. 4694-V.

ELECTRICAL ENGINEER — for system engineering and planning division. Should have at least ten years' experience in the design and operation of hydro and/or thermal generating plants and transmission systems, with particular qualifications as follows: Application of the method of symmetrical components to the solution of unbalanced conditions on A.C. systems. Experience in the use of the A.C. network analyser on load flow studies, relay problems and stability studies, both transient and steady state. Familiarity with problems associated with the operation of a power system, such as fluctuating loads, and methods used to mitigate the effect of same; also some knowledge of the operating problems associated with the inter-connection of two or more systems. Experience also desirable in A.C. system operation with particular regard to the maintenance of voltage levels, reactive and real power flow and speed governing problems. Address all applications giving full details of qualifications and experience and stating salary required to File No. 4723-V.

Situations Wanted

CIVIL ENGINEER, B.A.Sc., U. of T., M.E. I.C., age 49, married. Three years experience in road and municipal survey work. Over twenty years experience in steel, concrete and timber design. (Municipal, industrial and office building, bridges, large sewers and tunnels, flat slab, rigid frames, equipment and conveyor supports, piles, etc.) Considerable experience in inspection of construction, plant layout, and supervision of structural design and preparation of plans. Seeks responsible position with future possibilities—such as plant engineer. Preferably but not necessarily in South Ontario area. File No. 899-W.

PIPING ENGINEER: Nine years piping experience including gas and water. Presently completing $1½ million piping project including supervision of design, purchasing, construction. Canadian, aged 40, married. B.A.Sc., C.E., M.E. I.C., P.Eng. Present contract expires early 1954. Desires position as gas project engineer or superintendent anywhere in Canada. File No. 2466-W.

MECHANICAL ENGINEER, McGill 1944, single, aged 34, with industrial eng. background. Wide experience in administration and supervision, production control, maintenance, plant eng., personnel work, wage incentives, time-study, cost study, welding, fabrication. In welding industry, heavy equipment, production, printing. Seeks opportunity to join progressive firm in engineering, production, or sales. Will relocate or travel. Fire 2920-W.

MECHANICAL ENGINEER, age 30, graduate. Experience in design and development, machinery, heat transfer, heating and ventilating, aircraft. Location immaterial. Available immediately. File No. 3012-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. (McGill, 1949) BSc. 1947, age 26, married. Four years experience as a structural engineer on bridges of all types in steel, reinforced concrete and timber. Desires position with future anywhere in Canada where design experience will be an asset. Available on approximately one month's notice. File No. 3097-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc. (Alberta) 1949, married, age 34, with administrative experience in handling contracts, contractors and purchasing of construction materials for government work. Experience in hydraulics and hydrologic investigations. Desires change with responsibility and a future. File No. 3223-W.

GRADUATE ENGINEER, B.Sc., St. Francis Xavier University 1947, B.E. in Mechanical Engineering N.S.T.C., 1949, Jr.E.I.C. Age 29, married, one child. Two years as engineer in charge of machine and maintenance workshops for a research establishment. Two years as tool engineer and technical assistant to superintendent of a manufacturing division of a machinery manufacturing plant. Desires position with opportunities for advancement, where experience would be valuable. File No. 3547-W.

AN ASSISTANT CHIEF

Water Resources Division

at Ottawa

$7,500 - $8,100

Details and application forms at your nearest Civil Service Commission office, National Employment Office and Post Office.

CIVIL SERVICE OF CANADA

ADMINISTRATIVE EXECUTIVE post desired by civil engineer, B.Sc., M.E.I.C., with ten years of varied consulting and construction experience. Experienced in design of steel, reinforced concrete earthworks, the preparation of contract documents, specifications, and estimates; also in the site supervision of construction of an industrial plant, hydro-electric installations, bridges, roads, and railways. File No. 3796-W.

CIVIL ENGINEER, B.Sc., University of Manitoba 1939, M.E.I.C., P.Eng., age 36, married, 3 children, veteran R.C.A.F., 10 years experience in all phases of construction and management, mechanical superintendent. At present managing construction company. Desires position with progressive company offering responsibility and sound future. File No. 3831-W.

MANAGEMENT ENGINEER, specialized in industrial engineering and management techniques, married, bilingual, wants to find suitable position. Has had wide experience in various phases of industrial engineering as investigator, organizer, production planning supervisor, management consultant, etc., in companies of all sizes and in various fields, such as: automobile industry, foundries, electric cable and wire, machine shop, rubber, sheet metal, mining, etc. Expert in improving efficiency, methods and productivity, increasing output, cutting down of costs, materials handling, plant reorganization, survey analysis. File No. 3981-W.

GRADUATE CIVIL ENGINEER with B.A. (honours in mathematics), B.Sc. (civil eng.) degrees and post graduate work for Master's degree at McGill University, seeks diversified work in connection with dam design and construction and other hydro works. Past experience for 1½ years includes work on dam design, dewatering of foundations and mass concrete for a big power house and bridge erection work. Presently working as a field engineer supervising earthern dyke construction. Location of job site and salary no consideration if job offers interesting technical experience in design office or in the field. Married, one child. Age 25. Highest references and outstanding academic record. File No. 4108-W.

CIVIL AND INDUSTRIAL ENGINEER, B.Eng., M.E.I.C., age 29, married, small family. Experienced in planning of major expansions and plant improvements for pulp and paper industry, including reports, costs, and design (civil and some mechanical). During 5 years in pulp and paper, reaching supervisory capacity, have obtained broad field and office experience in structural design, plant engineering, materials handling Spent 1 year on design of power plants with hydro-electric consultants. Seek responsible position with industrial organization anywhere in Canada. File No. 4171-W.

MECHANICAL - CHEMICAL ENGINEER, (M.Eng. Dresden Karlruhe) M.E.I.C., P.Eng. Former lecturer at McGill. 15 years experience as plant engineer and asssitant manager in heavy industrial and chemical plants. Process and design for chemical plants. Bilingual Single. Location anywhere. File No. 4183-W.

MECHANICAL ENGINEER, graduated, married, over 20 years experience in piping, heating, plumbing, ventilating, air conditioning, refrigeration, waterwork and sewer installations, experience in process industries, steam-power plant, boilers, pumps, valves and layouts related to steel and reinforced concrete structures, desires adequate position with possibilities for advancement. Experience includes design, construction, maintenance, planning. Qualifications for administration, organizing, sales, has been used too. Location: preference for Montreal. Available 1st December. File No. 4211-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.E. (mechanical) Nova Scotia Technical College, 1949. Several years experience in machine shop practice, some experience in the design and installation of mechanical drying systems, three summers experience on survey parties, desires an engineering position not necessarily in the mechanical field, in or in vicinity of St. John's, Newfoundland. File No. 4255-W.

MECHANICAL ENGINEER, Jr.E.I.C., B.Eng., McGill 1950, age 29, married. Completed Canadian General Electric test course after graduation and am

GOLD COAST

TEMA DEVELOPMENT CORPORATION

Vacancies exist in the Senior staff of the Corporation, which has been established by Ordinance for the purpose of planning and developing the new town of Tema.

(1) Appointments will normally be on contract for two tours of 18 to 24 months each in the first instance, or for five years in the case of indigenous staff.

(2) Overseas officers will be entitled to seven days leave (exclusive of travelling time) on full pay for each completed month of residential service; African Senior Officers will receive five days leave on full pay for each completed month of service.

(3) Free return passages by sea (first class) or air will be provided for overseas officers each tour, and passages for a wife and up to three children under the age of 13 years will also be provided. Free rail travel to and from the port of embarkation when travelling to or from the Gold Coast is also allowed.

(4) It is intended to establish a Provident Fund, to which each officer may expect to have to contribute 10% of his salary, the Corporation contributing at least an equal amount. Pending the establishment of the Fund, gratuities will be paid as follows for each completed three months of satisfactory service:

Officers on salaries of £700-£999:	**£25 0s.**
" " " £1,000 and above:	**£37 10s.**

(5) Quarters (partially furnished) are provided for overseas officers in Accra, at the following rentals:

Salaries up to £1,350	**£ 60 per annum**
" £1,350 to £1,850 . .	**£ 75 " "**
" £1,851 to £2,400 . .	**£ 90 " "**
" £2,401 to £2,650 . .	**£120 " "**
" over £2,650	**£150 " "**

When the Corporation moves to Tema, officers will be expected to make their own arrangements.

(6) Free medical attention will be given to officers and their families.

(7) Officers required to use motor-cars in the course of duty will be paid a monthly maintenance allowance and mileage.

(8) Income Tax in the Gold Coast is at rates considerably lower than those in the United Kingdom.

Applications are invited from suitably qualified candidates for the following vacancies:—

A. TREASURER (CHIEF ACCOUNTANT). (Salary £2,600 p.a.)

Candidates should have had experience in Local Government finance, and preference will be given to members of the Institute of Municipal Treasurers or of the Institute of Chartered Accountants. The selected candidates will be responsible for the whole of the Corporation's accounting and financial administration.

B. CHIEF ENGINEER. (Salary £2,500 p.a.)

Candidates, who must he graduates (B.Sc. (Eng.) or other recognized Engineering degree) and be Associate members of the Institute of Civil Engineers or of the Institution of Municipal Engineers, should have had considerable municipal experience or experience in New Town Development.

C. ENGINEERS.

Vacancies also exist in the following Engineering branches:—Civil, Mechanical, Electrical and Structural. Candidates must possess a B.Sc. (Eng.) or other recognized Engineering Degree, i.e. a degree giving exemption from Sections A and B of the relevant Institutions examinations, or must have passed Sections A and B of the examination of the relevant Institution and must have at least 5 years practical experience after qualifying. Municipal experience, or experience in New Towns, is desirable. The following are the relevant Institutions:

Civil Engineers:	**Institute of Civil Engineers; Institution of Municipal Engineers.**
Mechanical Engineers:	**Institution of Mechanical Engineers.**
Electrical Engineers:	**Institution of Electrical Engineers.**
Structural Engineers:	**Institution of Structural Engineers.**

or comparable Dominion or foreign qualifications.

The salary for this grade is on a Scale £1,000 x 40 — £1,200. Opportunities will arise for promotion to the grade of SENIOR ENGINEER in the scale £1,300 x 50 — £1,500. In these grades overseas pay (£325-£350) is payable.

D. CHIEF ARCHITECT AND TOWN PLANNER. (Salary £2,500 p.a.)

Candidates must be A.R.I.B.A. and A.M.T.P.I., or have equivalent qualifications and must have had considerable municipal or New Town experience.

Vacancies also exist in the following grades viz:—

ASSISTANT ARCHITECTS. (Salary £700 x 30 — £910) must be students of the R.I.B.A.

ARCHITECTS. (Salaries £1,000 x 40 — £1,200) must be A.R.I.B.A., or hold a degree of diploma which is accepted as equivalent to having passed Sections A and B of the Institute's examination, and have reached the age of 28 years. Membership of the Town Planning Institute would be an advantage. Opportunities will exist for promotion to the grade of SENIOR ARCHITECT (Salary £1,300 x 50 — £1,500).

In these grades Overseas Pay (£175-£350) is payable.

E. CHIEF ESTATES OFFICER. (Salary £2,300 p.a.)

Candidates should be members of the Royal Institution of Chartered Surveyors or hold the degree of B.Sc. (Estate Management) and should have considerable experience in the management of large housing and industrial estates. Experience in the Estates Office of a Municipality or in New Towns would be an advantage.

APPLICATIONS: Persons resident in the United Kingdom and Europe should apply to the Commissionner for the Gold Coast, Melbourne House, Aldwych, London, W.C.2., England, for a form of application, while other applicants should send full details of age qualifications and experience and arrange, if possible, for a testimonial from present and/or recent employers to be sent to the Commissioner.

presently employed as mill superintendent of a small textile mill. Would consider a position with a textile company. Would also consider production or service engineering in other fields. File No. 4309-W.

YOUNG MAN, ENGINEERING PHYSICIST, S.E.I.C., B.C.S., Georgia, 1950 (Psychology with chemistry), B.Eng., North Carolina, 1953 (physics with mathematics), English and French languages. Two years general practical electronics, three years university teaching experience. Canadian army veteran. Desires permanent position with opportunity of furthering interests in research organization. Location anywhere in Canada. File No. 4321-W.

CIVIL ENGINEER, B.Sc., M.E.I.C., P.Eng., age 30, with five years engineering experience. Presently employed on the completion of a large expansion program in the paper industry. Desires position in the paper industry with greater responsibility and opportunity for advancement. File No. 4327-W.

MECHANICAL ENGINEER, Jr.E.I.C., veteran, married, 28 years of age, graduated in 1950 from University of Saskatchewan. Have 3rd class stationary engineering papers. Have been doing plant engineering work for large mining company. Good kowledge of machine shop practice. Desire position with opportunity. Location not important. File No. 4328-W.

MECHANICAL ENGINEER, P.Eng., Jr. E.I.C., Jr.A.S.M.E., Canadian graduate of Toronto, married, desires position preferably in mechanical production or maintenance with opportunities for progression Geographical location is of relatively minor importance but prefer one with access to sportsman's facilities (natural). Possess natural mechanical ability and seven years experience in automotive and aircraft maintenance; drainage equipment production; steel plant manitenance; motor vehicle parts maufacture; synthetic rubber plant pressure vessel, boiler and production equipment inspection, maintenance and senior development engineering. File No. 4329-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1951), with one year's experience in country engineering including O.L.S. surveying; two years in heavy building construction including precision surveying. Particularly interested in work in the west or in foreign assignments. File No. 4330-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc., M.A. 1946, B.E. (Civil) Nova Scotia technical college, 1948. Age 30, married with two children. Five years experience in the construction field on harbour works, industrial plants and municipal works. Desires a permanent position with good prospects for the future. Will consider any offer and can furnish good references. File No. 4331-W.

CIVIL ENGINEER, B.Sc., University of Manitoba, 1933, age 42, married, one child. Has experience in various fields of construction. Past 15 years employed by large Rhodesian Copper mine holding positions such as mine engineer and assistant underground manager. Recently returned to Canada to seek permanent employment and have open mind regarding suitable positions available. File No. 4332-W.

CHEMICAL ENGINEER, B.Sc. 1948, M.Sc. 1952, P.Eng., M.E.I.C., age 26, married with 2 children, experience in production control engineering research, presently employed in fuel research but desires change to more progressive position in production development or control work preferably in Alberta. Available on reasonable notice to present employer. File No. 4336-W.

CIVIL ENGINEER, B.A.Sc., M.E.I.C., P.Eng. (Ont.), aged 39, married with one child. Experience comprises 8 years on railway location and construction, track design and layout, subway layout, supervision of construction, and finally in charge of engineering maintainence of a division of 600 miles of track. Military service for 4 years as officer. Last 4 years and at present employed on railway inspection and arbitrating problems between railways and municipalities and detailed reporting of same. Has travelled through Europe and very extensively throughout Canada. Now desires position with engineering or architectural company on administration or with firm of solicitors advising on engineering matters or any other position where above experience would be an asset. Preferable location, Southern Ontario. File No. 4337-W.

GRADUATE CHEMICAL ENGINEER, Jr. E.I.C., 27, married 1 child, requires employment. Two years laboratory supervision experience in large chemical factory. Desires a position with wider scope of responsibility in laboratory or production. Location anywhere in British Columbia. File No. 4338-W.

GRADUATE CIVIL ENGINEER, Delft University. Age 35. Married. Experience in steel and concrete structures. Arriving Canada October, 1953. Seeks employment contacts. File No. 4339-W.

CIVIL ENGINEER, P.Eng., Jr.E.I.C. Age 25. Queen's 1951, experience includes 2 years of design and field work on construction and maintenance at Montreal Oil Refinery and 6 months of control and layout field work at Alcan Power House construction in British Columbia. Desires design and field work in concrete, steel and piping with firm in Montreal area. Available December. File No. 4340-W.

GRADUATE COMMUNICATIONS and electronics engineer, diploma U.H.F. techniques, Norway Institute of Technology, Trondheim, Norway. Experience: Europe, 2 years in communications work, transmitters, receivers, telephone equipment, etc. Canada: 2 years on test set design telephone circuitry, industrial electronics. Desire new position preferably in the U.H.F. or related field where possibilities are good for advancement. File No. 4341-W.

CIVIL ENGINEER, O.L.S., Jr.E.I.C., P.Eng. (Queens, 1951), desires to extend his experience in the municipal engineering field. Has worked since graduation with a consulting civil engineering and Ontario land surveying firm. Experience includes consulting for local improvements (field work, design and report writing), farm drainage, small concrete bridge design, filtration plant design, and all types of land surveys. Married, 1 child, has a car. Available on approximately 1 month's notice. File No. 4342-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Eng., power option, McGill 1950. Age 32, bilingual, single. Post graduate experience includes two year industrial training course and engineering salesswork with large electrical manufacturing company. Also possesses B.Sc. in physics and background of diversified experience. Presently following evening courses in business administration. Desires position with responsibility. File No. 4343-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., 31, married and presently employed by a consulting engineering firm. Experience consists of over 4 years in reinforced concrete design, structural design, and field work. Desires a position with complete supervision of design and/or field work with a real opportunity for advancement. Locality is no barrier. File No. 4347-W.

CIVIL ENGINEER, P.Eng. (Ontario). D.L.C. Hons. (civil engineering), S.E. I.C., age 22, single. Seeking a position entailing responsibility with a consulting or contracting firm dealing with hydro-electric power developments, oil fields or construction. Interests: economic studies design, construction, sales and research. Fully familiar with office procedure. Past experience with highway and general construction in England. Party chief on location surveys with department of highways of Ontario, and at present with consulting engineers on a hydro-electric power project. Prefer position offering advancement to an ambitious engineer. Excellent references. File No. 4348-W.

ELECTRICAL ENGINEER, U. of Alberta, 1951. Have 4 years communications and commercial radio experience prior to graduation; 2 years in heavy electrical manufacturing since. Graduate, Westinghouse Graduate Student Course. Have supervised assistants varying in number from one to three. At present manufacturing engineer in an industrial engineering department. Desire work of professioal calibre in Edmonton district. Hard work and responsibilities taken for granted. Can speak and write well. Salary desired, $5,000 or equivalent File No. 4349-W.

ENGINEERING EXECUTIVE, B.Sc. (Zurich, Switzerland), M.E.I.C., 35 years old, presently employed, having 12 years diversified industrial experience in Switzerland, Great Britain, United States and Canada which includes design of machinery, research work, development of domestic appliances, works management and general management including control of sales. Particularly interested in a position of chief engineer or works manager in machine, metal or appliance industry. Hard worker, energetic, accustomed to assuming responsibility. Location preferably Toronto area. File No. 4355-W.

QUALIFIED MANAGER, M.E.I.C., A.M.I. Mech.E., A.M.I.P.E., 16 years experience in U.K. Full apprenticeship tooling and production. Planning and control, plant and design. Sales and service. Bilingual. Managerial appointment sought in Montreal area. Minimum salary required $7,000 p.a. File No. 4356-W.

CIVIL ENGINEER, Jr.E.I.C., B.Sc., U. of A. 1951, married, age 29, experience in municipal engineering, also highway construction and some reinforced concrete. Would like permanent position in municipal engineering anywhere in Western Canada. File No. 4357-W.

CIVIL ENGINEER, McGill 1953, S.E.I.C., considerable construction experienice, seeks position in the construction field. Presently employed in non-construction work. Single, willing to work anywhere. File No. 4358-W.

CHEMICAL ENGINEER, 1945 graduate, M.E.I.C., P.Eng. (Ont.), with several years work in anodizing, lacquering, plating, plastic and metal-spraying, phosphatizing, electropolishing. Particular consideration of corrosion problems in the chemical, beverage, textile industry. Has practical experience in managing, as well as laboratory work in the field of analyzing and material testing. Did extensive research on chemical durability of lacquers and on adhesion of metals and paints on aluminum and steel. Desires a position in a plant or in a developing and research laboratory. File No. 4359-W.

CIVIL ENGINEER, M.E.I.C., with two years experience in Canadian structural design and detailing for industrial plants. 15 years broad and varied European experience as designer in structural, reinforced concrete and steel. Field and project engineer on foundations, bridges, harbour work, power and industrial plants, residential buildings, also cost estimating. Desire position where any past experience could be best utilized with contracting, consulting or operating company, preferably in Quebec, Ontario or Alberta. File No. 4360-W.

CIVIL ENGINEER, graduate 1950, Jr.E.I.C. Married with one child, age 29. 3½ years of experience with a structural steel fabricating firm estimating material and labor for structural steel and miscellaneous iron for buildings and also platework. Desires work with a firm with a future and opportunity for advancement. Available on one month's notice to present employer. File No. 4361-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.Sc. (Eng.), Man. 1949, age 25, single. Experience in steel fabricating design, welding and estimating. Complete familiarity with ASME and APJ codes. Desires responsible position preferably with petroleum industry in Winnipeg or immediate vicinity. Presently employed in Ontario. File No. 4362-W.

ENGINEER DESIRES design, development, or research work requiring limited travel. Experience with Dominion Government 4½ years on flood control, drainage, report writing; plus field experience, design and construction of small dams and sprinkler irrigation systems. B.S. degree in Agricultural engineering, 1949, University of Saskatchewan. Age 25. Married. File No. 4363-W.

CIVIL ENGINEER, S.E.I.C., P.Eng., Que., B.A.Sc., Toronto, age 28, married, presently employed. Seeks advancement, preferably in Southern Ontario. Have had limited experience in municipal surveys and planning, sewer design, construction and production. Also experienced in general plant engineering, structural steel and reinforced concrete design. Available on 30 days notice. File No. 4364-W.

CHEMICAL ENGINEER, M.E.I.C., M. of Sc. 1946, Denmark. Age 30. Canadian wife. Have worked in Canada since January, 1952, presently employed. Experience in petroleum products, and in

RESEARCH SUPERVISORS

Key positions with a future in our new, expanding, research laboratory are open to competent scientists. Applicants must have sound theoretical backgrounds and five years, at least, practical experience in:

(a) Natural and Synthetic Fibres—Paper

(b) High Polymers—Adhesives

They should have M.Sc. or Ph.D. degree in chemical engineering or physical chemistry and must be qualified to organize, plan, and supervise work of a group of men.

Replies will be held confidential. Submit personal résumé stating education and experience. Remuneration will be negotiated.

Write to:

The Director of Research,
Johnson & Johnson Ltd.,
2155 Pie IX Blvd.,
Montreal, Que., Canada.

vegetable oils for paint and varnish. Desires position with opportunities in product development or research. File No. 4365-W.

PRODUCTION ENGINEER, M.E.I.C., age 35, 1938 graduate, with successful record in plant management field. Extensive experience at responsible level in labour negotiations and all details connected with the operation of an independent production unit employing over 350 men, with special emphasis on the development of new production methods and machines to maintain maximum plant effort. Interested in position where creative ability and imagination coupled with a sound engineering background are required. File No. 4366-W.

CIVIL ENGINEER, B.Sc. (1949), Jr.E.I.C., age 31. Married. Bilingual. 4 years construction experience before and 2 years field engineering experience after graduation. Surveys, pipe line, railroad, highway, hydro, including earthworks, general construction, some office experience, R.C. design. Seeks position with responsibility. Location immaterial. File No. 4370-W.

ELECTRICAL ENGINER, B.Sc. (Hons.) 1941, St. Andrews University, Scotland, A.M.I.E.E., P.Eng., married. R.N. veteran. 3 years major oil company supervision maintenance and installation, 1½ years Canadian municipal utility in charge all electrical aspects. 2 years major electrical maufacturer in Ontario as applications engineer. Linguist, versatile, teaching experience, sound background, electronics and instrumentation, experienced in all aspects distribution, system studies, etc. Seeks job with greater responsibility, location secondary, available reasonable notice. File No. 4371-W.

MECHANICAL ENGINEER, 1950 graduate, Polish University College, London, age 31, married. Two years experience in diesel engine design and development, one year in water-tube boilers, and one year in industrial furnaces design. Also two years general machine shop experience prior to university studies. Seeks employment in Toronto in any engineering field, which offer a good opportunity for advancement. File No. 4372-W.

CIVIL ENGINEER, Man. 1948, Jr.E.I.C., age 29, married, 2 children, veteran. One year surveying. For past 5½ years worked on large diversification of milling and refining equipment and buildings for mining and smelting company whose plant has undergone expansion. Experience in layout, design and detail of refining plants, small mines, shops, warehouses, townsite and other works required for isolated location; estimating and preparing specifications. Could supervise drafting office but would prefer position offering responsibility and advancement to intelligent and personable engineer. Will accept position anywhere in Canada. File No. 4373-W.

YOUNG ENGINEERING EXECUTIVE, mechanical engineering graduate, M.E.I.C., P.E., of Alberta, age 33. Engineering experience, tool designing, design of pressure vessels, plate weldments, processing vessels and equipment. General experience; shop and field inspection, purchasing and sales. Executive experience, director and general manager of small steel fabrication plant (70 employees) located in Western Canada. Desires position requiring initiative, organizing, and supervisory ability. Anything offering future advancement in responsible position. File No. 4374-W.

WANTED IMMEDIATELY

SALES ENGINEER

Young mechanical (or civil) engineer, bilingual, with sales experience in—or good knowledge of—Diesel engines, road-building and municipal equipment required by important company for its Montreal sales staff.

This position provides an ideal opportunity for an engineer seeking a future in the heavy equipment sales field. File No. 4717-V.

ELECTRICAL ENGINEER, Jr.E.I.C., 28 years old, married. B.A.Sc. (E.E.), 1951-U.B.C., 2½ years practical machine shop experience, 2 years radio and radar RCNVR. 8 months preparing specifications for telephone power equipment. 2 years steel mill experience—design and layout of conduit and cable for strip mill equipment including the devising of electrical control and interlock circuits—design of power distribution system including main substation and low voltage distribution transformer vaults. Complete resume on request. Location no object. File No. 4377-W.

CHEMICAL ENGINEER, Jr.E.I.C., war veteran, 34, married. Experience includes two years supervision in a large chemical plant in Quebec. Desires employment on production or sales. Location preferred Southern Ontario. File No. 4383-W.

CHEMICAL ENGINEER, B.A.Sc., P.Eng. Graduated in 1950 from University of Toronto. Age 25, married with one child. Have excellent experience in time and motion study, methods study, cost control, and all phases of production. Presently employed as assistant plant superintendent in a small manufacturing concern in Ontario. Desires permanent responsibile position with good prospects for the future. Location anywhere in Canada. Available on reasonable notice to present employer. File No. 4384-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.A.Sc. 1952, war veteran, 31, single. Experience in production and instrumentation. Desires new position in engineering, development or instrumentation. Location: Ontario, Quebec. File No. 4385-W.

WAHLEACH, BRITISH COLUMBIA

Another Penstock job made easier with

DRESSER COUPLINGS

Lighter, high-yield steel pipe cuts tonnage, shipping, installation costs . . . speeds completion of 1760-foot Wahleach penstock.

Six weeks after construction began, this 70″ penstock—the fourth Dresser-Coupled installation made by the B. C. Electric Company—was ready to deliver water to a 75,000-kva power plant near Vancouver, British Columbia.

Eliminating extensive excavation, resilient gaskets in Dresser Couplings allowed the penstock to be deflected to the natural contour of the right of way. The lighter weight and longer lengths of high-yield steel pipe meant easier handling, fewer joints and anchors. A field crew of 20 men—with a minimum of skill, supervision and heavy equipment —*Dresser-Coupled 1,000 tons of steel penstock in 21 working days.* Under test, the line proved absolutely bottle-tight.

Dresser Couplings permitted faster completion of the line and assured permanently tight, maintenance-free joints. This resulted in *earlier revenue* from plant operation . . . *uninterrupted service* to power consumers.

Abave—Overbends made by 1° deflectians at each field jaint eliminated shap-made bends and special anchars.

Left—Faur men averaged less than faur hours making battle-tight joint . . . 975 psi warking pressure, 1500 psi shap test an cauplings.

Praject designed by B.C. Internatianal Engineering Ca., Ltd.
Penstack installatian by Arraw Transfer Ca., Vancouver

BE SURE you get a *better, faster* penstock installation. Put high-yield steel pipe and Dresser Couplings in *your* specifications.

FREE ENGINEERING DATA

Mail this coupon for interesting and infarmative engineering data an diversified Dresser installatians. It's file material that will be a big help next time you're designing a pipeline.

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Taranta, Ontaria, Canada

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News of the Branches

Activities of the Forty-six Branches of the Institute and abstracts of papers presented at their meetings

Corner Brook Branch

F. Tasker, s.e.i.c.,
Secretary

The Corner Brook Branch met on Tuesday, June 28, in the Engineering Department of Bowater's Newfoundland Pulp and Paper Mills, with Branch Chairman Eric Hinton presiding.

Financial matters were discussed, as well as the nomination of a representative to the Institute's nomination committee, the representative to be J. N. Franklin. A committee of three members, W. Smith, W. Hughson, and H. Carter, was elected and given the task of drawing up the Branch by-laws.

Mr. Hinton gave a short account of the convention in Halifax in May, describing it as a great success and a credit to the organizers. An entertainment committee was elected, and it was decided that its members, W. Read and L. Barron, would plan to organize a trip in July. The secretary was instructed to follow up the matter of the proposed joint agreement between the Professional Engineers Association of Newfoundland and the Engineering Institute.

Cornwall

L. H. Snelgrove, m.e.i.c.,
Secretary-Treasurer

John E. Pescod, jr.e.i.c.,
Branch News Editor

E.I.C.-A.I.E.E. Branches Meet

The first joint meeting of the Cornwall Branch E.I.C., and the St. Lawrence International Subsection of the American Institute of Electrical Engineers was held on the evening of October 13 in Cornwall.

J. R. Montague, director of engineering for the Hydro-Electric Power Commission of Ontario was the after dinner speaker. He has been associated with H.E.P.C. almost constantly since his graduation from the University of Toronto in 1914. After serving in various positions of increasing responsibility, he was appointed to his present post in 1948.

The speaker opened his remarks with a brief outline of the history of negotiations between the United States and Canada concerning the development of the St. Lawrence waterways for navigation and hydro-electric power. These negotiations date back to 1818 when a commission was appointed to report on navigation of the St. Lawrence system. At the present time, the New York State Power Authority has until November 5 to accept a license, granted by the U.S. Federal Power Commission, to co-operate with the Province of Ontario in the development of hydro-electric power on the International Rapids section of the St. Lawrence river.

Mr. Montague dealt in some detail with the various phases of construction and the types of generation and transmission equipment planned. The plans call for the first units of the power installation to be in operation within five years of the start of construction, the whole project to be completed within seven years. This estimate was based on the most economical schedule, that is without resorting to double shifts or weekend work. These plans are subject to approval by the U.S. entity, when appointed.

Mr. Montague voiced the opinion that the Canadian government would proceed alone with the navigation canal if the U.S. federal government did not enter into active participation in the project by the date of the acceptance of the power application by New York State. The total cost of the navigation and power phases of the International Rapids section was estimated to be $723,000,000, of which $623,000,000 would be for the power development.

John Morris, m.e.i.c., introduced the speaker and Lawrence Pries of the A.I.E.E. thanked him. The meeting was co-chaired by John Hawkes, chairman of the E.I.C. Branch and C. I. Bacon, chairman of the A.I.E.E. subsection.

Edmonton

P. M. Butler, jr.e.i.c.,
Secretary-Treasurer

K. Provost, m.e.i.c.,
Branch News Editor

Fall Season Begins, October 14

The Edmonton Branch opened the season's activities with a dinner meeting attended by about 130 Institute members and their guests.

Edmonton's new million dollar West End bridge was the after dinner topic of two prominent local engineers. L. F. Grimble, chief bridge engineer of the Alberta Department of Highways, described the bridge which is to be of reinforced concrete construction with five spans of about 146 feet each and two 110 foot approach spans. Factors affecting the choice of the bridge location, which had been the topic of considerable controversy throughout Edmonton, were also discussed by Mr. Grimble.

Dr. R. N. McManus, assistant professor of civil engineering at the University of Alberta, who directed the design of the bridge, followed Mr. Grimble's address with a description of the design techniques used and told of the unique features of this bridge which is designed as two bridges each having a 22 foot roadway and 5 foot sidewalk. The two roadways will be separated by a 4 foot center strip which will house future service pipes and cables.

A lively question period followed the addresses.

Mr. C. A. Davidson ably expressed the appreciation of the meeting to the two speakers.

The meeting was presided over by E. K. Cumming in the absence of Norman Allison, branch chairman.

Lethbridge

R. D. Hall, jr.e.i.c.,
Secretary-Treasurer

Paul Harding, s.e.i.c.,
Branch News Editor

Field Trip to Spray Lakes Project of Calgary Power Ltd.

On Saturday, September 12, over 40 members, affiliates and their wives, visited the Spray Lakes Hydroelectric Power development as guests of Calgary Power Ltd. The party left Lethbridge by automobile Saturday morning and assembled at Eamon's Restaurant on the Banff Trail just outside Calgary. Tom Stanley, production superintendent and Giff Horspool, plant maintenance supervisor of Calgary Power met the group at Eamon's and conducted the tour through the project. Tom Crowder, operations supervisor, and Keith Cole, superintendent of the Spray Plant assisted Mr. Stanley and Mr Horspool.

The first stop was made at the Kananaskis plant some 60 miles from Calgary. This hydroelectric plant is one of Calgary Power's older generating stations and houses remote control equipment which completely operates the three plants of the Spray Project. A total of seven unattended hydroelectric plants will soon be remotely controlled from this station. By using the remote control apparatus, the three plants of the Spray are maintained by a total of six attendants. The attendants look after normal plant maintenance, working a day shift only and in an emergency can be called upon to operate any or all of the three plants.

Following the tour through the Kananaskis plant the party drove to Canmore where the tour through the Spray Project was made in buses. The buses travelled from Canmore over several miles of mountain road past the Rundle Plant, Spray Plant and North White-

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mans Dam to the Three Sisters Plant, and returned for a tour of the Spray station.

Throughout the tour, the construction features and operation of the project were covered by the Calgary Power Ltd. officials. The scheme of the project was to divert the Spray river from its natural course, and lead it while maintaining its elevation to a point above the Bow River where its drop could be concentrated in a short horizontal distance.

Before any construction could be started a system of access roads had to be constructed through the rugged and beautiful mountain terrain. The main dam, blocking the natural course of the river is 193 ft. high, 640 feet long at the crest and 1,030 feet thick at the base. This dam, like the others in the project is of earth fill construction and contains 1,117,000 cu. yds. of material.

The storage reservoir, contained by the main and control dams holds 190,000 acre feet of live storage. 4,800 acres of land had to be cleared of timber before the reservoir was filled.

The Three Sisters Plant, at the control dam operates under a maximum head of 60 feet and contains a 3,600-hp. turbine. From this plant water is carried through a canal and tunnel system to the Spray Plant.

Following completion of the main canal, which is built along the mountain side, a portion of the canal bank failed, and the gap was bridged by a tunnel through the mountainside.

Above the main generating station, the water is carried through a 2,200 foot pressure tunnel where it drops 905 feet to the Spray plant. The tunnel 7 ft. 6 in. in diameter, is concrete lined at the top end and steel lined for the lower 500 feet.

The Spray Plant contains a 62,000-hp. Francis type turbine, which is directly connected to a 47,500-kw. vertical generator. During the tour of this plant the remote control of the plant was demonstrated. The generator was taken off the line and stopped, then started up and resynchronized onto the bus by the operator at Kananaskis.

From the Spray station, water is carried in a canal to a point near the Bow River where it takes its final plunge through a 325-foot penstock to the 20,000-kva. Rundle Plant.

Total cost of the project was over $12,000,000.

The storage feature of the project will permit extra generation through three additional present plants on the Bow River, and eventually through eight plants on this river between Canmore and Calgary.

Following the tour the group were treated to a cocktail party and dinner in the Cascade Hotel in Banff by the Calgary Power Ltd. Following dinner, Mr. D. Cramer paid tribute to the hosts for their engineering achievement and expressed the thanks of the Lethbridge Branch for the enjoyable and educational tour.

Mr. Stanley thanked the group for their interest, and outlined the main points of interest in Banff and vicinity for the benefit of the newcomers to the resort.

D. Cramer Chairs Dinner Meeting

On October 24, 1953, the Lethbridge Branch held their first fall dinner meeting at the Marquis Hotel, with more than 50 people present. Mr. and Mrs. Brown entertained with a piano-violin duet, and after dinner a sing-song was enjoyed by the group.

A. L. H. Somerville, city manager for Lethbridge, was introduced by the assistant to the city engineer, E. A. Lawrence. As a former district airway engineer for the department of Transport, Mr. Somerville spoke on the North West Territories.

The North West Territories has an area of 1,300,000 square miles, as compared to Quebec with 595,000; Ontario, 412,000; B.C., 366,000; Alberta, 255,000; Manitoba, 246,000; and Yukon, 210,000. The muskeg of the north occupies approximately 90 per cent of the area. During the extremely cold weather, this muskeg acts as an insulation. This fact was used to advantage during the war, when the foundations for radio range towers were supported by stripping the muskeg to the desired depth. The permafrost which exists in the far north is prevented from melting during the warmer months by the muskeg. As soon as the radio range tower foundation is embedded, the muskeg is replaced to keep the warmer air from melting the

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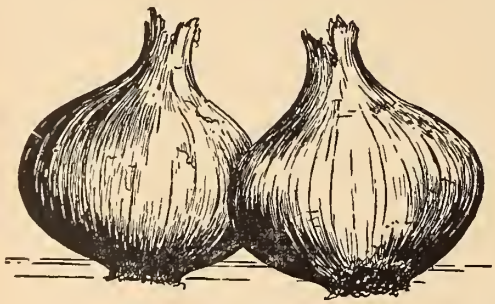

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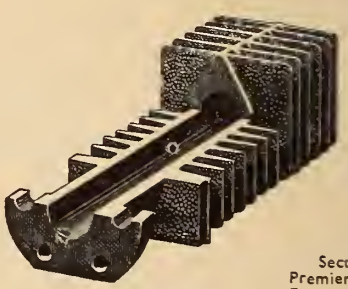

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A group of Lethbridge members and guests visit the Spray Plant of the Calgary Power Ltd.

permafrost, resulting in a stable structure. The radio range towers are still existing in the north country without any apparent settlement.

The population of the North West Territories in 1951 was 15,000. In 1918 this Territory was divided into the districts of MacKenzie, Keewatin and Franklin, for administrative purposes. The government is by a commission (Deputy Minister of Resources and Development) and a council of eight members, one of whom is the Deputy Commissioner. Of the eight, three are elected by the people of the MacKenzie district, and the other five are senior federal officials appointed by the government.

Mr. Somerville ended his talk by showing two home movie films portraying various phases of air, land and river traffic in the north country. P. E. Kirkpatrick thanked Mr. Somerville on behalf of the group for his very interesting and factual speech.

Left to right: D. Cramer, Branch chairman; T. D. Stanley of the Calgary Power Ltd., and R. D. Hall, secretary-treasurer of the Branch.

Montreal

R. J. Harvey, M.E.I.C.,
Secretary-Treasurer

S. T. Rudkin, M.E.I.C.,
Publicity Vice-Chairman

Plant Visit

On October 13, under the sponsorship of the Chemical Section, nearly one hundred members visited the petrochemical plant of B.A.-Shawinigan Limited—the only plant of its kind in the world—at Montreal East. This plant produces phenol and acetone from cumene, and, as its name suggests, is jointly owned by Shawinigan Chemicals Limited and the British American Oil Company. The group was conducted by R. E. Irwin, plant manager, and R. H. Hall, assistant manager, from the point of entrance of the cumene, through the various processes, to the shipping department, where tank cars and tank trucks are loaded with phenol and acetone, for distribution. These latter chemicals go into the manufacturing of hundreds of products, from nail polish removers to textiles, telephones, and radios. Meeting arrangements were by L. A. Phillips and H. G. Burbidge.

Hydraulic Research

On Wednesday, October 14, Dr. S. McNown, associate director of the Iowa Institute of Hydraulic Research and professor of Mechanics and Hydraulics at the State University of Iowa, gave a talk on the "Mechanics of Manifold Flow" to some thirty-five members at a meeting sponsored by the Civil Section. As hydraulic research consultant for the Bureau of Public Roads, and expert consultant, U.S. Corps of Engineers, Dr. McNown was particularly well qualified to speak on this subject, which is of timely interest with the start of the St. Lawrence Seaway project possibly close at hand. He outlined the program of research being carried on at the State University of Iowa, and stated that the development of the manifold flow system had allowed heads on locks to be increased immensely during the past few years. The rapid filling or emptying of locks, without extreme agitation of the water which might damage ships, is one of the major practical applications of manifold flow. The meeting chairman was Professor Carleton Craig of McGill University, and Raymond Boucher was in charge of arrangements.

Mechanical Section Meetings

On October 15, at a meeting chaired by R. A. Phillips and sponsored by the Mechanical Section, J. R. Houghton, superintendent of manufacturing engineering of the Northern Electric Company, spoke to a group of some eighty engineers on the subject "Engineering Problems in Production Development". He stated that there is a steady increase in the number of engineering graduates going into manufacturing concerns, where their knowledge may be applied in the fields of design, research, sales, and manufacturing. He stressed the value of competent technical knowledge for best results, and the necessity of keeping abreast, as much as possible, with technological development in the particular field concerned. Mr. Houghton outlined, in some detail, the problems involved in, first, the planning stage, and second, the development stage, in the putting into production of a new product, with particular emphasis on the role played by the manufacturing engineer. He stated that any production operation can be improved by the use of new equipment and techniques, and illustrated this point by a most interesting colour film showing old and

new methods of carrying out various specific jobs, with great savings in both time and plant space.

This important subject was further dealt with at a second meeting on November 3, which took the form of a panel discussion. In addition to Mr. Houghton, the panel consisted of W. W. Morrison, manager, Special Products Division, Canadian Marconi Company, A. H. Phillips, manager quality control, Continental Can Company, and Eric Burke, plant engineering, Canadian General Electric Company. These three experts dealt consecutively with costs, production schedules, and the need for a questioning attitude and the checking of all facts and assumptions. Members of the audience wrote their questions on blank cards, handed them upon entering, and these were discussed by the panel. Arrangements for both meetings were made by R. M. Freeman, and the second was chaired by E. S. Yuill.

The Electro-Chemical Industry

Under the chairmanship of O. R. Ball, a meeting sponsored by the Electrical Section was held on October 19. The speaker was George K. Dodd, development manager, Canadian Chemicals Division of the C.I.L., and his subject was The Electro-Chemical Industry—Its Present and Future. Some fifty members attended. Mr. Dodd described seven processes producing basic chemicals by the chemical action of electricity, and requiring significant quantities of power:-

1. The electrolysis of NaCl in diaphragm cells to produce commercial grade NaOH, chlorine and hydrogen.
2. The electrolysis of NaCl by the mercury cell process to produce rayon grade NaOH or sodium amalgam, chlorine and hydrogen.
3. The anodic oxidation of ammonium bisulphide to produce hydrogen peroxide. This process actually consumes only water and electric power.
4. The electrolytic production of sodium chlorate.
5. The electrolysis of water to produce oxygen and high purity hydrogen.
6. The electrolysis of fused sodium chloride to produce metallic sodium and chlorine.
7. The possible future electrolysis of surplus by-product HCl to recover the chlorine.

Mr. Dodd estimated that total power consumption for the above processes might reach 500,000,000 kwh. per year by 1960.

After an interesting question period, Norman Robinson thanked the speaker. Meeting arrangements were by A. J. Lawrence.

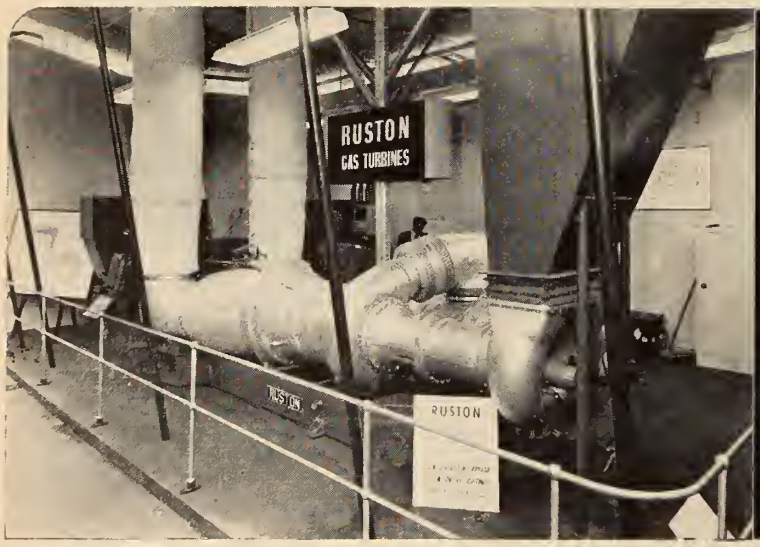
Ladies' Film Night

A standing-room-only audience of members, wives, and lady friends was on hand on October 22 for Ladies' Film Night, sponsored by the Special Section and chaired by R. A. Phillips. After an introduction by Paul Clark of ALCAN, an outstanding colour film entitled "Man with a Thousand Hands", produced by International Harvester Company with the co-operation of ALCAN, and based on the huge Kitimat project in northern B.C., kept the huge audience enthralled for almost an hour. With commentary by Raymond Massey, this splendid non-technical film, on one of the foremost engineering undertakings of this age, cannot be too highly recommended.

The "Packaged Plant" Debate

On October 27, the Management Section sponsored a most interesting panel discussion, before a large audience, on the controversial subject "The Packaged Plant or Divided Responsibility". With R. F. Shaw, vice-president, the Foundation Company of Canada Ltd., as moderator, the panel consisted of R. E. Heartz, president, The Shawinigan Engineering Company, Limited; A. S. Rutherford, vice-president, J. L. E. Price & Company; G. E. Sarault, consulting engineer, and R. H. Stokes-Rees, vice-president, Kaiser Engineering Division of Henry J. Kaiser (Canada) Ltd.

In debating whether an owner's interests are best served by employing one firm to design and another to construct, and whether anyone can assume responsibility for both and honestly follow his code of professional ethics, Messrs. Heartz and Stokes-Rees were on the side of the Packaged Plant, with



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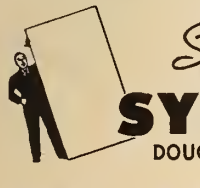

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Messrs. Rutherford and Sarault in favour of Divided Responsibility. Many potent arguments were put forth by each side, summarized by the Moderator, and the panel was then subjected to a barrage of questioning by the interested audience, with each member coming in for a fair share of the attack. R. B. Wotherspoon looked after both meeting arrangements and chairmanship.

Two Joint Meetings

The Chemical Section, in co-operation with the Society of Corrosion Engineers, were sponsors of a meeting held on October 29, attended by about 70 members, at which Mr. Robert Law, of the International Nickel Company, introduced and showed a film entitled "Corrosion in Action". This film was produced by International Nickel to promote an understanding of the fundamentals of corrosion, which takes an annual toll of some six billion dollars. It illustrates, by means of animated drawings, how corrosion takes place; what happens at metal surfaces under corrosive conditions, and what steps can be taken to reduce or eliminate, sometimes with relative ease and at low cost, at least a part of this terrific wastage of our resources. Mr. Law was introduced by the meeting chairman, Dr. Roger Brais, and thanked by O. R. Huggenberger. H. G. Burbidge was responsible for meeting arrangements.

The Electrical Section, in conjunction with the A.I.E.E. and I.R.E., were sponsors of a meeting held on November 2 at which J. E. Hayes, chief engineer, C.B.C., spoke on "Television in Canada".

Some one hundred members of the three societies were keenly interested in the future of T.V. in Canada, and especially in Montreal. Dealing mostly with the Toronto and the Montreal studios, Mr. Hayes illustrated, by means of slides, the complexity of equipment and set-up required to produce a T.V. program. With 100 kw. of lighting involved in the Montreal studio, ventilation becomes a problem, and a 200-ton refrigeration unit is required to overcome it.

The amazing growth of T.V. in Canada is indicated by the figures that show 30,000 sets in use in 1950, mostly in Southern Ontario, as compared with an estimated 450,000 by the end of 1953. The seven C.B.C. transmitters now in use or under construction, together with fourteen private transmitters in operation or under construction, will give Canada a coverage of about 75 per cent of her population, and make her the world's second nation in terms of T.V. transmitters in use. Mr. Hayes stated that Montreal's second station, with nearly twice the power of the first, may possibly be in operation by the end of 1953, and allow for simultaneous broadcast of French and English shows. The capital investment in receivers is about forty times as great as in transmitting facilities, and an industry of 20 firms, employing 10,000 people, has sprung up.

Mr. Hayes was introduced by A. F. Branscombe, and thanked by Alan B. Oxley. Meeting arrangements were made by J. Lawrence.

Saguenay

C. C. Louttit, jr.e.i.c.,
Secretary-Treasurer

Three Groups Meet

A joint meeting of the Saguenay Branches of the Chemical Institute of Canada, the Engineering Institute and the Corporation of Professional Engineers of Quebec was held on Tuesday, October 27, at the Aluminium Laboratories Ltd. auditorium, Arvida.

E. A. Woods, chairman of the C.I.C. Branch, opened the meeting and introduced Mr. Lavoie, manager of the Arvida Branch of the Bank of Montreal. Mr. Lavoie presented the speakers, Mr. M. Forget and Mr. A. V. L. Mills, joint managers of the Business Development Department, Royal Trust Company, Montreal.

Mr. Forget spoke on the subject "A Will of Your Own". In his introduction Mr. Forget pointed out the general need of a will and how a well executed will could perpetuate the results of a man's life labours to the benefit of his heirs. Of historical interest, the speaker pointed out that as early as 1662 in the Prayer Book of Charles II there was a passage concerning visiting the sick which directed that a sick person was to be asked if he had arranged the disposition of his worldly goods and to declare all his debts so that his executors could better attend to his estate.

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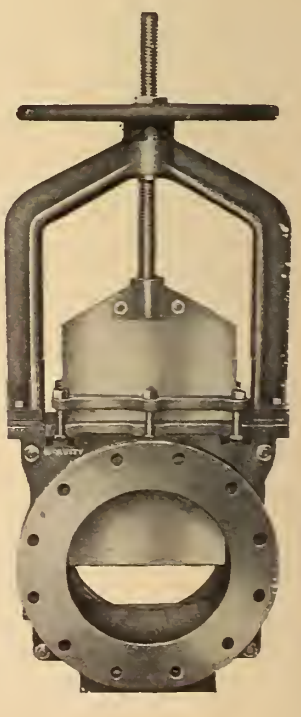

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example Mr. Forget pointed out that if a man dies intestate in the Province of Quebec leaving a wife and children, the wife would collect 1/3 of the estate while the children would collect the remaining 2/3. If there were no children she would still only collect 1/3 with the other two thirds being distributed between mother and father, sisters, brothers and nephews and nieces. This may not have been what the man had desired at all. The laws covering the disposition of a man's estate have to be inflexible and can not and do not differentiate between heirs according to need but by relationship only. The second reason is to insure proper administration of the estate by competent people. If the executors are not named management of the estate may fall into the hands of undesirable people with drastic results. The third reason is to ensure the continued protection of the heirs after death. In this respect a trust company can be of great benefit. Having wide experience in the handling of estates trust companies can usually save the heirs much money in legal fees, unnecessary taxes and the like. Appointment of a trust company as executor, or as co-executor with a relative, has the following advantages: 1) permanence—an individual as an executor may die; 2) financial responsibility —a guarantee of the maintenance of assets; 3) wide experience in making investments; 4) group judgment; 5) facilities of keeping proper records and for issuing proper reports. A point to consider in appointing executors is whether or not to give them the power to invest in other than trustee type investments. Trustee investments are limited to government bonds, first mortgages of not more than 50 per cent of the municipal valuation of the property and other similar investments. This may mean the difference between allowing your heirs to receive 3 or 4 per cent and 6 per cent.

Mr. Forget then gave the differences between the three types of wills recognized in the Province of Quebec. A holograph will is one written entirely in the testator's handwriting and signed only by himself. This will must be probated. An English Will is one that is not necessarily in the testator's handwriting but is signed by the testator before two witnesses who also sign the will. This will must also be probated. A notarial will is similar to an English will except that it is drawn up by a public notary and signed by the testator and witnesses before the public notary. This will does not need to be probated. Mr. Forget recommended that in moving from one province to another a person should have his will reviewed to be certain that it still is in order. For example a notarial will cannot direct the transfer of title of real estate in the Province of British Columbia.

Mr. Mills presided over the question

The Candid Camera at the Montreal Branch Oyster Party, November 6

and answer period that followed. A wide variety of questions were asked touching on the following points: how a person's domicile is determined and its affect on wills—representative fees charged by a trust company for its services—trust company's part in aiding the correct drawing up of a will—wills to cover the accidental death of both parents at the same time—effect of a marriage contract—succession duty rates in the Province of Quebec and other provinces, etc.

F. A. Dagg, vice chairman of the Saguenay Branches of the E.I.C. and the C.P.E.Q., thanked the speakers for a highly informative and entertaining talk and all present joined Mr. Dagg in a hearty vote of thanks.

Saint John

J. A. B. Brenan, M.E.I.C.,
Secretary-Treasurer
H. McCleave, M.E.I.C.,
Branch News Editor

Television Is Discussed

Saint John's television transmitter will cover a much wider area than had originally been forecast, according to J. G. Bishop, M.E.I.C., chief engineer of CHSJ-AM-FM-TV who spoke to the members of the Saint John Branch.

Introduced by A. A. Turnbull, Mr. Bishop talked about the planning and construction of the station which is expected to be on the air in March with a variety of filmed Canadian and American shows.

From the studios in downtown Saint John the program will be transmitted by micro-wave link to Mount Champlain where the full transmitter facilities will be located. Because of the remarkable location of this mountain, large parts of New Brunswick, Nova Scotia and Maine will be able to receive the programs.

Mr. Bishop then spoke of the technical aspects of T.V. and showed a film, "Sight-Seeing At Home".

On behalf of the members F. L. Dory thanked Mr. Bishop. The meeting was held on October 28 at the Admiral Beatty Hotel with Chairman A. G. Watt presiding.

Sudbury

George Fleming, M.E.I.C.,
Secretary-Treasurer
T. C. Robertson, M.E.I.C.,
Branch News Editor

Algoma Steel Engineer Is Speaker

The Sudbury Branch of the Engineering Institute of Canada held its second dinner meeting of the current season at the Sudbury Granite Club on November 5, 1953. After the business meeting, A. J. F. McQueen of Algoma Steel Company was introduced by Mr. Jim Smith. A graduate of Toronto University, Mr. McQueen continued his education by taking a test course in electricity at Schenectady. Thereafter, he confined himself to the steel industry and is now electric superintendent of Algoma Steel.

Few people, stated Mr. McQueen, realize the importance of steel in our present civilization. Had it not been for steel, man would not have been able to advance very far from the stone age. Almost every article used by us today is partially made of steel or at least requires the use of steel at some stage in its manufacture. The industry is "big" because large quantities of material have to be handled and heavy machinery is required throughout. The actual process itself is relatively simple but involved inter-relationships between the various components actually make it quite complicated.

The making of steel resolves itself into four major operations, coke making, pig iron production, refining of the iron to steel and finally rolling into required shapes. Large quantities of coke are required in the process and this is made in coke ovens which are long narrow brick chambers spaced so as to allow for heating. The coke ovens consist of 6 batteries of from 53 to 82 cells each. The cells themselves are approximately 18 in. thick, 13 ft. high and 40 feet long. A battery is charged with coal, sealed from the air and heated until the volatile materials are driven off. The cells are then opened and the red hot coke pushed into cars for quenching to halt combustion which occurs as soon as contact with air is made.

Some idea of quantities involved were cited from memory by Mr. McQueen. 5,400 tons of coal per day yield 3,800 tons of coke per day and 11,000 cu. ft. per ton of coke oven gas. This would be used to produce about 3,000 tons of pig iron. As the coal is brought

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in by boat upwards of a million tons of coal must be stored to carry over the winter months. About 80 per cent of the coke produced is used in the blast furnaces, some of the remaining 20 per cent is used in the sintering plant to pelletize iron ore dusts, and the rest is sold. The coke oven gas produced is largely used in the process but many by-products are obtained such as tar, ammonium sulphate, perodyne and napthalene.

As in the order of 4½ tons of air are required to produce one ton of pig iron large blowers are employed to furnish the air for the blast furnaces. A blast furnace, 20 feet in diameter and 100 feet high, is charged with the correct mixture of coke, limestone and ore and the charge burned with air. The pig iron is later tapped off and about half is cast into molds to be sold. The other half is transferred to open hearth furnaces hot where impurities such as carbon, silica and magnesium are removed and any necessary additions are made. The operation at Algoma used 5,600 tons of ore per day which is mostly shipped in by boat. Thus as in the case of coke the ore must be stock piled. Over a million tons of ore must be stored each year.

In the open hearth furnaces the manufacture of steel becomes an art rather than a science as the best possible formulae must yield to the skill of an experienced steel maker. These furnaces are charged with about ½ pig iron and ½ scrap and fired from the ends with a mixture of coke oven gas, tar and fuel oil, the proportions being a matter of controversy—coke oven gas for economy and fuel oil for better steel making. The blast furnace is a batch process and the size of the furnace is stated as the number of tons of steel produced in one batch. The steel from the open hearth furnaces is poured into ingots. These are generally of two sizes, 22 in. by 26 in. by 5½ ft. and 22 in. by 42 in. by 5½ ft.

The ingots are removed from the molds while still hot and placed in the soaking pits before being transferred to the blooming mill. This is the point where steel making becomes a mechanical rather than a metallurgical problem. The blooming mill is a huge set of rolls, 46 in. in diameter, through which the ingot is passed back and forth and reduced in size to approximately the dimensions 8 in. by 10 in. by 30 ft. The steel bloom thus formed is cut into suitable lengths, reheated and rerolled in one of various other mills. A 25 in. billet mill rolls rails and beams. The 18 in. and 24 in. merchant mills roll angles, beams, channels, hexagons, squares, rounds and flats. The structural steel mill rolls various structural shapes, an interesting one being the sheet steel piling used to replace the wooden piling formerly used. The cold roll mill under construction will be used to roll sheet material thereby adding desirable properties to the product.

As would be expected, much noteworthy auxiliary equipment is required and Mr. McQueen touched on some of the highlights. The transportation system includes 65 miles of track, 14 diesel-electric locomotives (80 to 115 ton), over 320 railway cars, 17 hoists. A boiler plant produces 8 million lb. of steam per day. Four emergency power generators, 1,500 kw. each, are powered by enormous coke oven gas engines in case of power failure. The 4,000-hp., d-c reversing 35 inch blooming mill drive motor is fed by 2 generators driven by an 1,800-hp. motor. There is, of course, a very large flywheel required and it is interesting to note that the 42 ft. 10 in.-long shaft was imported from Germany. While this installation was made in 1910 the set is still modern. The bar and strip mill has 18 separate drives totalling 15,000 hp. and ranging in size from 1,750 hp. to 250 hp. These are d-c motors and must operate at properly synchronized speeds so that the increased length of iron due to the reduction in size can be accommodated.

In closing, Mr. McQueen stated that the steel industry must and is continually striving to increase production, efficiency and diversity so that the needs of man can be met and further advances made.

After a question period Frank Orange extended the thanks and appreciation of the gathering for a most interesting talk.

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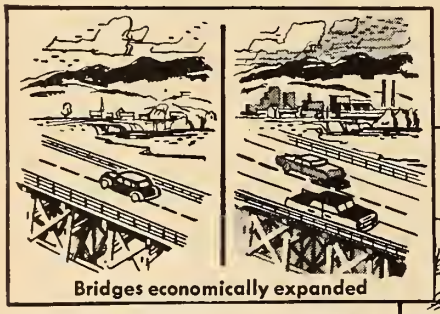
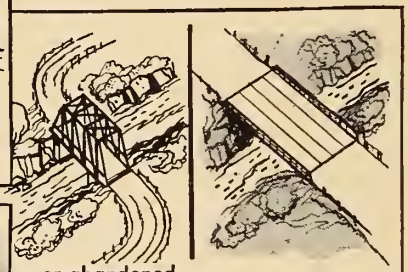
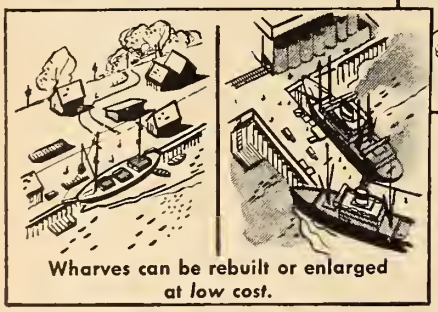


Bridges economically expanded



—or abandoned with materials salvaged.



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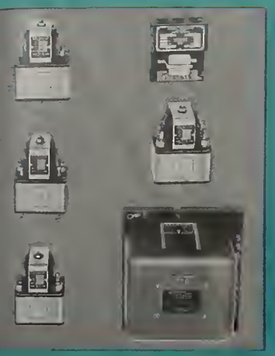
P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer

Fall Program Commences

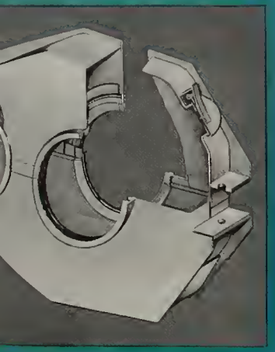
The Fall Program of the Victoria Professional Engineers opened on October 23 with the joint meeting of the B.C. Association of Professional Engineers and the Engineering Institute of

% MORE HORSEPOWER UP TO 15% HIGHER TRACTIVE EFFORT * LONGER MAINTENANCE CYCLE * LOWER MAINTENANCE COSTS



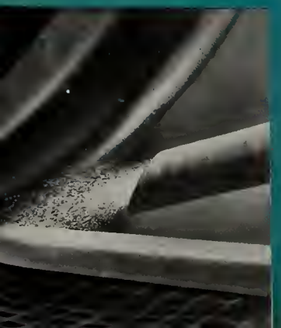
NEW CONTROL APPARATUS

Electrical control apparatus in the new General Motors locomotives is greatly simplified through the use of newly developed contact materials, and simplified motions which eliminate joints, bearings, complicated linkages and flexible shunts. The new controls, all designed for six-year maintenance-free operation, include: (1) totally enclosed interlocks; (2) new battery field, shunt field and battery charging contactors; (3) new motor shunting contactors; (4) parallel relay; (5) new starting contactors; and (6) solid cam switch contacts.



NEW SEALED GEAR CASE

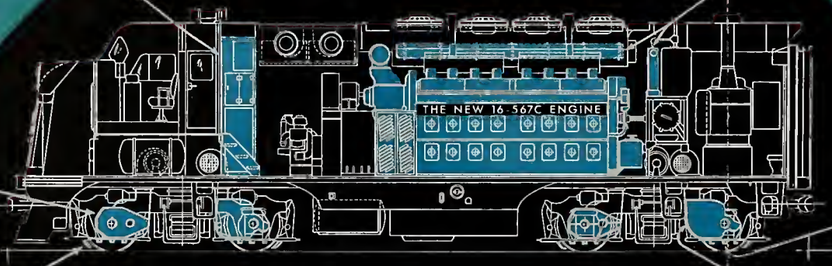
A completely redesigned traction motor gear case, with a new stable lubricant, will further reduce maintenance costs on the new General Motors locomotives. In experimental tests, this new case has run for more than a year in heavy service without the loss or addition of lubricant. Barring damage to seals, this new gear case can go at least ten times as far as the previous model without requiring change or addition of lubricant.



NEW AUTOMATIC WHEEL-SLIP CONTROL

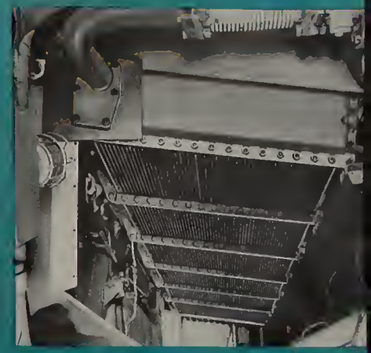
New and improved wheel-slip control in all F9, FP9 and GP9 road units results in marked improvement in operation of the locomotive under slipping conditions and at the same time reduces sanding requirements. The system consists, first, of a sensitive creep relay which anticipates slipping and automatically actuates the sander, and, second, an unloading device which automatically reduces power from main generator to traction motors during wheel-slip and then gradually reapplies the power under controlled conditions to effect maximum utilization of available adhesion. In addition to more effective utilization of increased power and tractive effort, these developments further reduce electrical maintenance by eliminating severe shocks caused by uncontrolled wheel-slips.

Plus these 6 Great new features!



INCREASED COOLING CAPACITY

In the new locomotive units where the higher horsepower capacity of the 16-cylinder 567C engine is utilized, engine cooling capacity is increased. Six-inch radiator cores are installed on F9, FP9 and GP9 for increased water cooling, with necessary modifications of hood and hatch arrangements to accommodate the larger capacity. In the SW9 model, cooling fan speed is increased. A new and larger oil cooler, with a 14-fin core replacing the 10-fin core, is installed in F9, FP9 and GP9 for increased oil cooling.



NEW BRAKE RIGGING STABILIZER

A newly developed stabilizer, added to the clasp-brake rigging on F9, FP9 and GP9 models, eliminates lateral play in this linkage to extend life and reduce maintenance of this equipment.

NEW TRACTION MOTORS

Improvements in stator insulation, with a new moulded coil which seals out moisture, permit another substantial increase in traction motor ratings with elimination of short-time ratings in most applications. Along with improvements in electrical performance and mechanical reliability of the field coils, mica in the armature coil pad has been entirely replaced with "Teflon"* a new material with a remarkably low coefficient of friction, which reduces chafing. With these developments, both stator and armature of the new D-37 motor can operate at higher ratings with lower temperatures than the D-27 motor. This means longer life and less maintenance with fewer removals for dipping and baking. The D-37 motor also incorporates the recently developed sealed lubricant armature bearings and a new moulded polyester glass insulated brush holder which can withstand flash-overs without damage.

*Trade-mark for Du Pont tetrafluoroethylene resin

BRINGING GREATER VALUE . . . RIGHT DOWN THE LINE . . . THROUGH ALL 6 NEW GENERAL MOTORS LOCOMOTIVES

Product development with General Motors locomotives is a continuous process. New improvements are constantly incorporated in the regular locomotive manufacture as a matter of course with constant increase in quality. But now, the changes in strategic components throughout the entire line of General Motors locomotives, applicable at one time, add up to such major improvements in the capabilities of the locomotives that they necessitate the designation of a whole new series of models.

The improvements bring new and higher standards of performance with longer life and substantial reductions in maintenance.

Standout features of these new locomotives are highlighted here. Culmination of years of engineering development, these basic advancements have been proved through millions of miles of testing. Together, they add up to better quality and greater value in every General Motors locomotive.

The new F9, FP9 and GP9 models — with ratings of 1750 horsepower and higher tractive effort — will haul more tons as fast, or the same tonnage faster, than their famous predecessors.

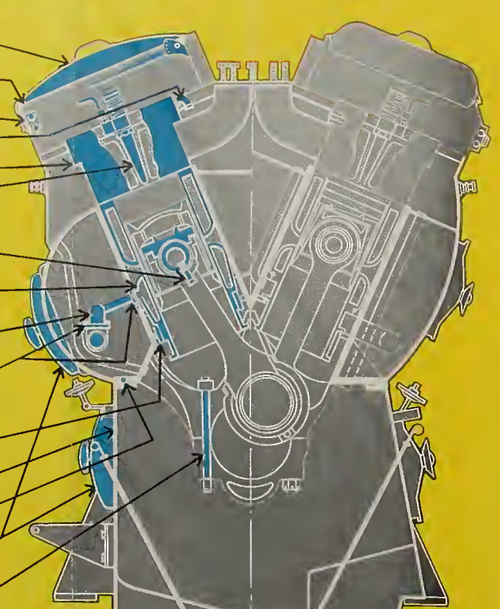
The switching locomotives — with the new higher-powered SW900 coming between the 600- and 1200-horsepower units — more efficiently meet all yard, terminal and transfer requirements.

Moreover, the improvements contributing to longer life and reduced maintenance of all the new locomotives are designed, wherever possible, to be applicable to existing equipment as well.

WITH A NEW MORE POWERFUL ENGINE

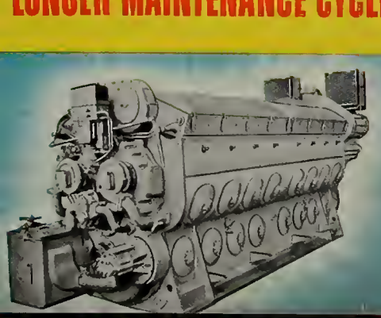
Look at these new developments!

567C 567B



1. Hinged, sealed covers for easier inspection, provided with adjustable support
2. Synthetic rubber seal designed to prevent oil leaks
3. Heavier cover frames and enclosed fuel lines
4. Upper water jumper from cylinder head
5. New cylinder head
6. Increased capacity injector
7. Trunnion-type piston pin and carries increase wrist pin bearing area
8. Redesigned cylinder liner with extended water jacket, closed at bottom
9. Lower liner seals eliminated through use of replaceable water inlet manifold with metal jumper line to each cylinder liner
10. Gasketed saddle mounting of jumper to manifold. Small "O" ring seal at flange connection to liner
11. Replaceable wear ring between liner and stress plate — eliminates wear on crankcase liner pilot bore
12. Entirely new strengthened crankcase and oil pan
13. Silicone seal between crankcase and oil pan replaces flat gasket for more positive oil seal, metal-to-metal contact
14. Improved hand hole covers and seals
15. "A" frame bolts used in place of studs for easy removal

LONGER MAINTENANCE CYCLE * LOWER MAINTENANCE COSTS



The New 567C

16 cylinder 567C General Motors Diesel Engine — 1750 h.p. for propulsion @ 835 r.p.m.
Powers new F9, FP9 and GP9 locomotives.
Also — 567C — 6 cyl. — 8 cyl. — 12 cyl. for SW600, SW900 and SW1200.

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in Canada

GP9 — 1750 H.P. General Purpose Locomotive

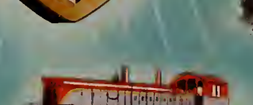
F9 — 1750 H.P. Heavy Duty Freight Locomotive

FP9 — 1750 H.P. Heavy Duty Freight and Passenger Locomotive

NEW POWER FOR THE *Nation's Economy*

SW600 — 112-Ton Switching Locomotive

SW900 — 115-Ton Switching Locomotive



SW1200 — 125-Ton Switching Locomotive

*R*ight down the line, through all six great new General Motors Diesel Locomotives, these major improvements mean greater value, new, higher standards of performance, combined with longer life and substantial reductions in maintenance.

GENERAL MOTORS LOCOMOTIVES

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Canada. There was a large attendance for the first meeting of the year and the speaker was R. L. I. Fjarlie of the Pacific Naval Laboratory and formerly of the Pacific Oceanographic Group in Nanaimo.

Mr. Fjarlie's subject was "Oceanographic Methods and Instrumentation". There was a display of oceanographic equipment including reversing thermometers, water sampling bottles, bathythermographs and an electronic depth measuring instrument.

The first part of the illustrated talk was devoted to a description of the various types of ocean currents in the world, and the problems involved in measuring the temperature and pressure variables which cause these currents were discussed. Following this, the apparatus on display which had all been developed at the Pacific Oceanographic Group and the Pacific Naval Laboratory was described.

Mr. Fjarlie concluded with an account of the work which he did in determining the circulation of waters in and around the Fraser Estuary and Vancouver Harbour for the Vancouver and District Joint Sewerage and Drainage Board. This study was carried out for the purpose of designing an expanded sewerage system for the Greater Vancouver area which would eliminate all the pollution problems which now exist in the recreational districts around Vancouver.

In the course of a lengthy question period Mr. Fjarlie pointed out that the services performed by the Pacific Oceanographic Group were available to all municipal engineers who were concerned with sewage pollution of recreational areas.

Winnipeg

C. S. Landon, M.E.I.C.,
Secretary-Treasurer

Electrical Section

G. Flavell, Jr.E.I.C.,
News Editor

The first meeting of the new season for the Electrical Section of the Winnipeg Branch took place on October 1 when Paul Shane, system supervisory engineer for the Manitoba Power Commission, discussed the methods of protection against single line-to-ground faults on Delta connected or isolated neutral long high voltage lines.

Mr. Shane pointed out that in the early days of their system Delta connections provided the greatest continuity of service, but at that time, single phase fault to-ground did not usually trip the circuit breakers, and the faults were left until they were located and repaired. However, as the network grew it became necessary to clear ground faults automatically.

For the Manitoba Power Commission's system three methods of ground-faults protection were investigated:

1. *Grounding Banks*—The use of three phase "zig-zag" connected auto-transformers, or Star primary, Delta secondary transformers, as grounding banks at suitable locations on the network to provide the equivalent of a solidly grounded transmission network. Standard residual ground fault current methods could then be used. However, because of the size of grounding transformer banks required, this method was economically unsound.

2. *Unbalance Current Relaying*—In this method, although the unbalance of current shows between the faulted and unfaulted lines, there is no descrimination between two or more lines off the same bus and there is the possibility of lines other than the faulted ones being taken off service. Mr. Shane pointed out, however, that one such installation on their system has proven very satisfactory.

3. *Directional Ground Relaying*—By using the residual current obtained from the neutral of Star connected line current transformers in conjunction with a directional relay, a selective relaying scheme can be applied.

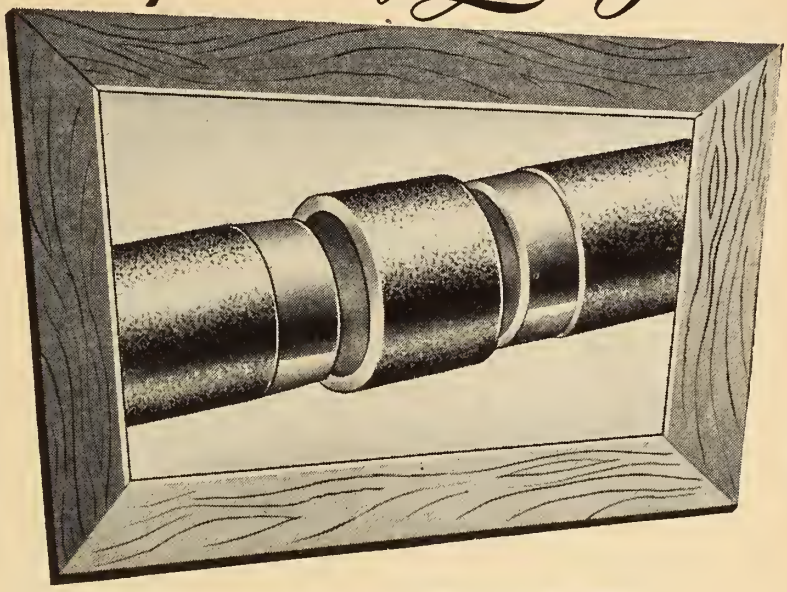
Mr. Shane suggested methods of network relaying used on various types of networks for directional relaying schemes, including the use of secondaries of Star connected potential transformers connected "open-corner-Delta" and Hi-pot couplers.

He explained the application of these methods of relaying, showing their use on certain types of networks.

At the present time, the Manitoba Power Commission have seven installations at 66 kv., installed since early 1952, and one installation at 33 kv., completed in late 1952, covering a network of over 900 miles. Since these installations they have recorded 79 faults, only 6 of which were permanent. Furthermore, they are no longer experiencing secondary faults occurring at other points on the network.

M. D. Young expressed thanks to the speaker for a very interesting evening. The length of the discussion following indicated the interest shown by attending members.

a picture of Quality



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Tough, durable and ductile, No-Co-Rode *Perforated* Pipe provides efficient, trouble-free distribution throughout the field area. Snap couplings prevent soil or silt entering at the joints, and keep the pipe in alignment during ground movement from frost action.

No-Co-Rode Pipe is supplied in long lightweight lengths — and provides Quality and Permanence at lowest cost.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Radio and television announcing. L. D. Barnhart. New York, Prentice, 1953. 283 pp., $6.65 (U.S.).

"The profession of radio and television announcing, like the industry itself, is a bouncing infant, and, like Topsy, it has 'just growed'."

The introductory chapter to this volume discusses speech and individual style of announcers, the need for individuality combined with the ability of working under supervision, and the very great importance of showmanship and air personality.

Educational qualifications are also stressed, personality factors in each individual, mental faculties, and physical equipment, the need for general knowledge, and recommended courses.

Reading ability is a thing that is generally taken for granted once a person has passed through grade school. Unfortunately, however, some people never learn to read for certain jobs, notably of course in this volume, for that of radio announcing. This is thoroughly discussed, including the art of communicating emotion to the proper degree, and the complicated mechanics of reading.

The necessity of dealing directly with people in every announcing job presents the consideration of personal appearance, business sense and acting ability, all of which are dealt with in the chapter "Personality factors", which is followed by a section setting forth the desirable qualifications for a television announcer.

The woman announcer is briefly dealt with in one page, but that one page is illuminating; and program types seems to cover and discuss every kind of entertainment one has ever heard on the radio.

The two sections, Pronunciation and Musical Appreciation, strike us as a horrible example of "culture in a nutshell", or the reading of digests of books to attain that social stature in the drawing room so beloved by advertisers. However, there is some information there, and it is all useable.

The latter three quarters of the book are taken up with examples of typical network announcer auditions, and will be of use to anyone comtemplating a radio career.

A two-page classified bibliography is an invaluable addition to this book, in itself of great interest to anyone with ideas along this line.

EMILY KEELEY

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Coastal engineering; proceedings of the third council, Cambridge, Mass., October, 1952. J. W. Johnson, ed. Berkeley, Council of wave research, Engineering Foundation, 1953. 343 pp., illus., $4.50 (U.S.).

A symposium by eminent workers in the field of hydraulic engineering, this volume is the result of a conference sponsored jointly by the Council on Wave Research and the Massachusetts Institute of Technology, with support from the Northeastern Section of the American Society of Civil Engineers, the Boston Society of Civil Engineers and the Boston Section of the American Society of Mechanical Engineers.

The work is roughly divided into four sections, namely, Basic oceanographic information; Coastal sediment problems; Design of coastal works; and Case histories of coastal projects.

Both diagrammatic and photographic reproduction illustrations are excellent and bibliographies with most of the papers add considerably to the value of this publication.

Conference on soil stabilization proceedings. Boston, Massachusetts Institute of Technology. 1952. 311 pp., illus.

The presentation of information contained in a collection of papers read at a symposium is a difficult one. However, the chief thing to note is that these papers are on all forms of soil stabilization, not soil sampling.

Stabilization by admixture, chemicals, chrome-lignin and ion exchange, bituminous, slope, field, and intrusion methods are discussed, as well as the effect of compaction on soil properties.

Mechanical and commercial methods and equipment are treated in four papers, and two papers deal with the incorporation of admixtures with soil.

Specialized uses for stabilized soil, as, for example, highways, airports, dam and

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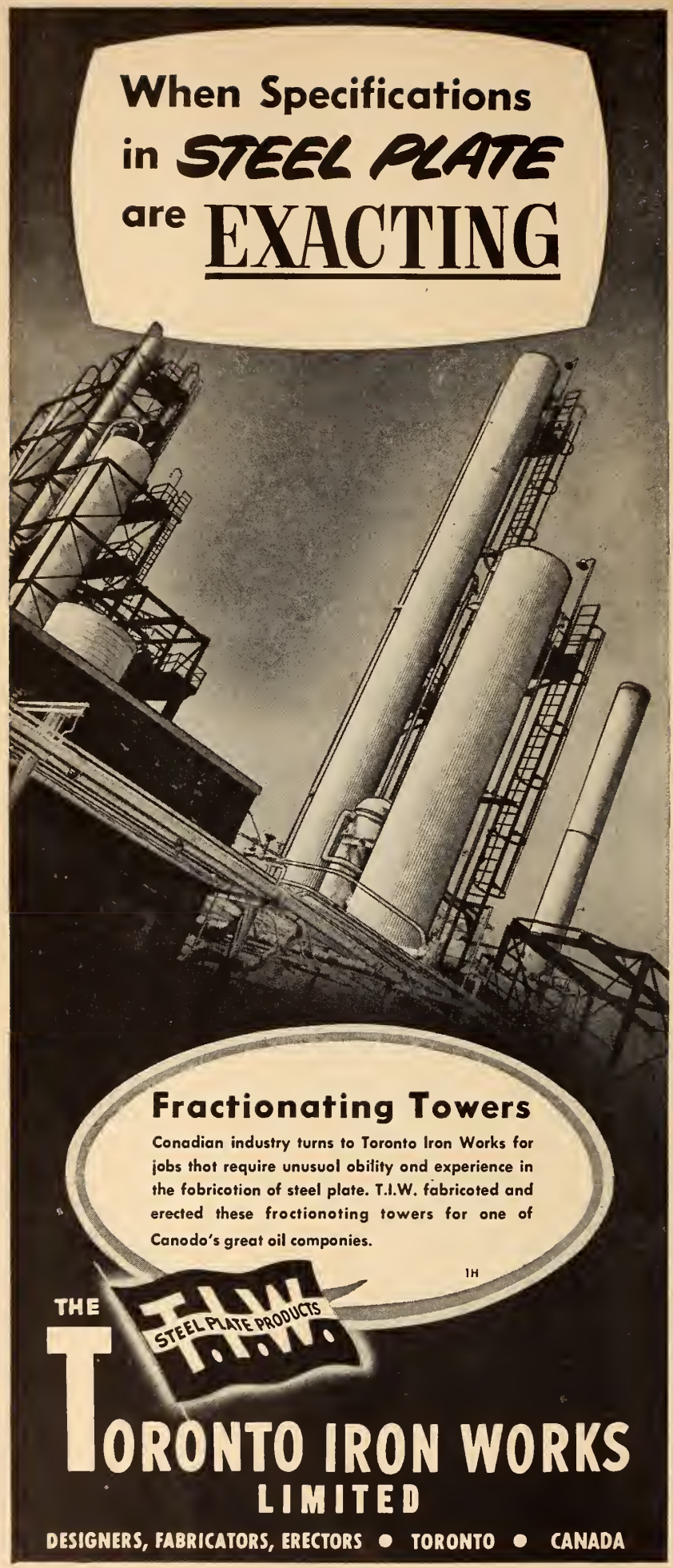

building foundations, and various other military and civil engineering requirements are included, and the whole conference is summarized by T. Wm. Lambe, associate professor of Civil Engineering and director of Soil Stabilization Laboratory, at Massachusetts Institute of Technology, when he states the "main purpose of this conference, was to assess the state of soil stabilization and to suggest its future. The author feels that this objective has been fulfilled to a large extent."

Detailed bibliographies are included with most papers.

The dimensioning of engineering drawings. W. Abbott. London, Blackie, 1953. 186 pp., figs., $2.00.

When interchangeability is a paramount requirement of drawings for engineering components in their finished state, the fundamental principles of this interchangeability are to be found in this volume. Its primary concern is with the distribution of tolerances previously decided upon, rather than the determination of these tolerances.

British Standard number three hundred and eight, is the basis of the fundamental principles involved, and the author has for some years been on this standard committee.

Symbols Mr. Abbott leaves to the standardizing authorities, but he has used letters to represent dimensions, capitals for basic, and lower case for tolerance.

The book carries both a bibliography, and an index, and is prepared primarily for maturer engineering students who have had some practical experience in industry.

The electrical manufacturers, 1875-1900. H. C. Passer, Cambridge, Harvard. Toronto, Saunders, 1953. 412 pp., illus., $8.00.

The author has limited his study of the electrical manufacturing industry to 1875-1900 because important activity in arc lighting did not begin until the former date, whilst by the end of the century the pattern of development in the industry was more or less determined. He also found that the leading electrical manufacturers were willing to release very few of their business records pertaining to this century. The three divisions of the book—arc lighting, incandescent lighting, and electric power—correspond to the historical order of the inventions on which the industry is based. The organization of each section is similar: there is first a brief description of the technical development of the equipment, and the potential market for it; then follows a discussion of engineer-entrepreneurs and their activities, both the failures and the successes. Following this are sections on the growth of the individual firms, and the relationships between them.

Mr. Passer gives vivid accounts of the rivalry which existed between the various firms; the battles over patents; the struggle with the gas-lighting industry; the controversy over direct versus alternating current; and the early experiments with street railways. For his information, the author has drawn chiefly on the records of the General Electric and Westinghouse companies, and although much of the book is naturally concerned with these two major companies in the field, the others are also discussed, and their evolution is related to the expanding economy and technological advances of the United States in the period covered.

Elementary engineering science. Arthur Morley. Toronto, Longmans, Green, 1952. 300 pp., diagrs., $1.10.

While not written for the experienced engineer, the author of this book presupposes a knowledge of heat transfer and expansion, and preliminary knowledge of mechanics gained from experiments on levers and equilibrium of oblique forces by means of strings pulled by weights or spring balances.

The object of the work is to provide a common introductory course in Engineering Science for part-time students preparing for their National Certificate, and also a basic introduction for engineering trade courses.

In this second edition, the units of current, voltage and resistance have been modified to agree with the absolute Electrical Units adopted internationally in nineteen hundred and forty-eight. Abbreviations and symbols are as recommended in British Standard number 560.

Each chapter is summarized at the end of that chapter; example problems are included with most chapters, and answers to these are in the back.

This is followed by conversion factors, trigonometrical and log tables; a series of problems constitute the appendix, and the book is indexed.

La fabrication et l'utilisation des tuyaux en béton armé et non armé. A. Guerrin et G. Daniel. Paris, Eyrolles, 1953. 134 pp., illus., 1200 fr.

Last year these same writers put out Calcul des Tuyaux en Béton Armé et non Armé, and their admirers will welcome the appearance of this companion volume.

Many engineers are faced with the problem of which type of pipe to choose for a given situation. In this volume compressed vibrating and centrifugal pipes are all discussed as to manufacture, and potential uses. The problems are presented first, and then their solutions are discussed. The book is well arranged and illustrated and has a good bibliography.

The instrument manual: 2nd ed. London, United trade press. 1953. 628 pp. + 105, illus., £4 4s. 0d.

Now in its second enlarged edition, this manual is published by the magazine "Instrument Practice". In this new edition, both "Patents" and "General trends in instrument design" have been omitted, as that information is already being brought to public notice through the magazine.

The sections Optical instruments, Measurement of fluid flow, Measurement of hydrogen ion concentration, General electronic instruments, and Automatic control have been completely rewritten.

Each section includes a bibliography and buyers' guide.

An alphabetical list of manufacturers follows the text proper, and this is concluded by a good detailed index.

We suspect the section Reference sheets is a binding together of the full-page advertisements from the magazine but they nevertheless serve a vital need. Of these there are one hundred and five pages.

To anyone interested in any phase of instrument design, markets, or purchase, this is an invaluable volume.

Mesure des vibrations et isolation des assises de machines A. Tenot. Paris., Dunod, 1953. 244 pp. ,$6.00.

A very major problem to-day, both in general living and in industrial activity, is the study of the protection commonly known as insulation of machines, measuring apparatus, homes, ships and vehicles against damage created by vibration.

Both active and passive types of insulation are discussed by the author, and the unit system MKfS has been used throughout for calculating.

The first section of the volume is devoted to machines for measuring accelerations, frequencies and amplitudes, and the second part to machine foundations, bases and pads.

Paragraphs are numbered and headed with bold type, which makes for great ease of reference.

A detailed table of contents and a bibliography further increase the usefulness of this volume.

Metal industry handbook and directory, 1953. London, Louis Cassier, 1953. 456 pp., £3 5s. 0d. (with a subscription to Metal Industry).

Now in its 42nd year of publication, this Handbook and directory is a comprehensive reference book for all those interested in the non-ferrous metal industries. Section I is entitled General properties of metals and alloys, and contains such information as specific heats of alloys, expansion of alloys, and sections on aluminum and copper and their alloys, magnesium and nickel alloys, and proprietary alloys. There are also lists of British

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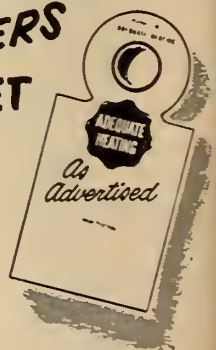

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Specifications for non-ferrous materials, giving brief contents of each. In Section II are found general information on weights and measures, conversion factors, hardness tables, metal prices, etc. Electroplating is covered in Section III, whilst the last section contains a directory of associations, and a buyers' guide.

Modern electric lamps. D. A. Clark. London, Blackie, 1952. 205 pp., illus., 20/-. (Blackie's electrical engineering series.)

The great interest in the science of illumination and in artificial sources of illumination has increased to such an extent over the past ten years that this book will be a welcome addition to the field.

Public interest and knowledge have been stimulated by the numerous new and specialized types of illumination, and problems of colour and colour rendering have increased with the introduction of the electric discharge lamps.

An explanation of the nature of light sources is presented in the first chapter of this volume, followed by the theory and method of operation of the metal filament lamp.

The remainder, and bulk of the volume is concerned with the more commonly used electric discharge lamps, their theory, construction, and operating characteristics.

The gas arc and flash tube are briefly dealt with, and the principles of illuminations and explanation of the nature of colour, complete the author's findings.

The illustrations, which are numerous, are well reproduced and the book is indexed.

Modern naval architecture. W. Muckle. London, Temple press, 1951. 154 pp., illus., $2.00.

The primary requirement of any ship is that she be capable of floating when carrying the load for which she was designed, but most problems of the actual design of the ship have changed little over the centuries. The development which has made ship architecture into a science is that of knowledge with regard to the various factors affecting the design of a successful ship. With this increase in knowledge it is now possible to produce a ship which will fulfil given requirements.

These requirements include provision for the necessary displacement to carry the specified loads; that the ship shall be stable in all normal conditions of loading; and that the desired speed shall be obtained with the minimum expenditure of power and fuel.

In addition to these general requirements, specific needs must be served for specific types of ship, i.e., cargo space, derricks, winches, defense armaments, life saving apparatus, passenger space, and so on. All these considerations are dealt with in the design of hull forms, propulsion of ships, speed and power trials, ship structures, safety and seaworthiness, and accommodation.

The book is briefly indexed, and carries a potentially useful bibliography, but unfortunately none of the entries are dated. We wonder when some of our otherwise desirable technical publishers will realize the importance of this matter of dating and indexing.

Moteurs et turbines à combustion interne. M. Seiliger. Paris, Dunod, 1953. 298 pp., illus., 2950 fr.

The particular reason a number of our members will have for welcoming this book is that it treats both types of internal combustion engines, piston motor, and gas turbine.

Following a general treatment of the thermodynamics of real gases, the first part of the book presents a detailed study of the functioning and calculating of piston motors, their combustion chambers, etc. Also of special interest in this section is the decreasing of weight of the piston engine for use in air travel.

The second section is a thermodynamic study of the flux and flow of gases to exemplify the theory of gas turbine burners in propulsion motors, and the combination of gas turbines with piston motors.

The field covered by the author, extends to fixed installation, road and railway traction, and marine propulsions, in short, all forms of combustion engines.

The book is well illustrated.

Newnes slide rule manual. F. J. Camm. London, Newnes, 1953. 112 pp., illus., $1.25.

That complicated bit of gadgetry termed the slide rule should no longer, according to this author, present the difficulties for many long years associated with it by the uninitiate.

Over the past twenty years, its use has increased tremendously, among people not necessarily in the engineering profession. To find this manual of inestimable value,

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Principles of the slide rule and of logarithms, is followed by detailed illustrated examples of the multitudinous uses of the rule, including circular types.

Useful sundry calculations, foreign measure tables, exchange rates, etc., and a good index conclude this practical little volume.

Outlines of structural geology. E. S. Hills. London, Methuen. Toronto, British Book Service, 1953. 182 pp., illus., $3.00.

Now in its thirteenth year of life, this book is appearing in its third revised edition dated nineteen fifty-three. Important new developments in research in structural geology make this new edition most acceptable.

The information contained is addressed particularly to the field geologist, and admittedly controversial subjects are included, as is only fitting in a work dealing with a rapidly advancing science.

Non-diatrophic structures; Mechanical principles of rock deformation; Major crustal structures; Folds, Faults; Structures of igneous rocks; and Petrofabric analysis are included.

Liberal footnotes constitute good bibliographical references, and a detailed subject index, plus an alphabetical author list, further add to the usefulness of this little volume.

Physique industrielle. 1953. Julien Izard. Paris, Dunod. 1953. 550 pp., $2.00 (Aide-mémoire Dunod).

The contents of Physique Industrielle now in its twenty-ninth edition, scarcely need a detailed introduction to our members.

However, improvements in this edition are an increase in tables, nomographs and numerical examples, which make it a valuable tool in both the office and the study room. Air conditioning, hot water heating and cooling, statistics for dry and humid air, movement of liquids in pumps, gas flow-meters, ventilators, generators, all are included in this most compact little volume, including forty-eight pages of mathematical tables.

Résistance des matériaux. G. Manuel. Paris, Dunod, 1953. 258 pp., illus., 1860 fr.

Assuming a good basic knowledge of mathematics on the part of the reader, the authors are here presenting an all-over picture of the variety of problems which may present themselves in testing materials.

Resistance of materials is often difficult to test in actual practice. In view of this, the author has presented all his findings on the theory of elasticity, and the problems which have to be overcome by the engineer that he may choose the best materials for a given job, and that he may be able to determine forms and dimensions best adapted to any concrete construction.

The volume has a detailed table of contents, and a short bibliography.

Rewinding and repair of electric motors. Karl Wilkinson. London, Spon, Toronto, British Book Service, 1952. 208 pp., illus., $4.25.

The principal consideration of this volume is to show how to copy and rewind an existing machine, but not to redesign, except for minor alterations of voltage, etc. A working knowledge of basic theory is assumed on the part of the reader. It is therefore, essentially a workshop manual, covering machines up to fifty hp. The heavier equipment necessary for these heavier motors is therefore omitted, although the principle remains the same.

The simple line drawings of the author are clear, and well reproduced, as are also the eight plates at the end of the book.

There is a good index and bibliography, and all entries in the latter are dated except the French ones.

TV sweep alignment techniques. Art Liebscher. New York, Rider, 1953. 123 pp., illus., $2.10 (U.S.).

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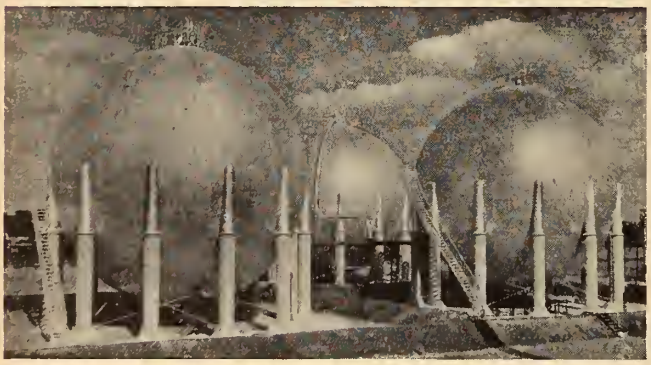

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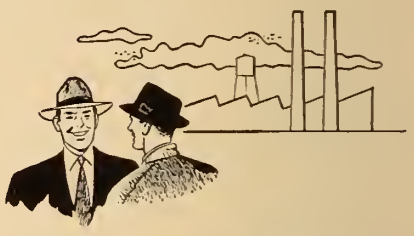

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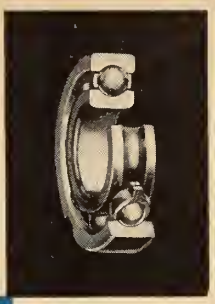

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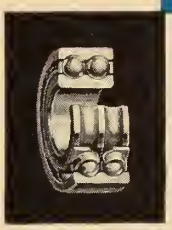

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detector alignment, and video amplifier response testing are all covered in this handy little volume which is also well illustrated and indexed.

BOOKS RECEIVED

Alternating current electrical engineering, 8th ed. Philip Kemp. Toronto, Macmillan, 1953. 680 pp., figs., $6.15.

Les atmosphères contrôlées dans le traitement thermique des métaux. Ivor Jenkins, tr. by J. Bernot. Paris, Dunod, 1953. 522 pp., illus., 4800 fr.

Automatic control of heating and air conditioning. J. E. Haines. Toronto, McGraw-Hill, 1953. 370 pp., figs., $8.10.

Beam formulas. A. Kleinlogel, tr., enl. and adapted by H. G. Lorsch. New York, Ungar, 1953. 143 pp., illus., $5.50 (U.S.).

Calcul et exécution des ouvrages en béton armé. V. Forestier. v.1 **Méthode générale de calcul. Mise en oeuvre.** Paris, Dunod, 1953. 236 pp., illus., 1060 fr.

Editorial directory. New York, Galub, 1953. 232 pp., $27.00.

Electrical installation rules and tables. 5th ed. W. S. Ibbetson. London, Spon, Toronto, British Book Service, 1953. 210 pp., $1.50.

Experimental nuclear physics, v.2. E. Segrè, ed. New York, Wiley, 1953. 600 pp., $13.20.

Heat transfer and fluid mechanics institute, 1953, preprints of papers. Stanford, University Press, 1953. 240pp., illus., $5.50 (U.S.).

Industrial specifications. E. H. Mac Niece. New York, Wiley, 1953. 158 pp., illus., $4.50 (U.S.).

Information theory. Stanford Goldman. New York, Prentice-Hall, 1953. 385 pp., figs., $9.00 (U.S.) (Prentice-Hall electrical engineering series).

Introduction to aeronautical dynamics. Manfred Rauscher. New York, Wiley, 1953. 664 pp., figs., $12.00 (U.S.).

An introduction to power systems analysis. F. S. Rothe. New York, Wiley, 1953. 187 pp., figs., $5.00 (U.S.).

Lost trail. Francis Cunynghame. London, Faber, Toronto, British Book Service, 1953. 213 pp., illus., $4.00.

Manual of traffic engineering studies. New York, Assoc. of Casualty and Surety Companies, Accident Prevention Dept., 1953. 278 pp., illus., $3.75 (U.S.).

Mechanical vibrations, 2nd ed. W. T. Thomson. New York, Prentice-Hall, 1953. 252 pp., $6.00 (U.S.).

Partial differential equations in engineering problems. K. S. Miller. New York, Prentice-Hall, 1953. 254 pp., $6.35 (U.S.).

Principles of transistor circuits. R. F. Shea, ed. New York, Wiley, 1953. 535 pp., diagrs., $11.00 (U.S.).

Sewerage and drainage of the Greater Vancouver area, British Columbia. Vancouver, Vancouver and districts joint sewerage and drainage board, 1953. 278 pp., illus., $10.00 (pa.).

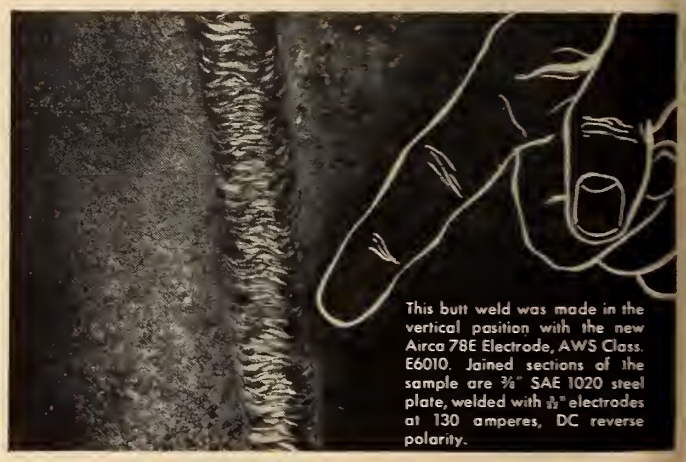
The spirit of philosophy. Marcus Long. Toronto, University Press, 1953. 306 pp., $3.00.

Statically indeterminate structures; their analysis and design. Paul Andersen. New York, Ronald, 1953. 318 pp., figs., $7.50 (U.S.).

Structural analysis of the Dome of Discovery T. O. Lazarides. London, Crosby, Lockwood, 1952. 64 pp., diagrs., fold, data sheets, 25/-.

Ultra high frequency propagation. H. R. Reed and C. M. Russell. New York, Wiley, 1953. 562 pp., diagrs., $10.45.

Welding practice. E. Fuchs and H. Bradley, eds. Toronto, Butterworth, 1951-1952. 3 v., illus., $8.50. v. 1 **Welding methods and tests.** 130 pp., $2.75: v. 2 **Welding of ferrous metals.** 198 pp., $3.50: v. 3 **Welding of nonferrous metals.** 183 pp., $3.50.



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The secret is in the 78E's improved flux coating. This gives higher current capacity and faster burn-off rate. Even at the higher rates of deposition possible with the new 78E, you don't have to worry about "fingernailing" or slag and gas inclusions in the weld metal.

Give the new AIRCO 78E a trial! A copy of Catalog 1318, "Pocket Guide to Airco Electrodes" will be sent on request.

AIR REDUCTION CANADA LIMITED

905 HODGE STREET, MONTREAL 9 (AIRCO) 180 DUKE STREET, TORONTO

Let's think About Lubrication

AND PREVENT 80% OF BREAKDOWNS TOO!

FIGURE 1

Complete Tecalemit range for industrial and marine machinery.

Figure 1 — Madel 17850 Radial Pump for grease or heavy oil. 1-19 units, each adjustable. Ideal for Crushers, Plate Shears, Ore Mills, etc.

Figure 2 — 20 unit "Brentford" Lubricatar with Rising Drop Indicators, 1-4 step-up Gearbox, Ratchet Arm and Priming Handle.

- **One, three and eight pints.**
- **One to twenty pumping units.**
- **Rotary or reciprocating drive.**
- **Step-up or reduction gear boxes. integral with lubricator if required.**

Yes, you **can** save the costly time that's spent on manual lubrication, and yet, still be sure that your equipment is thoroughly and regularly lubricated! How? By installing Tecalemit Automatic Lubrication. It's as simple as that!

With Tecalemit Automatic Lubrication, lubricants are supplied continuously or at fixed intervals direct to all lubrication points while the machine is working. No hold-ups!—and that means increased production and lower overhead costs.

What's more, Tecalemit Automatic Lubrication is so much more efficient that it helps to cut breakdowns by 80%!

Write us, or get in touch with your local agent.

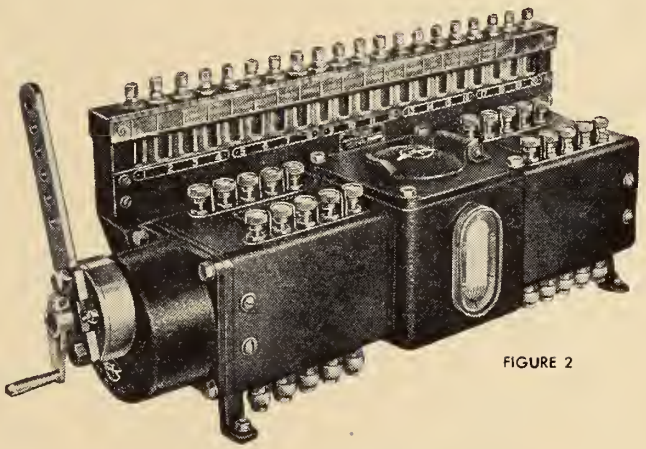


FIGURE 2

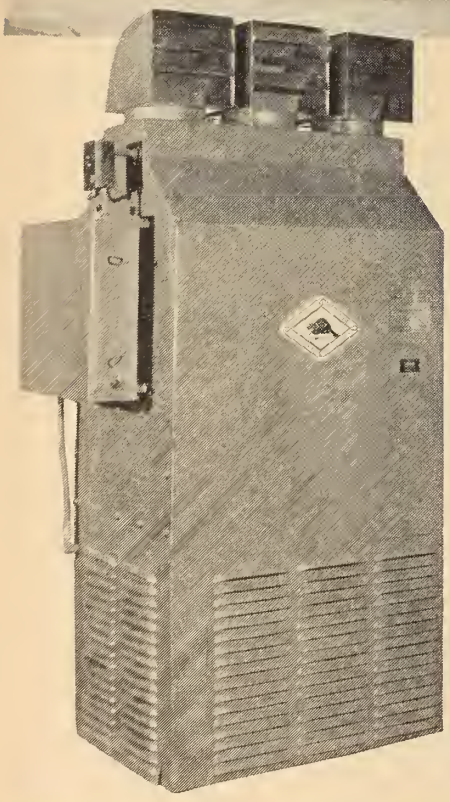
Thomson-Gordon Ltd., Hamilton
Moore Bros. Machinery Co. Ltd., Montreal
The Federal Belting and Asbestos Co. Ltd., Toronto and Vancouver

TECALEMIT
(CANADA) LTD.

The Authority on Lubrication

431 KING ST. WEST TORONTO, ONT.

11 DRAVO *Counterflo* HEATERS INSTALLED to service huge new Canadair warehouses



Another of Canada's great industrial organizations has found Dravo "Counterflo" Direct-Fired heaters to be the answer to their heating problems. Canadair Limited at Montreal has equipped its two new warehouses with eleven Dravo heaters, thereby assuring maximum comfort with minimum roof heat loss. Dravo heaters require no expensive pipe covering, radiators or ducts and not only do they possess a quick warm-up but also carry automatic on-off or modulating controls.

DRAVO HEATER PLUS VALUES

• Low initial cost • Direct-fired . . . low fuel consumption • Long service life, low maintenance • Easily moved to any location • Flexibility . . . can be mounted horizontally or vertically • Available in sizes from 400,000 to 2,000,000 Btu/hr.

WRITE FOR MORE INFORMATION. **It's worth your while to look into Dravo Counterflo Heaters for any of these five functions. You'll be glad you did.**

DRAVO

HEATING DIVISION

MARINE INDUSTRIES LIMITED

SOREL, QUE.

A CHRISTMAS MESSAGE-
We are indeed grateful for this opportunity—which comes but once each year—to wish you and yours a Christmastide of wholehearted fellowship, and may the coming year be for you a fruitful one, both materially and spiritually.
WIRE AND CABLE
DIVISION
Northern Electric
COMPANY LIMITED
3053-3

unsolved

THE CASE OF "THE CRYING METAL"

Indium is a strange and fascinating metal. Silvery-white, it looks like platinum. Yet it is so soft that you can gouge it with your fingernail. It is slippery to the touch and you can easily bend it between your fingers, even at very low temperatures. When you do it "cries" with a crackling sound.

Despite these and many other interesting characteristics, only a few uses for indium have so far been developed. Yet Cominco could recover one million ounces a year from its Sullivan Mine and believes that outstanding new uses can be found.

So Cominco's great resources of men, materials and money have been brought to bear on a full-scale study of indium's potential. Continuing Cominco research leads the way, while the company actively supports the research of others. And the day may not be too far distant when new light will fall on the Unsolved Case of the Crying Metal—and indium will begin to serve us all.

Cominco's booklet "The Metal Indium" presents, in concise form, information about indium and its present and potential uses. Write Cominco, Metal Sales Division, 215 St. James St. W., Montreal 1, P.Q.

"COMINCO"

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED

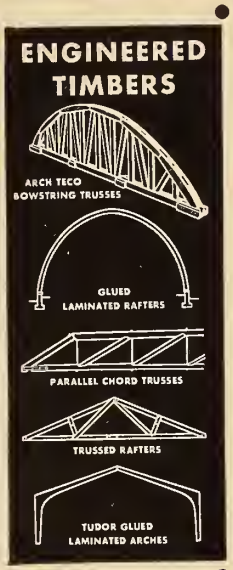
Build Huge Spans... Clear Floor Space

Simply... Economically with Glulam

● Glulam (glued-laminated) Timbers offer greater freedom of design — more functional strength for modern construction — at moderate cost. Glued laminated timbers rank as one of the finest of permanent structural materials. They offer superior advantages for building industrial plants, supermarkets, warehouses, arenas, schools, airport hangars, and other structures . . . where huge spans, clear floor space are of primary importance.

● Glulam members are formed of kiln-dried Douglas Fir. They are fully adequate for permanent use. Fire-resistive, they have preferred insurance ratings. Timber Structures of Canada Ltd. forms glulam members to any shape and design, and to the most exacting specifications. (Trusses, Beams, Girders, Columns, Craneways, Arches, Rigid Frames.)

For full information and illustrated booklets write to Timber Structures of Canada Ltd., P.O. Box 837D, Peterborough, Ont.



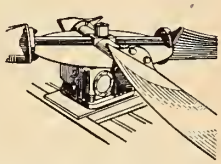
TIMBER STRUCTURES OF CANADA LTD.
PETERBOROUGH • ONTARIO

TORONTO • MONTREAL
VANCOUVER • CALGARY • WINNIPEG

CLEVELAND Type CU

...ideal drive for cooling towers

● This worm gear drive is designed specifically for cooling tower service. It meets a long-felt need for a compact, heavy duty speed reducer that will operate continuously, at high speeds and for long periods. It is inherently quiet in operation. Extreme conditions of heat and humidity do not affect it. It carries high thrust loads and high radial loads without loss of efficiency. It lends itself to rugged mounting, and due to the simplicity of its design, it is easily installed, serviced and adjusted in the field.



Cleveland Cooling Tower Drives (built in sizes 50 CU to 500 CU inclusive) are rated under Class 2 service conditions, except that thermal limitation does not apply. Heavy, externally ribbed housing effectively dissipates heat to air stream.

Every CU drive is run in and pretested under load before it leaves the factory. Thousands of units now in use prove its reliability in all classes of service—in the oil fields, in industry, in air conditioning systems in commercial and public buildings—in short, wherever there's a cooling tower, you can depend on CU.

Write for Bulletin 135 for full description of Type CU. Peacock Brothers Limited, 224 St. Patrick St., Montreal 32, Que. Also Calgary, Noranda, Sudbury, Sydney, Toronto, Vancouver and Winnipeg.

Representatives in Canada of The Cleveland Worm & Gear Co., and The Farval Corporation.

CLEVELAND
Worm Gear
Speed Reducers

Business & Industrial Briefs

A Digest of Information received by The Editor

Appointments and Transfers

John R. F. Sangster. — John R. F. Sangster, has been appointed general sales manager of Plate and Structural Steel Limited.

J. R. F. Sangster

Martin Engineering Expansion. — Leonard Martin, M.E.I.C., president of Martin Engineering Inc., has announced the opening of an office in Sherbrooke, Que. It will be located at 1072 Prospect Street. John S. Nightingale, who joined the firm recently, will manage the newly formed Eastern Townships branch of the Company. *(See also "Personals")*

A. J. Abbott.—A. J. Abbott has been appointed manager, accounting, Chemical Department, Canadian General Electric Co. Ltd.

George Hanson.—Mines and Technical Surveys Minister George Prudham announced recently the selection of Dr. George Hanson by the Civil Service Commission as director of the geological survey of Canada. Dr. Hanson succeeds Dr. W. A. Bell who has been chief geological consultant.

Josam Appointment.—F. H. Van Dyk & Company have been appointed Western Ontario representatives of Josam Canada Limited.

H. C. Tucker.—H. C. Tucker has been appointed contracts manager of English Electric Company Limited. He was formerly supervisor of switchgear sales. In his new capacity, Mr. Tucker will coordinate and expedite the work of all departments involved in the completion of contracts.

Packard Electric. — Packard Electric Company Limited has announced that Clayton Mark has joined the engineering department of the Company and Douglas Rickers has been appointed to the works department as a plant engineer.

J. L. Bourbonniere.—J. L. Bourbonniere has been appointed general manager of Bogue Electric of Canada Limited, 1405 Bishop St., Montreal.

Karel Rybka Organization. — Karel Rybka and Associates, consulting engineers, 96 Bloor St. W., Toronto have made the following staff changes in connection with the reorganization of their practice.

Karel Rybka, M.E.I.C., is president and managing director. Odrich Smith, M.E.I.C. is vice-president. New associates of the company are Lionel M. Ginslar, who has served with Mr. Rybka since his graduation, will be mainly active on supervision. A. L. Girdas Vjonynas has been given added responsibilities with respect to designing and mechanical work. William N. Stowe, has been entrusted with new responsibilities connected with electrical design. *(See also "Personals")*

S. N. Plummer.—Stuart N. Plummer has been named manager of V-Belt Sales, B. M. Goodrich Company of Canada Limited.

T. V. Sweeny

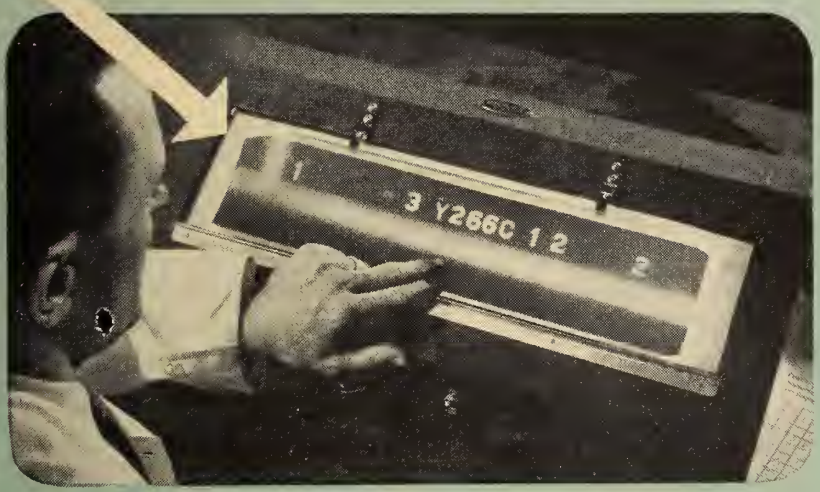
T. V. Sweeny.—T. V. Sweeny has been appointed sales manager of the commercial products division of Canadian Marconi Company, Montreal.

Mr. Sweeny is a well known figure in the Canadian electronics industry. He is a graduate of Acadia University. He served in the Canadian Army during World War II and joined the Canadian Marconi Company in 1947 as a sales engineer. More recently he has been

(Continued on page 1708)

PHOTO COURTESY EASTMAN KODAK CO.

We do it too...



In engineering, X-Ray is used as in medical practice. At Dominion Bridge, in conjunction with other modern testing techniques used in our shops, it typifies the scientific approach to manufacturing problems . . . backed by a research department, which is constantly investigating new materials and new methods. That's why you can always depend on "Platework by Dominion Bridge."

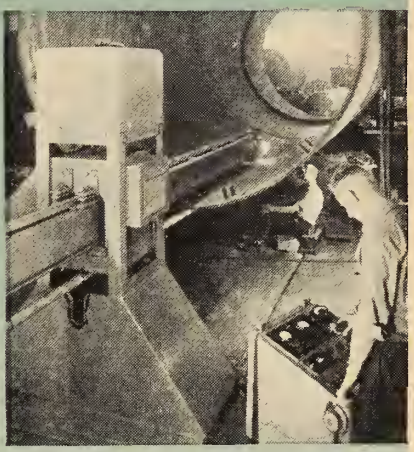
Write for Catalogue No. PF-100

PLATEWORK DIVISION* DOMINION BRIDGE COMPANY LIMITED

*Other Divisions: Structural • Bailer • Mechanical • Warehouse.

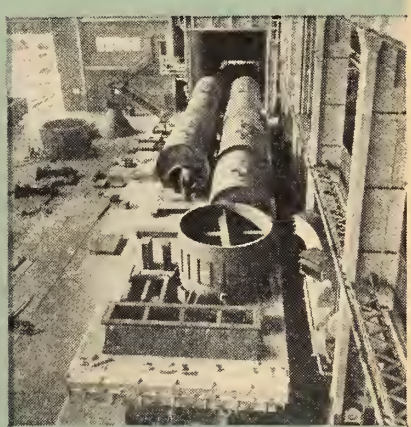
OFFICES AND PLANTS THROUGHOUT CANADA

Forming heavy plate in 20 ft. rolls.



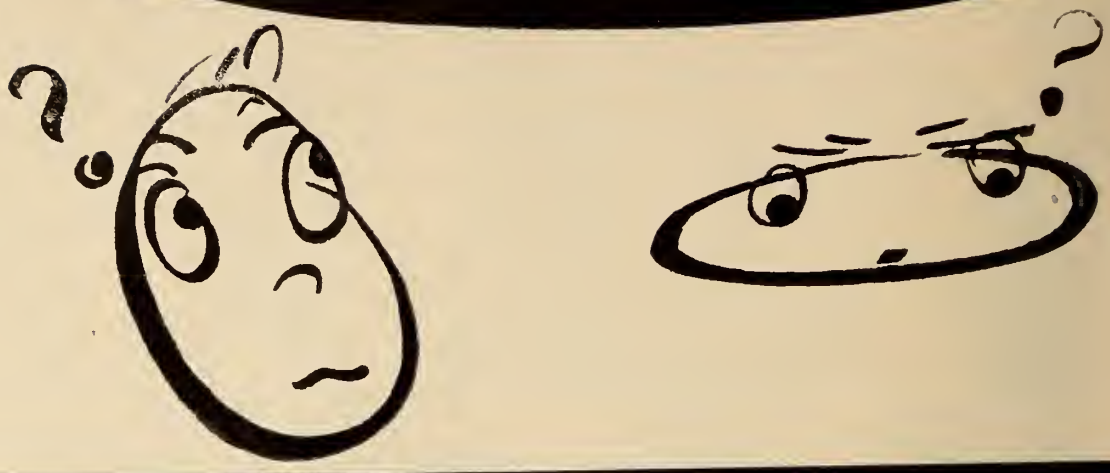
Automatic internal welding by machine developed by Dominion Bridge.

Welded vessel being X-rayed.



Loading Canada's largest stress relieving furnace

*this answers your questions Mr. Advertiser



who

RECEIVES BUSINESS NEWSPAPERS REGULARLY?

Random sampling from independent and representative lists of business and individuals in randomly selected areas without reference to coverage and circulations of studied business papers showed:

83.1%

Canadian business and professional men receive business papers regularly.

what

PERCENTAGE OF BUSINESS MEN READ BUSINESS NEWSPAPERS?

Of the respondents who receive business papers (1) Retailers and Dealers (2) Manufacturing and Processing firms (3) Institutions (4) Financial. Sales and Advertising Firms (5) Professional (6) Service Establishments (7) Transportation, Storage and Distribution:

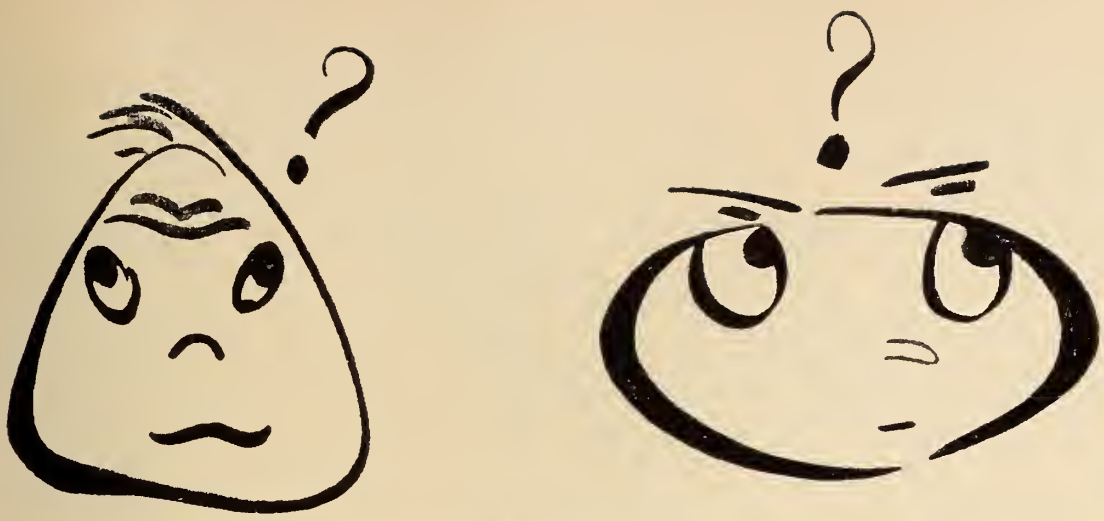
95.6%

read Canadian Business Papers. They receive 1.73 papers and read an average of 1.02 regularly.

*The survey of Business Newspaper readership soon to be published was made through personal interviews conducted by Gruneau Research Limited. Publications varied but interviewers' kits always included (1) current issues of General Business Publications for business classifications, (2) current issues of Horizontal Industry Publications for surveying all manufacturing classifications, (3) current issues of all other publications that applied to the particular business category within which the respondent came. Respondent and interviewer went through current issues together page by page. There were 762 interviews recorded across Canada.

THE ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA



how

THOROUGHLY ARE BUSINESS PAPERS READ?

The average respondent who reads current issues (less than 4 weeks old) reads into 58.7% of all major editorial units. He reads all of 33.9% of the major editorial units. A total of:

71.4%

of the receivers of current issues pass their business papers along for others to read. Finally 44.7% of current issues go into personal or company files.

why

YOU SHOULD ADVERTISE IN BUSINESS NEWSPAPERS

You asked for this survey, Mr. Advertiser, and the nub of the story is that although 90.9% of current B.N.A. Papers are received at place of business, 36.6% of those read were read at home:

71.2%

of the respondents in seven groups of business and professional people interviewed found something, frequently or occasionally, that could be applied directly or immediately to their businesses, professions or jobs.

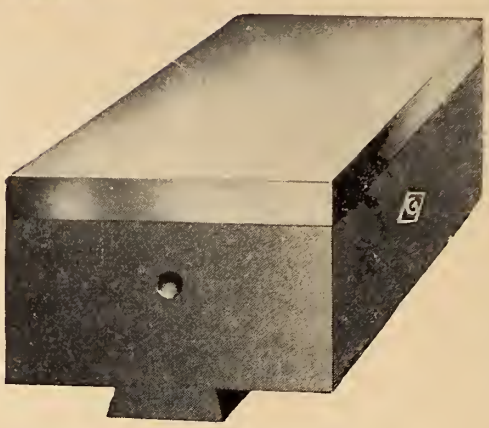
MORE THAN 25% GAVE SPECIFIC EVIDENCE OF ACTION TAKEN AS A RESULT OF READING EDITORIAL OR ADVERTISING PAGES

This paper is a business paper—one of over 100 trade . . . technical . . . service . . . and management publications covering every section of Canadian business and industry, and each a member of the Business Newspapers Association of Canada, 137 Wellington St. W., Toronto, Canada.

When you want to talk Business use Business Papers

Canforge

DYSON DIE BLOCKS for Dependable Long-Life Performance



The name DYSON represents more than 35 years experience in forging and heat treating Die Blocks and special steels. Dyson Die Blocks have been quality proved in service, and by comparison in our own large drop forging plants. They mean longer life and lower operating costs.

This illustration shows larger size Die Blocks made for the forging of aircraft parts.

Dyson Die Blocks and Upsetter Die Blocks are made from high quality Alloy Steel, normalized and tempered, top and bottom faces planed, oil hardened and tempered to four standard hardness ranges.

Inserts and Insert Bars are made from high quality Alloy Steel, normalized, oil hardened and tempered to four standard hardness ranges.

Dyson Die Blocks can also be supplied in the annealed condition when sinking prior to hardening is desired. Heat treating data furnished on request.

Dyson Die Blocks are supplied faced top and bottom only. Supplied shanked on request.

Catalogue giving complete data on Dyson Die Blocks supplied promptly on request

CANADA FOUNDRIES & FORGINGS
LIMITED · WELLAND, ONT.
MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

BUSINESS AND INDUSTRIAL BRIEFS

(Continued from page 1704)

product sales supervisor of nuclear measuring and other electronic instruments. In this position, he pioneered, with Chalk River and Marconi scientists, in the development and application of important electronic tools for nuclear research.

●

Defence Production.—The following changes have been announced with respect to the Department of Defence Production.

C. R. Snell, who has been co-ordinator of the branch has returned to Canadian National Railways to take up his new appointment as general purchasing agent. He will be replaced by D. M. Erskine who will have the title of director of general purchasing.

●

Dow Chemical. — Dow Chemical of Canada Ltd. have occupied their new executive and sales offices at 600 University Ave., Toronto. The telephone number is still Empire 6-9171.

●

Westinghouse Changes.—As part of Canadian Westinghouse Company's reorganization programme the following changes have been made.

The air brake division will be known as the air brake—turbine division. Each unit will have its own engineering, manufacturing and sales department.

Four appointments have been made in connection with this change to bring both air brake and turbine operations under a central authority.

W. J. McNicol, JR.E.I.C., has been appointed manager of the turbine division's sales department; E. H. Dowell, manager of turbine manufacturing; T. Eedson is manager of the air brake and engineering department and W. Duckworth has been named consulting engineer for the air brake division.

●

W. R. Jackson.—W. R. Jackson has been appointed manager, sales, carboloy and alnico products, Canadian General Electric Co. Ltd. He will also retain his present responsibilities as works manager Carboloy Works.

●

Guggenheim Award.—Charles Augustus Lindbergh has been selected as the recipient of the Daniel Guggenheim Award for 1953. The announcement was made, jointly, by the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the Institute of the Aeronautical Sciences. Presentation of the award will be made by Harry Guggenheim at the honours night dinner of the Institute of the Aeronautical Sciences on January 25, 1954, at the Hotel Astor in New York.

Lindbergh was selected as this year's medalist "for pioneering achievements in flight and air navigation".

●

Shell Oil, Montreal.—The following changes have been made by the Shell

DER IN CANADA FOR POWER TRANSMISSION AND MATERIALS HANDLING EQUIPMENT

UNITED STEEL

Serves Every Industry

where there is a Power Transmission or Materials Handling Problem

- We manufacture, stock and sell equipment parts, and deliver them QUICKLY from our warehouses and dealers across Canada.
- We also design, fabricate and engineer complete installations which embody them.
- Our business is to improve the earnings of industrial plants of every type by **increasing** production and **reducing** maintenance costs.

UFACTURERS OF
ig Machinery
tural Steel
actors' Equipment
Elevator & Mill Equipment
vood Handling Equipment
ulic Presses and Bending Rolls
ge and Sanitation Systems
Rolling Mill Equipment and many
er types of mechanical equipment
Industry

UNITED STEEL

CORPORATION LIMITED

RONTO • WELLAND • MONTREAL • WINNIPEG • KIRKLAND LAKE

Canadian **BROOMWADE** Limited

144 PARK LAWN ROAD, TORONTO, ONTARIO

Sales and Service:

MARITIMES: Atlantic Bridge Co. Ltd., Lunenburg, N.S.
QUEBEC: Laurie & Lamb, Railway Exchange Building, Montreal
ONTARIO: Laurie & Lamb, (Stationary), 284 King St. West, Toronto
Sheridan Equip't Co. Ltd. (Portable), 33 Laird Drive, Toronto
MANITOBA & SASKATCHEWAN: Medland Machinery, 576 Wall Street, Winnipeg
BRITISH COLUMBIA: B. C. Equipment Co., Ltd., 551 Howe Street, Vancouver

5305 D17

Oil Company of Canada Limited in the Montreal area.

P. Orrell is now manager of Montreal division purchasing-stores department. He will be located in the Company's office at 660 St. Catherine St. W. R. M. Boone has taken over Mr. Orrell's former position of Montreal refinery stores manager. He is located at the refinery in Montreal East. In his position of stores manager, Mr. Boone is not involved directly in any purchases of materials.

B. P. Malley is replacing Mr. Boone as senior buyer, Montreal branch. He has been transferred from the Company's head office in Toronto. Mr. Malley will be located at 660 St. Catherine St. West, although his work entails only purchases for the Montreal refinery.

●

White-Rodgers Ltd. — White-Rodgers Limited, 611 Gerrard St. East, Toronto is a newly formed company which will manufacture and sell in Canada, White-Rodgers controls for heating, air-conditioning and refrigeration applications.

Following are the names of officers of the Company.

Eric C. Wells	President
Rowan E. Powers	Vice-President
Stuart Thom	Secretary

●

Dahl Brothers Appointment. — Dahl Bros. (Canada) Limited, have appointed R. E. Johnston Co. Ltd., 1250 Homer Street, Vancouver, as British Columbia's distributor of their valves, fittings and pipe hangers.

●

Mechron Engineering Appointment.— Mechron Engineering Products Ltd., Ottawa, has been appointed exclusive sales and engineering representatives in Canada of Electric Regulator Corp., Norwalk, Connecticut. All sales were handled, previously, from the United States.

●

R. C. D. Laughton.—The Right Hon. C. D. Howe, Hon. M.E.I.C., has announced the appointment of Robt. C. D. Laughton as director, mechanical transport division, Department of Defence Production.

●

Leslie C. Williams.—Leslie C. Williams has been appointed manager of the Ontario division of Dominion Engineering Works, Limited. He will make his headquarters in Toronto.

●

Shawinigan Chemicals. — Shawinigan Chemicals Limited has released the following information with respect to changes in personnel.

A. H. Andersen, who has been director of development of Shawinigan Chemicals Limited for the past two years is now technical director of the company. He has been succeeded in his former post by F. K. Rogers.

●

New Equipment and Developments

Metal Parts Cleaner.—A machine has been developed for cleaning small metal parts in which the work is carried out on a wire mesh conveyor belt past high pressure jets which spray the parts with paraffin or white spirit. The conveyor runs at eight feet to nine feet per minute and is driven by a ¼-hp. motor. The washing chamber contains 18 jets supplied with liquid from a sump embodied in the structure of the machine. The jets are fed by a multi-stage centrifugal pump and the sump is fitted with a large removable strainer for extracting solid matter from the used fluid. The fluid is kept in good condition by being passed through a continuously-operating centrifugal clarifier with which the machine is equipped. Dirty components on the conveyor pass through sealing doors into the washing chamber and the cleaned parts emerge through sealing doors. By Alpha-Laval Company, Ltd., Great West Road, Brentford, Middlesex, England.

●

Flexible-Shaft Equipment.—New flexible-shaft equipment adapted for floor, bench or suspended use has been introduced by Flexible Drives (Gilmans) Ltd., 195, High Street, Smethwick, 41, Birmingham, England. Driven by a ¾-hp. motor from which a range of four main speeds of 1,000, 2,000, 3,000, and 6,000 r.p.m. are obtained by four-step cone pulleys or a V-belt, it can be supplied with various handpieces all of which have built-in gearing so that their spindles may run at speeds suited to the work required. The motor is totally enclosed and surface-cooled and it can be removed quickly from its floor stand. For brushing, sanding and grinding the four main speeds are used but for drilling these are reduced to 100, 200, 300 and 600 r.p.m. For light grinding the speeds are increased up to 1650 r.p.m., and the handpiece used for tungsten carbide burrs will give up to 2400 r.p.m.

●

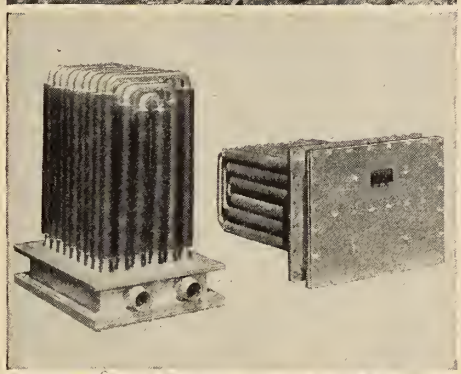
Oil Groove Cutter.—Selson Machine Tool Company, Ltd., of Cunard Works, Chase Road, London, has introduced a new machine which enables an operation that previously took 40 minutes to be completed in under four minutes. It is an oil groove cutter which will produce all the standard oil grooves normally called for on outside diameters, inside diameters, internal and external tapers and faces of components. It will also cut multiple oil grooves continuously and each groove is symmetrical on each side of the centre line. On earlier machines multi-grooves are cut separately and the machine has to be stopped for each groove. The resultant grooves are usually of inconsistent depth. The new process is continuous and is claimed to be much more efficient, as well as being speedier. A variable gearing enables the tool to oscillate to the desired number of times to one revolution of the work piece. The makers claim that the new machine,

(*Continued on page 1716*)

Unifin* **eliminates all common finned tube difficulties**

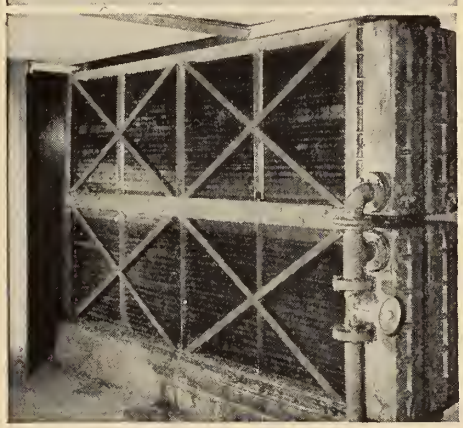
IT IS UNAFFECTED BY VIBRATION

Shown here are two Canadian Ingersoll-Rand 125 CFM All-Canadian air compressors fitted with Unifin intercoolers fabricated from copperline tubing, an integral aluminum finned tube with a seamless copper liner. These compressors are supplying air to pneumatic hammers at several thousand feet above sea level on the Aluminum Company of Canada's Kitimat-Kemano project.



IT WITHSTANDS INTENSE HEAT

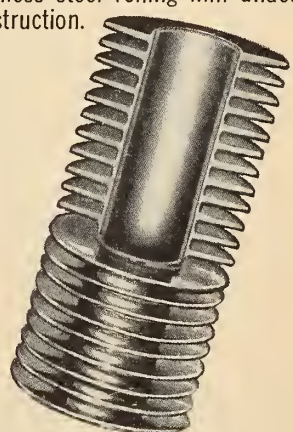
This Unifin water cooling coil is used by Dominion Foundries & Steel Ltd., Hamilton, Ont., for cooling manufactured gas prior to its entry into a transmission line. The temperature of the gas before cooling is approximately 1000° F. Unifin is the only finned tube capable of withstanding this temperature.



IT RESISTS THE EFFECTS OF AGE

These Unifin Removable Cover Plate Water Cooling Coils were installed more than 12 years ago at Atlas Steels Ltd., Welland Ont. Their function is to cool the motor generator sets supplying power to the main rolling mills. These coils have given completely satisfactory service over the years and Unifin is presently supplying a similar set of cooling coils for the new stainless steel rolling mill under construction.

Unifin Tube Company
LONDON, CANADA



In addition to the characteristics mentioned above, Unifin tubing withstands severe bending and forming, and can be safely welded or brazed. The superiority of Unifin tubing for all heat transfer applications is due to one unique feature — **the integral construction of fins and tube.** The fins are extruded from the actual metal of the tube wall. There is no jointing or bonding of any kind. . . . The fins and the tube are one!

Complete engineering data is available on request.

* **THE ONLY INTEGRAL FINNED TUBE.** Patented in Canada and patents pending.

HERE'S THE PUMP ACTION
YOU NEED FOR THOSE
"Hard to pump"
MATERIALS

HERE'S
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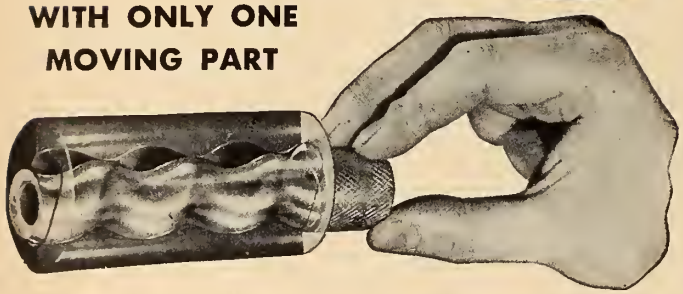

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1711*)

called the "Trojan", can help manufacturers to overcome many production difficulties, and they are prepared to export to any part of the world. Delivery is approximately two months and service arrangements are stated to be very good.

●

Control System for Temperature in Feed of Molten Glass.—A control system for ensuring the efficient and consistent production of glass-ware from automatic machines has been developed by George Kent Ltd., of Luton, Bedfordshire, England. By its use a constant temperature is maintained at the feeder source. This ensures that the viscosity of the glass at the scissors mechanism is constant, whereby production is speeded up, the number of faulty rejects is reduced and a more rapid return to stable production after stoppage is effected. The Kent system utilises a platinum/platinum-rhodium thermocouple immersed in the molten glass in the feeder, which is encased in a platinum sheath to resist erosion. The thermocouple is connected to a Multelec recording potentiometer. Fitted inside the potentiometer case is a controller which, by altering the position of a diaphragm-operated valve in the high pressure air-line, regulates the high-pressure air supply to the inspirator of the glass feeder burners, thereby varying the heat input to the combustion chambers. Control temperature may be set at any level. Under the potentiometer a manual control panel is also provided to enable operators to control the plant by hand during repair or when shutting down or starting a new feeder. When the control valve is at the limit of its travel in either direction, signal alarms warn the operator.

●

Tower Crane for Building.—Strong interest is being shown by the building industry both in Britain and overseas in the Wild-Fawcett tower crane, which is the outcome of experience gained in the experimental operation of a similar crane during the building of a housing site in Britain when the number of man-hours per house, to the roofed-in stage, was cut by approximately one half. The crane is manufactured in two sizes with maximum reaches of 42 feet six inches and 52 feet, and with lifting capacities at these reaches of 12.5 and 17.0 cwt. respectively. With these reaches reduced to 13 feet and 16 feet three inches, however, the two models will lift 35 cwt. to nearly 80 feet and 40 cwt. to nearly 105 feet respectively. At the maximum reaches, with the boom in a horizontal position, the heights of lift are approximately 45 feet and 65 feet. In general arrangement both models are identical. Manufacturers are Thomas C. Wild (Machinery) Ltd., Sheffeld, England, in conjunction with Messrs. Fawcett, Preston and Co. Ltd., Bromborough, Cheshire, England The motors are by the Lancashire Dynamo and Crypto Company, Ltd. and are of the totally-enclosed cranerated pattern. Each model has separate motors for slewing, travelling and hoisting, the motors being two, four and seven and a half h.p. respectively for the smaller model and four, seven and a half and 12½ h.p. for the larger model. They are all for a 400 to 440-volt three-phase 50-cycle supply and are controlled from the operator's cabin some 25 feet above ground level. Three different speeds are provided for all motions, which may be made separately or together as required. The chassis of the crane is of fabricated-steel construction, mounted on cast-steel rails to run on 50 to 55 lbs. section rails. The central pivot is of heavy construction with bronze bushes and all gearing is machine-cut and the greasing points are extended to provide for easy lubrication. An hydraulic safe-load indicator also combines the functions of a positive overload cut-out, which cuts off current to the motors and applies all brakes, no matter what the jib position. Among the accessories available with the cranes are a brick box of ten cwt. capacity and a mortar or concrete skip

●

Card Roller Grinding Machine. — A new machine for grinding workers, strippers and all top rollers used in the woollen, worsted and asbestos industries has been developed by Dronsfield Brothers, Ltd., of Atlas Works, Oldham, Lancashire, England. Suitable for card rollers used in the Bradford system, or with some modification for those used in the Continental European system it is, for safety, totally enclosed with a strong sheet-metal hood at each side. But consideration has been paid to handling problems, for the hoods at each side swing back well clear of the machine to allow loading to the grinding steps. Two card rollers may be ground simultaneously on the machine, the limiting dimensions being between two inches and 22 inches on the machine designed for the Bradford system and between two inches and 16 inches on the Continental system. Rollers are driven by a belt from an eight-inch pulley on the driving shaft which is geared for two speeds 112 r.p.m. and 450 r.p.m. for grinding or turning-up wooden rollers. For the latter operation a hand turning-up rest can be supplied and the machine can be made to any width to suit the roller sets in use in the mill. The grinding roller, nine and three-quarter inches in diameter, is covered with Dronsfield's "Atlas" brand emery fillet. It is driven from a two and a half h.p. motor through totally enclosed gearing at a speed of 620 r.p.m. and is fitted with the firm's patent traverse motion which gives the grinder a five-eighths of an inch traverse. A movable end to accommodate rollers of various widths is fitted. Feeding of the card rollers is by a hand screw with setting collar on each step mounting. Normaly, the grinding steps are fitted with conventional brass inserts but special steps suitable for various types of bush can be provided where necessary. Dust extraction is by a 12-inch fan driven by a two and a half h.p. motor at 2,900 r.p.m. The air-flow is through two ducts at the base of the armoured hose to a duct which can be machine case connected by flexible connecter to the dust extraction system of individual mills.

●

Portable Pump.—A new portable, self-priming centrifugal pump, designed for the use of civil engineers and public works contractors has been produced by Goodenough Contractors Mcy., Ltd., 70/72 London Rd., Twickenham, Middlesex, England. The difficulties of transportation and handling on site of large-size pumps are obviated by this model which is a six inch 660 automatic self-primer. The engine, an Armstrong-Siddeley diesel developing 20 horsepower and the pump are mounted for maximum mobility on a towing trailer equipped with overrun brakes. Highly suitable for draining flooded sites, excavations, pumping out caissons, and so on, the pump will handle water containing a high percentage of abrasive matter, solids up to 25 per cent liquid mud, sewage sludge, oil, petrol and chemicals.

●

Mercury Float Switch.—Despite their normally long life, one of the chief reasons for the eventual failure of mercury switches is the appearance of pin holes in the glass tubes due to mechanical shock to the mercury. To overcome this, a new mercury float switch has the switch rocker arm cushioned by rubber. Made by Thomas and Son (Worcester) Ltd., Climax Works, Worcester, England, the new switches can be used for automatically starting and stopping pumps at the "low" or "high" water levels in storage tanks or for starting pumps at "high" level in sumps and stopping them when sumps have been drained. Arranged for conduit entry, virtually drip-and-rust-proof, each switch is complete with operating arm, copper float, copper cable with adjustable stops and balance weights, and an earthing terminal is provided.

●

Magnetic Crack Detecting.—Capable of dealing with castings or shafts up to five feet long, or longer to special order, a new universal machine has been added by the Magnetic Equipment Company, Ltd., Lake Works, Porchester, Hampshire, England, to its range of crack-detecting equipment. Two types are available—MCC for current flow testing and MCD, arranged for current flow and magnetizing tests. Machines comprise two sliding heads which can be opened from two inches to five feet or more. One head can be clamped in position and the other moved and held by an air-operated pressure cylinder for repetition work, thus leaving the operator with both hands free to handle the work. Magnetizing and air cylinder control is by foot switches. Where inspection of large castings necessitates the work being laid on trays and solenoids formed by wrapping turns of heavy flexible cable around different parts of the casting, the machine's rear terminals and a heavy current changeover switch prevent false readings being made if the heads or cables should be accidentally short-circuited by other work. For quick operation in current flow testing of work adjacent to the machine, provision is made for plugging in magnetic leeches. There are no bare conductors on these machines, which also have advantages of types in which the coils are mounted above the trays, in a position where damage might occur, and in which the sliding heads run on round steel bars which can easily be damaged by castings being dropped on to them.

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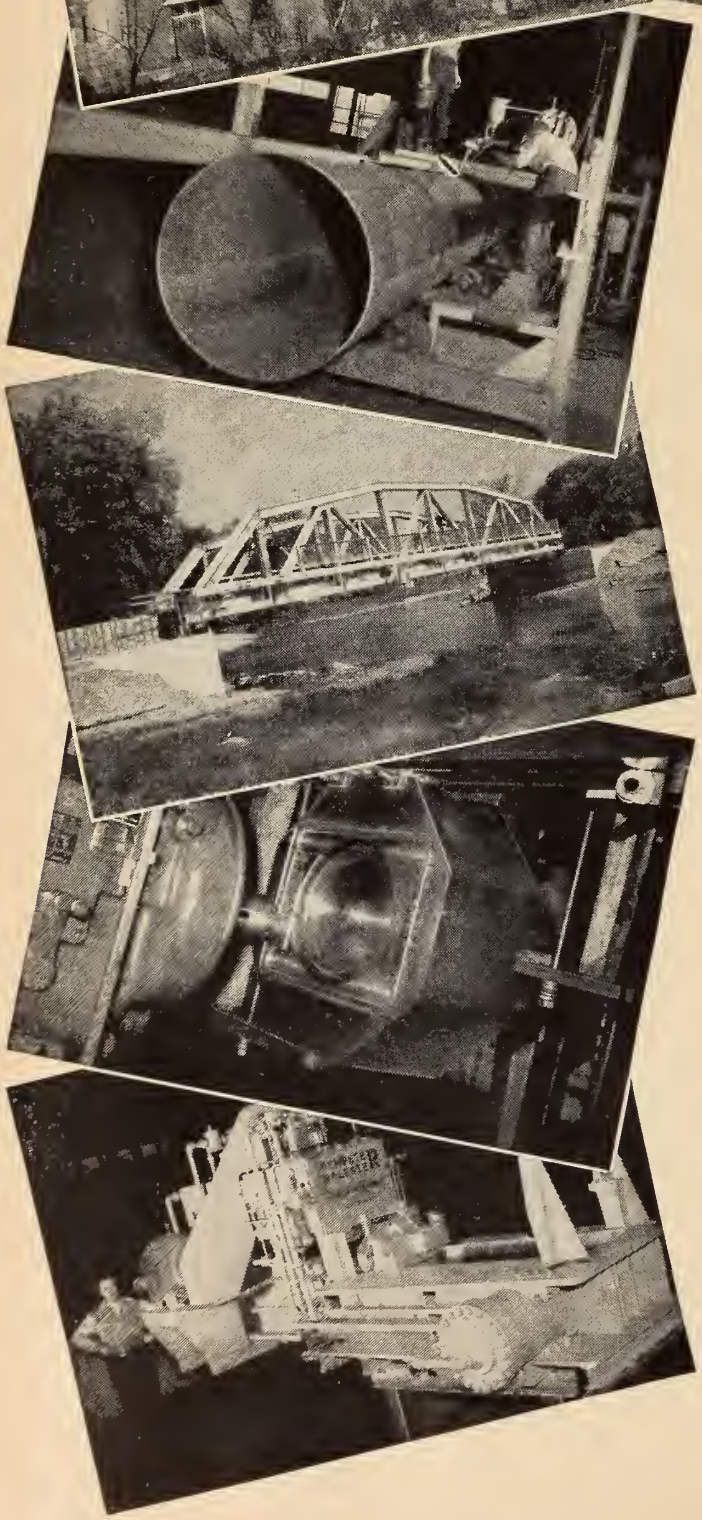

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